The New Educational Benefits of ICT in Higher Education: Proceedings

Editors:
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1. Education, Higher – Teaching and Learning. 2. Education, Higher – Educational Change. 3. Educational Technology. 4. Educational Models. 5. Implementation Strategies.

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1. Preface

The OECR, SURF Educatief and CHEPS have organised this conference to bring together university staff and national policy makers of the different European countries to discuss the contemporary educational benefits of modern Information and Communication Technologies (ICT) in Higher Education. These benefits refer to teaching and learning within Higher Education institutes, as well as opportunities for cooperation between Higher Education institutes and other organisations within their region.

The conference has been organised along four themes. For the theme *The Mirror of Europe* the Organisation Committee has invited 12 speakers from 12 different countries, to present their national developments in the area of ICT in Education. These invited papers will be published in a separate booklet. The same goes for the contributions of the invited keynote speakers. The full papers within the themes *Institutional Responses* and *Regional Context* are contained in this book of the conference proceedings.

We are convinced that the high quality and originality of the submitted full papers found in these proceedings ensure stimulating discussions on the new benefits of ICT in Higher Education. Many papers are based upon findings of thorough educational research in the area of teaching and learning, other papers rely upon broad experiences with actual implementation and application of ICT in educational institutes. Together with the invited papers these contributions present a complete picture of the status quo in this area.

The papers in these proceedings are gathered in three tracks. The track *Teaching and Learning Models* covers interesting topics such as Learner-centred Education, Competence-based Education, Digital Learning Environments and Learning Styles, Learner Motivation and Innovative Educational Models. Examples of topics in the track *Organisational Change* are Training Teachers in the use of ICT, Implementation Strategies and Virtual Universities. Although the track *Infrastructure* contains only a small number of full papers, some of these are very up-to-date and cover topics such as Collaboration Systems, Learning Management Systems and Rapid Content Production.

We thank the authors of the papers for their contribution to these proceedings. The huge effort that they spent on before hand is the base for the success of this conference and for the quality of this book. We are grateful to them for joining with us their thoughts and experiences.

Ton Kallenberg

On behalf of the Organisation Committee

Maarten van de Ven

On behalf of the Programme Committee

2. Conference Committees

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3. Papers Track 2: Teaching and Learning Models

1 Proven Strategies for Teaching and Learning[1]

David G. Brown[2]

International Center for Computer-Enhanced Learning
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Abstract

50 technology-using professors at 50 of America's most-wired campuses were asked to explain how their teaching strategies have been augmented by the use of computers. From their responses emerges a pattern. Most professors are using computers in teaching in order to enable more controversy and debate in their classrooms, to promote more collaboration among students, to facilitate more and more timely interaction between professor and student, to differentiate tasks and assignments according to student interests and capacities, and to involve practitioners as well as colleague scholars with their students.

In this paper, these five "newly popular" teaching strategies are elaborated. Specific examples from many different disciplines are cited. Materials from the author's economics course are used to illustrate each of the concepts.

A goal of this paper is to suggest trends in pedagogical styles that are likely to dominate the next decade, to enable participants to lead faculty workshops around these five principles, to start participants toward their own incorporation of time-effective computer exercises in their own courses, and to disseminate information about these important research findings.

The paper is an outgrowth of work published in 2002 with Gordon McCray, Craig Runde, and Heidi Schweizer by Allyn Bacon/Longman under the title Using Technology in Learner-Centered Education: Proven Strategies for Teaching and Learning (http://vig.abacon.com/product/0,2371,0205355803, 00.html).

Paper

My thesis is that the future of teaching and learning, at least over the next decade, will be largely shaped by what the computer is newly allowing us to do. During the decade between 2000 and 2010, professors throughout the world will be experimenting with and evaluating the new teaching tools enabled by the Internet.

I carry the thesis one step further. No only will twenty-first century professors be using these new methods in their teaching; they will also be penalizing their colleagues, at promotion and tenure time, for *not* trying out these new methods. In other words, the conventional wisdom of this first decade in the new millennium will be that the teaching methods best supported by the computer are also the most effective pedagogical methods.

History provides many instances that reinforce the thesis that the new and novel receive disproportionate attention. During the latter half of the 20th century, trends in teaching methods emphasized textbooks and bound collections of readings, both innovations contributed by the publishing industry earlier in the century. Another example: for the last three decades, many doctoral dissertations have explored the role of gender, nationality, ethnicity, age, and other personal characteristics in assigning meaning to an author's creations and discoveries. New doctoral students have to rush toward dissertation topics that are newly fashionable. During the same years, a major criterion for judging scholars has been whether they have accounted for the personal characteristics of the subjects studied. During the previous half-decade (1920s-60s) the prevailing orthodoxy, New Criticism, preached the opposite: that the author and his/her intentions were outside the critics' purview?

So if the emerging decade's trends in teaching and learning will be shaped by the teaching strategies that are best supported by the computer and the associated Internet, it behooves us to ask, "What pedagogies are best supported by the computer?"

Fortunately, the early adopters of computer-enhanced teaching provide a rather clear roadmap. In 1997, I wrote to the chief academic officers of America's 100 Most Wired Campuses, according to the annual survey by Yahoo Magazine. Letters went to Harvard, Stanford, MIT, Michigan, Berkeley: names most of us recognize. Each officer was asked to name three professors, from any discipline or profession, who were successfully using technology in their teaching. The nominees were contacted. Eventually, professors from 36 universities in 27 disciplines wrote 93 essays.

They were all asked to explain why they incorporated computers as teaching tools. What tenets of their educational philosophy did they have in mind when they decided to supplement the old with the new? I was frankly surprised at how often these professors spoke of the same things, how much they were chasing after the same objectives.

Over 90 percent of them said that when teaching, before using computers, they found that students seemed to learn more when they engaged in dialog with their professors, when they were applying the theories they were studying, when they were interacting with the material. Therefore, these professors said, they were incorporating computers in their

teaching, because computers and the Internet offered the prospect of more interaction, of interactive learning.

The essayists proceeded with examples. Between lecture sessions, students could email them questions. Before a particular lecture, they could ask their students to share, by email, any confusion over the "muddiest point", and the class session could be restructured to help students over these hurdles. When coached on how to build a profit-and-loss statement, students could experiment on their own computers by building their own statements and then sending them to the professor for immediate feedback. Immediately upon completing a lecture, the professor could ask the students to enter their own versions of the lecture's basic concept into a chat session, and the professor could immediately respond.

The early adopters say they have embraced computers to support interactive learning. We can expect that the hiring panels and promotion and tenure committees of 2008 will be looking for "interactive learning" in the teaching of prospective and current colleagues.

Similarly, over 90 percent of the 93 essayists emphasized collaborative learning— students teaching other students—as their new strategy of preference. They had found that students working together in teams tend to learn more. Even in the humanities and social sciences, they found that the project team approach—so common in scientific doctoral education—is very effective. They incorporated computers in their teaching, because they believed that they facilitate certain types of collaboration.

Again, the essayists provided many rich examples. Rough drafts of student essays are shared with two or three other students, who are expected to suggest improvements in time for the original author to incorporate them into the final draft. Students are paired to locate and to annotate Internet sites where the "topic of the day" is explained in an alternative and effective way. Team assignments—to make a presentation in class, to create a public web page, to pursue a joint research project—are all facilitated by Internet-supported communication.

Another example: Student A is asked to answer to a question related to the reading assignment and to send a rough draft to Student B for endorsement or revision. The consensus answer by A-B is then sent to Student C for endorsement or revision. Finally, the A-B-C answer is submitted for grading. In the process, all three students are forced to articulate their positions and benefit from the knowledge of others.

The early adopters say they embraced computers to support collaborative learning. We can expect that the hiring panels and promotion and tenure committees of 2008 will be looking for "collaborative learning" in the teaching of prospective and current colleagues.

A third motive for adopting computers emerged from the essays. Professors recognize the need to provide "different strokes for different folks." They assign projects to match up with student interests; for example, a statistical problem using biological data for biology majors or 18th-century British cultural data for English literature majors.

Each student has different abilities, learning styles, and interests. A physics professor who designs and videotapes all in-class experiments and then makes those tapes available at a course site on the Internet allows each student to repeat the experiment as many times as necessary. Some will grasp the concept during class. Others will have to rerun the experiment a dozen times before they feel they have mastered the material.

Customization also includes providing many different methodologies for learning the same material. For example, a finance professor can create a cybershow (a videotape) of his lecture and also provide a transcript for those students who learn best from reading.

At Virginia Tech's Math Emporium, student failure rates in beginning calculus have more than halved, because students are now provided multiple ways to complete the material. They may take the course by computer in the laboratory, where professional advice is always available, work through the material with a student learning team, attend the weekly lecture given by Professor A, attend the weekly lecture on the same topic by Professor B, or do all of the above.

An analysis of the 93 essays reveals two other strategies that atttracted the early adopters of computer in teaching. They sought an opportunity to add controversy and debate to their teaching. The Internet made it easier to connect students with experts whose opinion differed from the instructor's. Student teams could be asked to prepare competitive presentations, using the resources of the Internet to bolster their capacities.

Closely related is the final strategy: using adjuncts and consultants in teaching. The computer allows students to be in touch with more people, at greater distances. Moreover, by transferring many activities that previously took class time to interactions with the computer, visiting lecturers could be invited lead discussions. Students could be sent out to remote learning sites, even other countries, and still keep in touch with their professor and fellow students.

From a study of these early adopters of technology, we gain a clearer picture of trends in teaching and learning. Teaching is to become more interactive and more collaborative. Students will respond to individually designed curricula. Professors and students will join in project and learning teams. Courses will blend assignments that are pursued face-to-face with exercises that are completed outside of class time, in both teams and individually. The clear lines between "learning years" and "practicing years" will become blurred, as students spend more time in the real world, and practitioners spend more time with students.

The magic of our new tool, the computer, is in the rich communication system that it supports. There are some gains from fancier presentations. More gains come from the access to information provided by the Internet. But the giant steps that are to be taken during the next decade will be enabled by

robust communication systems enabled by computing. The computer allows us to break a number of barriers. Messages may be one to one, one to many, or many to many. They may be simultaneous or asynchronous. They can be archived, indexed, and searched with minimal effort. They can be linked to elaborations and more detailed explanations.

The emerging profession of teaching will be focusing on new communication methodologies and enriched by them for decades to come.

Notes

[1.] Many more examples of effective teaching strategies are provided in David G. Brown, Gordon McCray, Craig Runde, and Heidi Schweizer, eds., *Using Technology in Learner-Centered Education* (London: Allyn and Bacon, 2002).

[2.] The author is closely associated with the Ubiquitous Computing Movement in the United States. At Wake Forest, every student and every faculty member is supplied with a powerful laptop computer. More information is provided at www.wfu.edu/~brown.

2 Probing and Proving Competence

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Abstract

Since 1997 the Amsterdam Faculty of Education (EFA) has been officially recognised as a Dutch centre for experimental teacher education. EFA is a co-operation institute of the Hogeschool Inholland and the Hogeschool of Amsterdam.

In this paper we will describe the essentials of an assessment system and a web-based portfolio system that should help students take responsibility for their learning and their proving competence at three consecutive integrative assessments. The whole Faculty with 3500 students has embarked on a transition from "supply driven education and assessing whether the supply is absorbed by the student" to "demand driven education and challenging students to prove in their own way that they are competent".

To support the understanding of portfolio use, the new concept of curriculum for educating higher-level professionals is discussed briefly. We will stress the aspect that a new educational concept can only be successful in implementation if the assessment system is correspondingly altered. ICT plays an important role in this change.

The portfolio system helps people, under their own responsibility, to collect materials that can be used and re-used at different times for different purposes:

- learning (probing your learning processes, often with help of feedback by other people)
- assessing (proving competence, towards an outside authority; e.g. to gain admission to the next phase of the course, or to get a job, or to get admission to a next level of job)
- sharing (products and expertise should be part of a knowledge base; "unknown" people should be able to find them)

The nice thing about web-based portfolio is that you can use the same materials for those different purposes. Materials over the years can be ordered at different times for different purposes. For each purpose you pick a selection of the materials and cement them together (with a storyline) into a structure that serves the purpose.

The portfolio system is now in use for three years. Information can be found at the EFA publication site: http://www.efa.nl/publicaties/english.html

1. Introduction

We will start with an example before moving into abstractions.

At the Amsterdam Faculty of Education a member of the teaching staff maintains her own portfolio. It is part of the web-based system of portfolios of all teachers and students.

Figure 1: Menu bar of the EFA portfolio system

In the competence-section of her portfolio this teacher, among other things, reflects on the competencies that are needed to be a good coach of students who have to take responsibility. That is: responsibility for their own learning process and for the way in which in the future they are going to prove their competence to an assessment committee. This committee guards the entrance into the next phase of their study route or into the professional career.

Her analysis in her teacher portfolio induces reflections about the growth of her own competence in this area. She uses examples of feedback she got from students, she shares examples of teaching materials that she created or adapted, she experiments with creative multimedia forms of information and representation, and she uses metaphors to organise the material in such a way that growth and dilemmas become visible.

The building stones for these reflections however, -her products, the feedback she got-, are put into the products-section. There she collects those objects, orders them and provides them with short explanatory descriptions. When needed in the arguments under "competence", a simple hyperlink suffices.

Her portfolio is real, it is meant to stimulate her growth, because she considers herself as much a learner as a teacher. At the same time her portfolio is an example for students who still have to learn the delicate skills of reflection as a catalyst for learning. The white link "Portfolio" on the right of the menu in fig. 1 gives access to the portfolios of the other members of the community of students and teachers. With one restriction: every owner of a portfolio can close any part of his portfolio for strange eyes. But, and that is important, he

can then choose specific persons and make that part readable again, just only for those people. It is one of the tools in the tools-section.

A student who wants admission to a next phase in her study route, -e.g. a 6-month supervised teaching job connected to a demand driven educational arrangement from the Faculty-, has to show that she can handle the basic complex situations on the job. She has to show a basic competence. The Faculty has formulated criteria for this. That is done in such a way that there is much room for the applicant to design her own idiosyncratic proof that shows her specific identity and professionalism. However, these criteria are not built into the portfolio system. It is the student who has to be creative and convincing. This is shown in her selection of materials that have been collected, and in the way these building blocks have been cemented together.

The presentations-section is meant to construct this kind of assessment portfolio. And hyperlinks are used to point to the building blocks in the product-section and the competence-section. To be able to make an appropriate selection at different moments and for different purposes in their learning life, it is evident that students must continuously collect materials. It could be that a proof of competence growth, or the ability to adapt to changing circumstances, has to show a historic sequence over many years.

2. Collecting things for different purposes

So, 'portfolio' is about collecting. Collecting yourself for different purposes. A portfolio system helps people, under their own responsibility, to collect materials that can be used and re-used at different times for different purposes:

- ***probing***

  monitoring your learning processes, providing argumentation to choices that must be made, acquiring higher level metacognitive skills, asking and using feedback by others, e.g. mentor educator, instructor or peer students/workers

- ***proving***

  towards an outside authority; e.g. to gain admission to the next phase of the course, or to get a job, or to get admission to a next level of job

- ***sharing***

  products and expertise should be part of a knowledge base; "unknown" people should be able to find them

The nice thing about a web-based portfolio is that you can use the same materials for those different purposes. Materials over the years can be ordered at different times for different purposes. For each purpose you pick a selection of the "stones" and cement them together with a storyline into a structure that serves the purpose.

Let us look into the kind of stones that should be collected. We use a classification by Barton and Collins (1997) that is supplemented by Matthijsen, Elshout-Mohr and Van de Berg (2002).

Artefacts. Materials produced by students as a result of assignments in the curriculum. Of course, not everything has to be collected in the portfolio. It has to be useful for the purposes that the owner of the portfolio has in mind. However, it is better to collect many things, because you never know which new purpose you will think of in the future. Examples: piece of videotape, a pronunciation-test, article or paper, educational website, the result of a series of lessons given, even an answer you gave to an open question that tests comprehension.

Reproductions. These are artefacts produced outside the realm of the curriculum. They were not assigned, but they can be very important. You can very well use materials from the life as a leader of a scouting group in the portfolio of a student teacher. Maybe a newspaper wrote something on your amateur musical performance. Things like that.

Attestations. This is the feedback from others. Their opinion on your work, your knowledge, your skills, you way of co-operation. It could be just a mark on a test. It could be an written or oral evaluation of the role you played in a project. It could be an answer to an evaluation question you have put forward.

Statements. At certain moments a person should make position-statements about himself. Short and powerful. In which direction will I go? Or specifically not go. Where am I now in relation to certain competency-goals and how will I proceed? Of course, these statements can be scaffolded by hyperlinks to the artefacts, reproductions or attestations in the portfolio.

Captions. All materials in the portfolio (artefacts, reproductions, attestations, statements) should be given a meaning by short explanations to keep them connected to their source and history. Other captions could give meaning by telling about reasons why the material concerned is taken into the portfolio. Categories to structure the materials also belong to this kind of "stones". We like students to design their own system of categories.

Creations. Information is conveyed not only by text and other media like film, sound or picture. A lot of information is contained in the way the material is presented: a metaphor that is consistently used can be very convincing or enthusiasmizing, or an unexpected way of ordering the material that shows sudden insight. So, creations are discoveries and inventions in communication in educational situations using portfolio. Many inventions will be done in the future, in the gradual development of a 'portfolio-grammar', as happened to the film-grammar.

We hope that this way of looking at the content of portfolio shows how important it is for the course management not to pre-structure and to pre-phase the portfolio of the student.

They should understand that a rich environment in which to design your own idiosyncratic portfolio is a must for a lasting effect on learning and motivation. It leads to a more valid assessment. The rivalry between validity and reliability should be won by validity. We come to that in section 4.

3. A Learning Route

Let us follow the course of a student, 18 years old, coming from high school and starting with a teacher education course. He gets a Mentor teacher in a special metacognitive part of the curriculum ('Metawork') who explains that during this year you should continuously think of collecting materials that you could possibly use in an assessment session at the end of the year in which you apply for admission to the main phase of the course. In the modularised ICT-course during the first 10 weeks not only searching the Internet comes to order, but also publishing on the net. FrontPage is introduced. A personal portfolio is initialised and some materials that already have been collected during Metawork are now being placed into the portfolio. Here the ICT course ends and the Mentor teacher of Metawork carries on the stick. Students who want more advanced things in the area of web publishing can get optional courses.

So now, in Metawork, the real work begins: which things to collect, for what purpose, and which feedback do I ask from whom. A frame of reference is given in the form of the nation-wide agreed competencies of the beginning teacher.

This frame should help students in constructing story-lines that show their progress and that eventually can be used in the assessment. This activity is an efficient way to get students to gradually grasp the meaning of those competencies.

At first, the student likes it to show herself in her portfolio, that everyone can see. She likes to show off with pictures and provocative texts. Then the approaching assessment makes things serious. Your self-evaluation, supported by a cleverly ordered selection of evidence material, is scrutinised by the assessors. This could lead to a "no": not admissible yet to the assessment itself because your portfolio is incomplete or lacks the power to convince. The mentor plays a role in preventing these occurrences, but it can happen. Once you are in the assessment procedure you will have to defend yourself against critical questions on your history and its conclusive force with respect to the criteria for admission. And students find that they learn very much from this. Students even say reproachfully that the Program assesses in a competence based manner, but does not allow for enough competence oriented material to be collected. In this way the portfolio assessment exerts innovative implementation power by means of the students themselves!

In the main phase, under guidance of the Mentor teacher, there is more room for students to collect the materials that can be used to provide arguments for choices within the curriculum, to monitor your own learning process. Regularly you have to issue statements on your status on your way to certain competencies. The portfolio also provides for the means to visualise these appraisals on a time line.

In this phase students have to formulate and contract learning goals. They have to record agreements on the specifications of products that have to be delivered in dual learning-working environments. The feedback on the deliverance on the agreements, coming from other people than the student himself, can be put and fixed into the portfolio. Often the student asks for specific persons to give feedback on matters that are present in the portfolio and that are made accessible only to those few critical friends. If you want to combine the different functions of development portfolio and assessment portfolio you need to have a portfolio system that gives the owner the control on who may see what!

The criteria that control the assessments become increasingly loose when the students progresses to higher forms of professionalism. The criteria give more and more room for students to design and build their very individual proof, structured by themselves to fit their individual qualities, to make their proof most effective. It supposes a growing equivalence between assessee and assessor.

The influence of the portfolio in the assessments increases in the course of the study route, simply because there is more history present in the portfolio with which you can show, and give arguments about, professional growth.

During the study Program a student will recognise the importance of sharing products that can be used by others. Learning is connected closely to production of useful things, we believe. He will learn the conditions for effective sharing of expertise and information. By the way, often the concerned materials will not be in the portfolio itself, but at the place where they have been produced, usually an Electronic Learning Environment. In that case the portfolio contains short captions that show the essence and a hyperlink.

4. Educational Context

The most important issue is the transfer of responsibility from teacher to student. In learner centred education we consider the learning circle as the base of the educational context. An educational program must be seen as a set of facilities that can be used by the student to get to his goals as efficiently as possible.

Each learning process the student goes through, consists of, the phases of **orientation, planning, execution and evaluation**, and is guided by the competencies derived from the professional profile. See fig. 2. For students this means that in their orientation with respect to the learning and working process they take the competencies they need to acquire as their point of departure. In doing so, they are aware of the fact that at a later stage, maybe after many circles, during the assessment they will have to demonstrate that they have actually acquired the required competencies. On the basis of that orientation, they formulate and contract concrete learning goals and activities (planning),

subsequently work on useful products in a learning environment created by the program (execution), and, finally, they evaluate the degree to which those activities have contributed to the realisation of their learning goals and the acquisition of competencies. They have to re-assess their position as a part of the next orientation in the next learning circle.

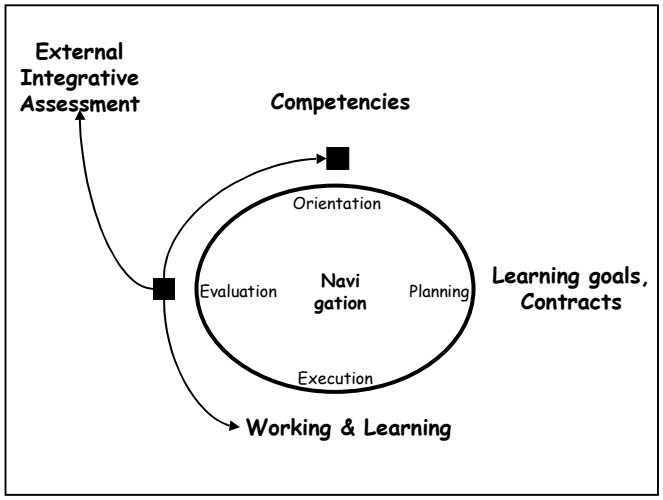

Figure 2: Facilities in a learner centred program

Also they have to keep in mind that after many circles they will have to show proof of competence at an integrative assessment session. This is a reference for the next orientation and a guide in the selection of materials that will be collected into the portfolio system.

Traditional education will think about transfer of responsibility only in the bottom part of the circle, because Orientation, Planning and Evaluation are traditionally done by the teachers. If we want to educate enterprising, risk bearing individuals who are prone to change and who will pro-actively manage change in society, then we should make a serious effort to transfer responsibility also in the other phases of the learning circle! Portfolio plays an important role in this transfer.

Educational notions with respect to constructivism, productive and authentic learning, competencies, and demand driven dynamic curricula are closely connected to this responsibility issue. We don't elaborate on this issue here.

We have put forward the thesis that an educational program must be seen as a set of facilities that can be used by the student to get to his goals as efficiently as possible. A clear formulation of competencies, understandable by students, is one of those facilities. The next one is a system that takes care of contracting learning goals en planning. Then, learning practices should be provided in which authentic learning can take place connected to useful productive work. An set of integrative assessments should be present, together with a way of communicating with students about the criteria that are being used. Each of these subjects deserves a separate paper! Here we concentrate on the portfolio facility. It should be clear that the notion of continuously collecting materials to be used for different purposes connects to all four phases of the learning circle.

It is clear that a change in concept of how to educate people must be accompanied by a corresponding change in assessment system. Students are calculating people who want to get results as efficiently as possible. So, construct the assessment system in such a way that they calculate with the important things of the new concept! Let them calculate on showing competencies in their personal most efficient way, instead to calculate on credit points.

To enable students to calculate, competence descriptions are necessary both in relation to the 'internal thermometer' (self-assessment) and in relation to the 'external thermometer' (assessment by others).

At the Amsterdam Faculty of Education there are three consecutive integrative moments of assessment during the program. For this to be possible, criteria must have been formulated for each competence, which students have to meet before they can consider themselves 'competent to undertake the main phase', 'competent to undertake the assistant teacher phase' or 'a competent and qualified teacher'.

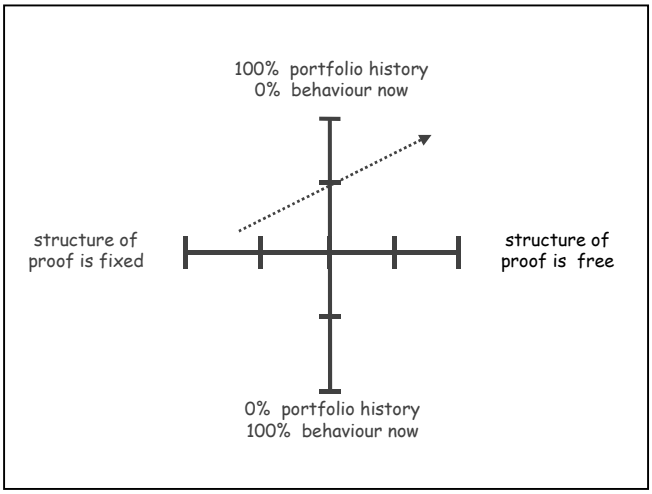

Figure 3: Dimensions of portfolio assessment

These three integrative assessments are being developed in a two-dimensional space. The parameters determine how much freedom a student will have in designing his or her own convincing way of proving competence, and which role the history from the portfolio plays in that proof. The sequence of three assessments will follow the positions indicated by the skew arrow.

An issue that is closely connected to this dimensional cross is the competition between reliability and validity of the assessment. In the case of assessment of higher professional qualities it seems that stress on reliability is at the cost of less validity. 'Fairness' on this level means accounting for differences. See Elshout-Mohr (2000) for a elaboration on this.

We teachers must resist the temptation to prescribe the way in which competencies are proven. We are tempted because

we think heavily in terms of reliability and comparability (is it because we want obsessively to keep grip on things?). A portfolio system should not be fitted with prescribed forms of proof. Of course, a Program can prescribe certain ways of proof, but that should not be built into the system. The student himself has the responsibility to comply with the demands that the Program has made.

5. Portfolio System

To conclude we offer the concept of a web based portfolio system that can be used for the many different purposes that have been mentioned until now. The portfolio system of the Amsterdam Faculty of Education, which is in use for three years now, should be seen as an previous stage in the development of this concept. At the moment a consortium of several Dutch universities and polytechnics is building a system according to the concept. A basic characteristic of the design is the focus on the individual owner, and not on the program or course or educational institute. The owner keeps up his portfolio when he uses portions of programs of other institutes and continues to use it in his professional career.

We refer to section 2 of this paper. A portfolio system helps people, under their own responsibility, to collect materials that can be used and re-used at different times for different purposes: ***probing, proving, sharing***. At this place we add: ***showing off***.

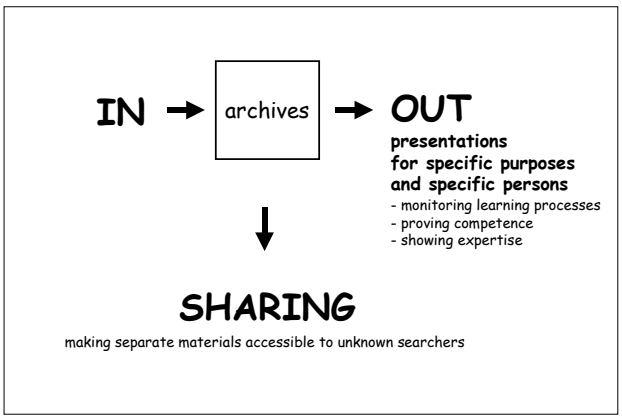

Figure 4: Portfolio system

A portfolio system consists of an "Archives" part, a "Presentations" part and an "Administration" part.

The "Archives" is a web based database in which the owner can keep, classify and find his materials. The owner can design his own classification and search system. All materials can get captions. The read and write rights are exclusively for the owner.

Using his archives the owner can construct many specific "purpose-portfolios" or "Presentations". E.g. a development portfolio, an assessment-portfolio or a show-portfolio. Functionalities connected to this part of the system include: selecting archives-material, constructing a presentation and sending a message to persons or an authority, automatically providing them with access-information. The person concerned arrives immediately in the Presentation that has been prepared for him. The owner can adjust the time window in which the "guest" will have read-access to his presentation.

A post-box is provided for feedback from the guest.

The presentation can have any form: html, tables, PowerPoint. We prefer translation to html because it gives the most control over the links to the elements in the database.

The system provides for different level owners: from no skills in web publishing to many skills. Also the use of templates is supported. This gives the educational institutes the possibility to provide, at their supporting website, students with help in constructing a presentation that should meet certain requirements. As has been said before: those templates will not be built into the system. One reason is the responsibility question, the other the fact that this system should serve many learners in many institutes and programs, and even professionals in their career.

A special kind of Presentation is the Show-portfolio. This presentation is accessible for the whole world. No invitation of guests is necessary. It is the default entrance of the owner into his own portfolio. The system provides for a search mechanism for visitors from the world.

Until now we covered *probing, proving* and *show*. The *sharing* is taken care of by the possibility for the owner to mark any element from his archives, by which it is offered to a knowledge management system. This system offers to the visitor-from-the-world advanced search-and-find facilities.

We will not end this paper without a few remarks on the role of ICT. Some aspects of portfolio-use that we have described can be implemented very well with a paper portfolio.

It could be smart to start with a paper portfolio. This refers to starting students but also to starting institutes. You will have to give much time to the educational implementation aspects connected to a possible shift in paradigm in thinking about educating professionals.

But you will miss a lot if you continue on paper. Sharing and Showing, at the scope we presented here, will not work on paper. And yet these aspects are closely connected to future changes in education. Offering Presentations to several specific persons at the same time will be a logistical horror. Organising your archives with database facilities like multiple categories is another thing you will miss. And last but not least, we must think of the Creations in section 2. It is about discoveries and inventions in web publishing with respect to communication in educational situations, and with respect to showing essentials and relations in a newly convincing way.

References

Barton, J. & A. Collins (1997*). Portfolio-assessment: a handbook for educators*. Dale Seymour Publishers.

Elshout-Mohr, M., Oostdam, R., Dietze, A., & Snoek, M. (2000). *Assessment in a Competentence-Oriented Dynamic Curriculum*. Paper presented at the ECER-conference, Edinburgh. Available at: http://www.efa.nl/publicaties/docs/elshout.doc

Matthijsen, E., M. Elshout-Mohr & T. van den Berg (2002). Oral communication

Ritzen, M. & Kösters, J.M.P. (2001*). Combining Different Aims in a Portfolio System.* Paper presented at the Ed-Media conference, Tampere, Finland. Available at: http://www.efa.nl/publicaties/docs/finlandtrans.doc

Weijdema, W. (2000). *Using a web-based portfolio for improving language competencies.* Paper presented at Eurocall 2000. Available at: http://www.efa.nl/publicaties/docs/pf-taal.doc

Wielenga, D.K. (2000). *Proving Competence: Integrative Assessment and Web-based Portfolio System in a Dynamic Curriculum*. Paper presented at the SITE conference San Diego. Available at: http://www.efa.nl/publicaties/docs/proving.doc

Wielenga, D.K. (1999). *Le programme expérimental de formation des enseignants aux Pays-Bas*. Rapport sur une expédition à la recherche d'un programme de cours plus dynamique. Document destiné au séminaire de formation CSEE/AFETT sur les nouvelles technologies dans l'éducation, Florence 3-9 décembre 1999. Available at: http://www.efa.nl/publicaties/docs/frans.doc

Wielenga, D.K. (1998). *Transformation to a dynamic curriculum*. Paper presented at the conference on Improving University Learning and Teaching, Dublin. Available at: http://www.efa.nl/publicaties/docs/iut98.doc

Wielenga, D.K. (1998). *Naar een vormende lerarenopleiding.* In: De Bekker-Ketelaars e.a.. Vormende Lerarenopleidingen. Utrecht, SWP. (*Towards a developmentally oriented teacher education. In: Developmental Teacher Education*)

Links to many different portfolio sites can be found on:
http://www.efa.nl/publicaties/teksten/pf04.html
http://www.edusite.nl/portfolio

3 What is the Added Value of Web-based Learning and Teaching? The Case of Tampere University of Technology

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Abstract

The purpose of this paper is to describe added value in web-based learning. The question is how contexts and situations influence added value and what university students think of it. The added value in a given learning context should not be generalized to all contexts.

Keywords: value added, web-based learning and teaching in higher education, transfer of best practices

1. Introduction

The present research has not attempted to study the added value in terms of achievement. Instead, it has concentrated on students` expectations and experiences of web-based learning and teaching processes. The added value of web-based learning will also be evaluated in comparison to conventional learning. For the further development, planning and implementation of web-based teaching and learning it is important to find pedagogically appropriate teaching methods for various teaching situations. The users of web-based learning environments should consider critically how to add value to their teaching and learning by using web-based environments.

Later in this paper we describe the results of the research aimed at exploring the added value of web-based teaching and learning at the Virtual University of TUT (Tampere University of Technology). The findings of this study indicate both the expectations and experiences of added value. To make optimal use of web-based learning environments we need pedagogically validated models and concrete instructions for teaching and learning to be carried out on the net.

2. Categories of added value

The question of added value in web-based teaching and learning has concerned educators, administrators and the public for various reasons (Rogers, 2001). Earlier research suggests a great potential for added value for learning through the use of the web (e.g. Overlock 1995; Whitnall et al. 1994; Jones & Smith 1992; Lamb 1992; Lennon & Maurer 1994; Kappe et al. 1993; Andrewartha & Wilmot 2001; Felix 2001). However, several studies on comparing conventional courses with computer-based or technology-enhanced courses yielded no significant difference in academic achievement (Russell, 1997). In fact, the results of media-comparison studies indicate, that the use of one instructional medium over another will most likely produce no significant difference in achievement (Clark, 1983; 1994a; 1994b; Kozma, 1991; 1994a; 1994b; Jonassen, Campbell & Davidson, 1994; Lockee, Burton, & Cross, 1999, Russell, 1997).

Why is the question of benefits and the added value of web-based learning and teaching so interesting and why are institutions of higher education so hard fighting to secure funding for technology? Because nowadays higher education must respond on many fronts, including workforce training, just-in time learning, shortages of teachers, geographically limited learners, significant changes in part-time and full-time learning and learners with special needs (Adelman, 1999; Dolance & Norris, 1995; Green, 1999; Schneider & Shoenberg, 1999; Rogers, 2001). Therefore the benefits of using various media and teaching methods should be systematically investigated. Teachers and learners should choose the pedagogically most appropriate methods and tools for each learning situation. We assume, like Rogers (2001), that a rich mix of learning, teaching and thinking tools meets the needs of market-driven convenience, affordability, accessibility and opportunity for significant cognitive change.

Bartolic-Zlomislic & Bates (2002) have pointed out that in order for web-based course to be successful, benefits and limitations to the organization and to the student should be appropriately balanced. Focus must be on potential performance and value added must be benefits to both the institution and more importantly to the student.

The aim of this paper is scrutinize the question of added value from the students` perspective in higher education. Forsblom & Silius (2001, 2002) have divided the concept of added value into four categories: flexible organization of learning, improvement of teaching quality, development of learning and communication skills by using web-based learning environments and the innovative use of information and communication technologies in teaching. These categories have also been used in the present study.

2.1. The flexible organization of learning

2.1.1. Understanding time and space

The concepts of time and place become relevant when designing web-based teaching and learning. Web-based learning and teaching need not necessarily be real-time, nevertheless studying always takes place in a physical context (Matikainen 2000; Vahtivuori 2000). In learning all physical and cognitive activities are somehow contextualized. According to Vahtivuori and Masalin (2000) the physical surroundings and cultural context define and change the nature and way of our activity: when the context affects us and changes our activities, our activities produce that context. In web-based learning the physical context is exemplified by a lack of physical presence. This sometimes impacts a feeling that learning is independent of time and space and a feeling of unrealistic easiness in learning. Therefore teachers have to plan interactive activities, and the course structure (e.g. timetable for the course) carefully beforehand. How the interaction between teachers and students will succeed in web-based learning depends to a large extend on the teachers` ability to plan and use pedagogically appropriate methods in teaching, to give guidance and support for collaboration.

2.1.2. Interdisciplinary and vertical study opportunities

Web-based study open up opportunities for both interdisciplinary and vertical studies. Interdisciplinary and vertical studies bring teachers and students from different fields together to observe the same phenomenon. Such crossing of institutional borders over different education levels, fields and organizations increases sharing of knowledge and know-how (Eteläpelto & Tynjälä 1999). The flexible organization of learning via the net diversifies the course supply in small units. Web-based course supply also gives students an opportunity to choose from a wider selection of courses, even from international markets.

2.1.3. Access to digital materials

Students should be informed about appropriate materials available electronically. Efficient and effective systems that support students` access to electronic material could be provided e.g. through full text databases and electronic journals together with flexible borrowing systems (Lefoe et al., 2001).

2.2. The improvement of teaching quality

2.2.1. The design of learning environments and course structures

In web-based learning the work of the teacher is partly changing into designing learning environments. The role of the teacher is to know the tools and the characteristics of the learning environments they use well enough to make pedagogically reasonable choices and solutions in the planning of teaching. Carefully designed and appropriately selected tools of the learning environments support students` learning processes and enable teachers to concentrate on the essential contents of the substance. In line with Uljens (1997) and Vahtivuori & Masalin (2000) we see the carefully designed and pedagogically appropriate learning environment essentially as a community of learners where communal learning and culture and the active process of the learner may become real.

Some earlier teaching experiments (Hämäläinen 1999; Hämäläinen & Muhonen 1999; Forsblom 2001; Pohjolainen et al. 2001) carried out by the Hypermedia Laboratory of TUT show that the properties available in the learning environments were not fully exploited. Pohjolainen et al. (2001) consider that in the teaching experiment in mathematics the tools that did not provide direct support for the learning were not utilized. The results of the teaching experiments using the "Russian on the Net" learning environment indicate the same (Forsblom, 2001; Forsblom & Silius 2001; Forsblom 2002).

Pohjolainen et al. (2001) consider that it is not necessary or beneficial to use all possible methods and tools in every context and situation, even if the methods and tools as such are useful. In their opinion the excessive cognitive load may inhibit goal-oriented learning, e.g. by undermining students` motivation to study. We agree partially with this argument. On the other hand, we note that it is also possible that the tools of the learning environments are not used appropriately, because in some cases teachers and students do not know how web-based learning environments could be used in a pedagogically appropriate way.

2.2.2. The quality of teaching materials

We assume that teaching materials can be produced and updated easily in web-based environments. The new research knowledge can be transferred quickly to teaching via the net. Web-based teaching and learning improves the quality of teaching materials provided that the designers take a great responsibility to produce high quality material in these more open environments. Network-based environments offer various ways to illustrate teaching materials by simulation, modeling and visualization.

In learning it is not essential to memorize things; the ultimate objective of learning is to restructure and enhance the knowledge of a student. Therefore learning should be closely connected to real life situations. Lambert Gardiner (1993) argues that hypermedia-based teaching material is educationally superior, because it simulates the real life situation and students deal with information from many sources. When planning web-based courses teachers should consider how they could connect teaching e.g. to situations in working life.

2.3. The development of learning and communication skills using web-based learning environments

There are many studies presenting the clear advantages of cooperative and collaborative learning over more individual

and competitive formats (Johnson & Johnson, 1975; Slavin, 1991). According to Bonk and Reynolds (1997) many collaborative pedagogical strategies also have relevance in web-based learning. Interactive and distributed technologies enable learners and instructors to participate in an incredible array of information, resources, and instructional experiences (Bonk & Cunningham, 1998).

2.3.1. Collaborative web-based learning

Collaborative web-based learning tools, like tools for student collaborative inquiry, problem-based learning, articulation and dialogue, debate and personal reflection, offer various ways for learners, instructors, and experts to interact (Bonk & King 1998; Cummings et al.; 2000; Oliver & McLoughlin, 1999; Oliver et al., 1998). Web-based courses that are based on the theory of collaborative learning give students an opportunity to learn sharing information and argumentation in a multidisciplinary way. Students learn to use scientific terms and concepts by explaining their meanings to each other. According to Bonk (2001), to create a learning community, the system must bring people together for some initial common interest or quest (e.g. sharing, problem solving etc.) Members of the online groups also need ways to become informed about events of the learning community (Duffy et al., 1998).

2.3.2. Individualized self-directive web-based learning

Web-based learning environments are affected by the actions of the user (Tucker 1990). Students are able to actively choose program components in whatever desired order, which develops self-directive skills (Barker & Tucker 1990; Bonk & King, 1998). According to Weston and Barker (2001) student control is especially desirable for lessons that cover a wide range of difficulty so that students can choose an appropriate difficulty level. In this case instructors must relinquish some control of students learning, because some students` have neither the discipline nor the inclination to work independently (Weston & Barker (2001).

It should be remembered that we do not have to choose between collaborative and individualized teaching and learning methods in one separate web-based course. It is possible to use both so that teachers and students consider which method is pedagogically appropriate in each context.

2.4. The innovative use of information and communication technologies in teaching

New functional and pedagogically appropriate teaching methods can be found by testing the technological innovations. When planning the course structure, teachers should carefully consider the possibilities for learning provided by the environments. The use of environments` tools should be closely connected to the course objectives and the teaching methods on the courses. After the experiments, researchers, teachers and students should evaluate whether the selected tools brought added value to teaching and learning.

In some cases the technological improvements, e.g. the quality of photos on the web, have caused changes in teaching methods. Technological improvements have essentially changed teaching methods e.g. in medicine. Nowadays medical students learn to make diagnoses by comparing laboratory photos on the net. (Forsblom & Silius 2001; Forsblom, 2002).

3. Students` expectations of added value in web-based teaching

Expectations of added value were investigated at the Tampere University of Technology. The research was carried out before and after web-based courses. The data comprise of 400 responses before the web-based courses and 160 responses after the experiments. Empirical material was collected by web-questionnaire in autumn 2001 (Silius et al. 2002).

The students` background information was also researched. Majority of the students were at the beginning of their studies and usually they did not have any experiences of web-based learning. In their opinion they had been succeeded quite well in earlier studies. They live near the campus and they were going to study a web-based course at home or in computer classroom at the University of Technology. Of these students 40% were working while studying and 30% of them studied during the working day at their workplace. Students reported that they could use word processing software, helps, email, web-browser and install plug-ins but they did not know news and chat as well (Silius et al. 2002).

Students were allowed to mention all value added as they expected. After experiences they were also allowed to mention all the value added which had been realized.

From the students` perspective the most considerable added value in web-based teaching was the flexible organisation of education.

Expectations	(%)
Flexible participation	56%
Access to course material	37%
Flexible learning environment	24%
Automation of teaching routines	22%
Crossing of institutional borders	14%

Table 1: Students` expectations of added value/flexible organisation of education.

Those students who were working while studying were in special need of flexibility in their study schedules. They mentioned that participation in courses organised only on campus were inconvenient for the most of them. For those students the opportunity to study via the web was the value added. In the situations where course schedules overlapped or courses were full the web-based teaching and learning were reported to be value added.

Access to course material was also mentioned as an added value. Students expected to get all the course material via the web and they thought that the sources of web-based teaching materials will be better marked. In their opinion using the web in learning and teaching students are able to automate their everyday routines and routine tasks (like the delivery of teaching materials, enrolment in exercise groups or to courses etc.).

The results of the study indicate that "*The improvement of teaching quality*" was considered as value added.

Expectations	(%)
Better quality of course material	26%
Flexible feedback and support practices	19%
Individualized teaching	12%
Multidisciplinary courses	11%
Course material produced by specialists	10%
Support to personal contacts	9%

Table 2: Students` expectations of added value/improvement of teaching quality.

Students expected that web-based teaching and learning would improve the quality of teaching materials. They hoped that teaching materials would be illustrated, for example, by simulation, modelling and visualization. The students expected that they would get more just-on-time feedback and support for their studies in web-based teaching.

The students` expectations of added value in web-based learning in the category "*The development of learning and communication skills using web-based learning environments*" are as follows:

Expectations	(%)
Practice in self-direction skills	36%
Practice in learning to learn skills	18%
Practice in collaborative learning skills	6%

Table 3: Students` expectations of added value/development of learning and communication skills using web-based learning environments

The students expected that their learning to learn skills and self-direction skills would improve in web-based learning and also that open learning environment and tutoring practices would support the development of those skills.

The innovative use of tools was mentioned as an added value in the category "*The innovative use of information and communication technologies in education*".

Expectations	(%)
Innovative use of tools	16%

Table 4: Students` expectations of added value /innovative use of information and communication technologies in education.

From the students point of view new kinds of web-based tools could bring added value to teaching and learning. The technological improvements, e.g. the illustrated hyperlink mind maps, improve students` skills in knowledge construction and the tools for creating team consciousness improve motivation to study.

4. Realization of added value

To obtain more information about good web-based learning practices in technical sciences eleven teaching experiments were evaluated (http://www.virtuaaliyliopisto.tut.fi/verkkopakki).

The evaluation process consists of pedagogical and usability sections (see Albion 1999; Leinonen et al. 2002; Quinn 1996; Soloway et al. 1996; Squires 1997; Squires & Preece 1999; Tergan 1998). The researchers paid attention to how the learning context and pedagogical appropriateness were taken into account in user interface, tools, tasks, quizzes and in planning, designing and implementation of content production. The needs of learners such as growth, diversity and motivation should be supported in software learning environments. Special the attention was paid to how software supports those needs (see Soloway et al. 1996).

The data indicates that course web sites were composed of html pages with information about lectures, course structures and so on. Usually there were links to course material. The pages also included the option to register for the exercise groups or to return seminar papers or exercises to the teacher via the web. Interactive drills, web-lectures and simulations for testing comprehension of course materials were used in the teaching experiments. Activating and motivating tasks for reading comprehension concerning course materials were also used. Teaching methods like learning diaries and porfolios were used only on few courses.

The table illustrates the added value realized better then expected.

Realized vs. expected added value (%)		
	Realized	Expected
Flexible participation	60%	56%
Practice in self-direction skills	56%	36%
Better quality of teaching material	27%	26%
Practice in collaborative learning skills	13%	6%

Table 5: Realized vs. expected added value from the students` perspective.

The table below illustrates the added value realized less than expected.

Realized vs. expected added value (%)		
	Realized	Expected
Access to course material	35%	37%
Flexible learning environments	23%	24%
Automation of teaching routines	19%	22%
Practice in learning to learn skills	13%	18%
Flexible feedback and support practices	12%	19%
Individualized teaching	11%	12%
Crossing of institutional borders	7%	14%
Multidisciplinary courses	7%	11%
Support for personal contacts	6%	9%
Material produced by specialists	5%	10%

Table 6: Realized vs. expected added value from the students` perspective.

5. Discussion and conclusions

The results of the study showed problems in design and implementation of web-based courses (see also e.g. Hara & Kling 1999; Noble 1997, 1998a, 1998b). This is the reason why added value was not perceived as useful.

According to the data the educational benefits and the appropriateness of web-based courses were sometimes forgotten. In courseware design it must be remembered that there is no pedagogical benefit arising from simply hypertextualising existing course material. It is not advisable to use the web to replace of books or television. The web is a new kind of media, which is also often forgotten. The benefits and the power of that new media should be understood and exploited in well-proved ways.

The roles of students and teachers were perceived to be similar as in conventional education. No attention was paid to the change needed in web-based learning environments. Only a few experiments took account of the fact that teachers are no longer mere information sources for students. In web-based teaching they guide the entire learning process. According to Kook (1997) the teacher's new role in network-based teaching is like a consultant who searches for information, teaching materials and guides students in their learning processes. Kook sees the teacher as an assistant in the learning team. Teachers will also help each other in planning teaching schedules, sharing new ideas, helping each other with education challenges etc. Both institutional and individual borders will become invisible when teachers together develop web-based tools for instructing students.

Unfortunately the need for experienced tutors was often forgotten. The tutoring system, like all the other support systems, should be planned carefully beforehand, because the reactions to problems that arise during the ongoing courses are always slow. Usually in theory the teacher is seen as a tutor. To achieve good learning results the change in the students' role has to be reflected in the students' conception of his/her own learning and in learning theory which supports the learning environment.

Some web-course designers concentrate not on the instructional design or teaching support aspects required for teaching and learning via the web but on the technical tools and design of web pages themselves. The pedagogical issues and solutions have not always been thought out. Too often conventional education methods have been used on web courses and too often the creative use of new learning theories has been neglected.

The transfer of added value to various contexts requires more information from experiments. The quality of learning does not improve by using computers if one does not know how to use them appropriately. The potential of the web-based learning environments in comparison with the more traditional learning environments needs investigation. When defining added value e.g. content, learning culture, goals and the level of education should be considered. The results of

some studies show that there is some useful added value in different contexts, but it is difficult to transfer the best practices of those studies to new learning situations. Background information is needed when transferring one successful added value to another quite similar teaching context. The background information includes factors like structure of the course, planned learning methods, students` learning histories and demographic information on students, the roles of teachers and students and the level of formality.

We have found that the added value in the defined context cannot be generalized as useful in all contexts. It is clear that we need more information about the methods which work in web-based learning environments. The evaluation group of the Hypermedia Laboratory and the Virtual University of TUT is making an effort to clarify the conception of added value by investigating the advantages and disadvantages of web-based learning in various contexts. The data will be collected in the pilots of the Hypermedia Laboratory and the Virtual University of TUT for many years. The paper presented some results of the teaching experiments carried out last year. We hope that the findings of future teaching experiments will facilitate even more the transfer of added value to new web-based learning situations.

References

Adelman, C. (1999). Crosscurrents and riptides: Asking about the capacity of the higher education system. Change, 31(1), (pp. 21-27).

Albion, P.R. (1999). Heuristic evaluation of educational multimedia: from theory to practice. http://www.usq.edu.au/users/albion/papers/ascilite99.html (checked up 2.7.2002)

Andrewartha, G. & Wilmot, S. (2001). Can multimedia meet tertiary educational needs better than the conventional lecture? A case study. Australian Journal of Educational Technology 2001, 17(1), (pp.1-20).

Barker, J. & Tucker, R. N. (Eds) (1990). The Interactive learning revolution: Multimedia in education and Training: New York: Nichols.

Bartolic-Zlomislic. S. & Bates, A.W. (2002). Investing in Online Learning: Potential Benefits and Limitations. http://bates.cstudies.ubc.ca/investing.html (checked up 2.7.2002)

Bonk, C.J. (2001). Online Teaching in an Online World. Bloomington, IN:CourseShare.com.

Bonk, C.J. & Cunningham, D.J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In C.J. Bonk, & K.S. King (Eds.), Electronic collaborators: Learner-Centered technologies for literacy, apprenticeship, and discourse (pp. 25-50). Mahwah, NJ:Lawrence Erlbaum Associates.

Bonk, C.J., & King, K.S. (1998). Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse. Mahwah, NJ:Lawrence Erlbaum Associates.

Bonk, C.J. & Reynolds, T. (1997). Learner-Centered Web Instruction for Higher-Order Thinking, Teamwork, and Apprenticeship. In B. Khan (ed.) Web-Based Instruction. New Jersey: Englewood Cliffs, (pp.167-177).

Clark, R.E. (1983). Reconsidering research on learning from media. Review of Educational Research, 53(4), (pp. 445-459).

Clark, R.E. (1994a). Media and method. Educational Technology, Research and Development (ETR&D), 42(3). (pp. 21-29).

Clark, R.E. (1994b). Media will never influence learning. Educational Technology, Research and Development (ETR&D), 42(2), (pp. 7-10).

Cummings, J. A., Bonk, C.J., & Jacobs, F.R. (2000). Twenty-first century syllabi: Dynamic tools for promoting interactivity. Manuscript submitted for publication.

Dolence, M.G. & Norris, D.M. (1995). Transforming higher education: A vision for learning in the 21st century. Ann Arbor, MI: Society for Collage and University planning (SCUP).

Duffy, T., McMullen, M., Barab, S., & Keating, T. (1998). Professional development in the 21st century: Preparing for the future. A strategic plan for research and development. Unpublished manuscript, Indiana University of Bloomington.

Eteläpelto, A. & Tynjälä, P. (1999). Oppiminen ja asiantuntijuus. Työelämän ja koulutuksen näkökulma. WSOY, Porvoo.(In Finnish)

Felix, U. (2001) A multivariate analysis of students´ experience of web-base learning. Australian Journal of Educational Technology 2001, 17(1), (pp.21-36).

Forsblom, N. (2001). Intercultural foreign language studies in the Russian on the Net Learning Environment. In EDMedia 2001. World Conference on Educational Multimedia, Hypermedia & Telecommunications. June, 2001 Tampere, (forthcoming).

Forsblom, N. (2002). What is the Added Value of Web-based foreign language learning ?. In V. Kohonen & P.Kaikkonen (eds.) Quo vadis, foreign language education /Fremdsprachenunterricht? Publications of the Department of Teacher Education, University of Tampere (in print).

Forsblom. N. & Silius, K. (2002). Value added on Web-based Learning Environments. In E. Pantzar (ed.), Perspectives on the age of the information society. Tampere: Tampere University Press, (pp. 103-113).

Green, K.C. (1999, March April). When wishes come true. Colleges and the convergence of access, lifelong learning, and technology. Change, 31(2), (pp. 11-15).

Hara, N. & Kling, R. (1999). Students´ frustrations with a web-based distance education course. First Monday, 4(12). /verified 16 Mar 2001/ http://firstmonday.org/issues/issue4_12/hara/

Hämäläinen, M. (1999). Russian on the Net. Intelligent Computer and Communications Technology: Teaching & Learning for the 21st Century. PEG99. Proceedings of the Ninth International PEG Conference 10-12 July 1999, (pp.1.13). University of Exeter, England.

Hämäläinen, M., & Muhonen, J. (1999). Venäjää verkossa. In H. Ruokamo & S. Pohjolainen (eds.), Etäopetus multimediaverkoissa : Kansallisen multimediaohjelman ETÄKAMU -hanke (pp. 251-265). Helsinki: Paino-Center Oy. (In Finnish)

Johnson, D.W., & Johnson, R.T. (1975). Learning together and more: Cooperation, competition, and individualization. Englewood Cliffs, NJ: Prentice Hall.

Jonassen, D.H., Cambell, J.P. & Davidson, M.E. (1994). Learning with media: Restructuring the debate. Educational Technology, Research and Development (ETR&D), 42(3), (pp.31-39).

Jones, L. J. & Smith, S.G.(1992). Can multimedia instruction meet our expectations? EDUCOM Review, Jan-Feb, (pp. 39-43).

Kappe, F., Maurer, H.& Sherbakov, N. (1993). Hyper-G. A universal hypermedia system. Journal of Educational Multimedia and Hypermedia, 2(1),(pp. 36-66).

Kook, J-K. (1997). Computers and Communication Networks in Educational Settings in the Twenty-First Century: Preparation for Educators' New Roles.

Educational Technology 37 (2), (pp.56-60).

Kozma, R.B. (1991). Learning with media. Review of Educational Research, 61(2). (pp. 170-211).

Kozma, R.B. (1994a). A reply: Media and methods. Educational Technology, Research and Development (ETR&D), 42(3), (pp. 11-13).

Kozma, R.B. (1994b). Will media influence learning? Reframing the debate. Educational Technology, Research and Development (ETR&D), 42(2), (pp.7-19).

Lamb, A.C. (1992). Multimedia and the teaching learning process in higher education. In Teaching in the information age: The role of educational Technology. New Directions for Teaching and Learning Number 51. The Joddey Bass Higher and Adult Education Series. San Francisco: Jossey-Bass Publishers.

Lambert Gardiner, W. (1993). Using hypermedia to turn university teaching inside out. In N. Metallinos (Ed), Verbo-visual literacy: Understanding and applying new educational communication media technologies. Selected Readings from a Symposium of the International Visual Association, June 25-29, Delphi, Greece (pp. 65-72).

Lefoe, G., Albury, R., Littler, C. & Trivett, N. (2001). Collaborative partnerships: Changing roles for academic and support staff in new learning environments. In J.G. Hedberg (Ed), Online Learning Environments: Research and Teaching. RILE Monograph. Wollongong: Faculty of Education, University of Wollongong.

Leinonen, T. (2002). Collaborative discovering of key ideas in knowledge building. Computer Support for Collaborative Learning (CSCL 2002) Conference. Boulder, Colorado, USA, January 7-11, 2002.

Lennon, J. & Maurer, H. (1994). Lecturing Technology. A future with hypermedia. Educational Technology, April, (pp.5-14).

Lockee, B.B., Burton, J.K., & Cross, L.H. (1999). No comparison: Distance education finds a new use for 'No significant difference'. Educational Technology, Research and Development (ETR&D), 47(3), (pp.33-42).

Matikainen, J. & Manninen, J. (2000). Aikuiskoulutus verkossa. Verkkopohjaisten oppimisympäristöjen teoriaa ja käytäntöä. Helsingin yliopiston Lahden tutkimus- ja koulutuskeskus. Tampere: Tammer-Paino. (In Finnish)

Noble, D.F. (1997). Digital Diploma Mills, Part I, The automation of higher education. /verified 16 March 2001/ http://communication.ucsd.edu/dl/ddm1.html

Noble, D. F. (1998a). Digital Diploma Mills, part II, The coming battle over online instruction. /verified 16 March 2001/ http://communication.uscd.edu/dl/ddm2.html

Noble, D.F. (1998b). Digital Diploma Mills, Part III, The bloom is of the rose. /verified 16 March 2001/ http://communication.uscd.edu/dl/ddm3.html

Oliver,R., Omari, A., & Herrington, J. (1998). Exploring student interactions in collaborative World Wide Web computer-based learning environments. Journal of Educational Multimedia and Hypermedia, 7 (2/3), (pp. 263-287).

Overlock, T.H. Sr. (1995). Development of a multi-year plan for the integration of multimedia technology into the learning environment at Northern Maine Technical College. EdD Dissertation. US, Maine: Nova Southeastern University, (pp. 55-73).

Pohjolainen, S., Hautakangas, S., Ranta, P., Levasma, J. & Pesonen, K. (2001). A Learning Experiment in Mathematics using A&O-Learning Environment. Intelligent Computer and Communications Technology -

Learning in On-Line Communities. PEG 2001 23 rd-26th June 2001, Tampere, Finland, (pp. 30-35).

Quinn, C. N. 1996. Pragmatic Evaluation: Lessons from Usability. http://www.ascilite.org.au/conferences/adelaide96/papers/18.html

Rogers, P.L. (2001). Traditions to Transformations: The Forced Evolution of Higher Education. Educational Technology Review. Vol. 9 No. 1, 2001 (online). Available:http://www.aace.org/pubs/etr/rogers.cfm

Russel1, T. (1997). The " No significant difference" phenomenon as reported in 248 research reports, summaries & papers. North Carolina State University (on-line).

Schneider, C.G., & Shoenberg, R. (1999, March/April)). Habits hard to break: How persistent features of campus life frustrate curricular reform. Change, 31(2), (pp. 30-35).

Silius, K., Tervakari, A-M. & Kaartokallio, H. (2002). http://www.virtuaaliyliopisto.tut.fi/verkkopakki/ (checked up 2.7.2002)

Slavin, R.E. (1991). Synthesis of research on cooperative learning. Educational Leadership, 48(5), 71-82.

Soloway, E.(1996). Learning theories in Practice: case Studies of Learned-Centered Design. Computer-Human Interaction. CHI'96. Electronic proceedings. http://info.acm.org/sigchi/chi96/proceedings/papers/Soloway/ es-txt.htm (checked up 2.7.2002).

Squires, D. (1997). An heuristic approach to the evaluation of educational multimedia software. Computer Assisted Learning Conference, University of Exeter. http://www.media.uwe.ac.uk/masoud/cal-97/papers/squires.htm (checked up 2.7.2002).

Squires, D. & Preece, J. (1999). Predicting Quality in Educational Software: Evaluating for learning, usability and synenergy between them.http://www.ifsm.umbc.edu/communities/Heur2.html (checked up 2.7.2002).

Tergan, S-O. (1998). Checklists for the evaluation of educational software. Critical review and prospects. Innovations in Education and Training International, 35 (1), 9-20.

Tucker, R.N. (1990). On interactivity and open learning. In J. Barker & R. N. Tucker (eds.), The interactive learning revolution: Multimedia in education and training. New York; Nichols.

Uljens, M. (1997). School didactics and learning. Hove, East Sussex: Psychology Press.

Vahtivuori, S. (2000) Kohti yhteisöllisen ja kokemuksellisen verkko-opetuksen suunnittelua - käyttäjät suunnittelun polttopisteessä. In S. Tella, O.Nurminen & S. Vahtivuori (eds.) Verkko-opetuksen teoriaa ja käytäntöä. Studia Paedagogica 25. Publications of the Department of Teacher Education, University of Helsinki. (In Finnish).

Vahtivuori, S. & Masalin, T.(2000). Designing Communal Web-based Learning Environments: Case GLOBE Project. In S. Tella (ed.) Media Education Publications 9. Media, Mediation, Time and Communication Emphases in Network-Based Media Education. Publications of the Department of Teacher Education, University of Helsinki.

Weston, T.J. & Barker, L. (2001). Designing, implementing, and Evaluating Web-Based Learning Modules for University Students. Educational Technology, 41(4), (pp.15-22).

Witnall, R., Fernandes, E., Almassizadeh, F., Love, J., Dugan, B., Sawrey, B.& Wilson, K.(1994). Multimedia chemistry lectures. Journal of Chemical Education, 71(9), (pp. 721-725).

4 Learners, Learning Styles and Learning Media

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Abstract

The paper is an account of an ongoing research project studying the links between learning style and learning media. The particular focus of the paper is on online learning. For centuries the lecture was the standard method of teaching in higher education, but the widespread introduction of ICT into Higher Education has led to dramatically increased educational benefits for learners. These benefits can be summarized as increased access to learning material and increased learner control of that material, and this, in turn, makes individual differences between learners an important factor in the learning process. A series of studies are reported using second year and third year psychology undergraduates, whose detailed examination marks were obtained in order to establish whether examination performance was a function of teaching method. Results were inconsistent, but there was evidence to suggest that lectures were the least effective teaching medium. When learning styles were measured using the Cognitive Style Index (Allinson and Hayes, 1991), some effects of learning style effects of learning style were apparent and a comparison between learning style and marks from lecture-based and online-based examination questions showed significant interactions between learning style and teaching medium – with web-based learning favouring the analytical learning style and summarized material favouring the intuitive learning style.

1. Introduction

In this paper we suggest that the needs of individual learners have been overlooked in the expansion of online learning. In particular, we suggest that the learning style of an individual may determine the way the individual approaches and uses online learning and this, in turn, may influence the benefit gained from the online learning. We further suggest that the importance of learning style needs to be more widely acknowledged in higher education, given the trend to move away form teacher-directed instruction to learner-centred study.

For centuries the lecture was the standard method of teaching in higher education. Tutorials, seminars, practical classes and other forms of teaching were used, as appropriate, but the learning experience remained narrow and was almost always based largely on lectures.

Distance learning first began in Australia in 1911 and was first formalised on a large scale in Britain in 1969 with the creation of the Open University. Though very effective and more varied than traditional Higher Education, distance learning was initially lecture-based in the Open University model, with television and radio broadcasts replacing, but virtually reproducing, face-to-face lectures. Distance learning thus retained the narrow, sequential and non-interactive properties of the traditional system.

This picture began to change in both traditional and distance learning by the introduction of online learning, which is now becoming widespread. Indeed, it threatens to become the norm. Using Australia again as an example, significant numbers of students now choose distance/online learning in preference for traditional campus based learning for reasons of cost and convenience. The growth of 'learner-earners' is driving the demand for a flexible approach to Higher Education, in which online learning plays a crucial role.

The 'flexible learning' differs from the traditional approach in several ways, three of which are of particular importance in this context. Flexible learning involves:

- Matching the needs of the institution, faculty, school and individual
- Less lecturing
- More independent learning

As we shall see, introducing flexible learning successfully is less than straightforward in these terms.

2. The problem

In theory, if flexible learning really does meet the needs of the institution, faculty, school and individual, it will become the norm for Higher Education and will embed online learning in the curriculum. In practice, however, attempts to introduce a flexible learning approach have not been fully successful. At Griffith University in Australia, for example, students found the new approach difficult. They complained of being inadequately prepared for the new approach and of not having sufficient access to staff. There was a high student drop-out rate.

Griffith University addressed these problems by:

- enhancing their induction programme
- adding more ICT training
- offering more support during courses

- introducing a standard VLE
- re-introducing more traditional teaching methods: the view was generally that students did not like standard lectures, preferring to have the material available beforehand and to be able to discuss it afterwards with the lecturer.

The overall effect of these and other changes was to greatly improve student views of their overall experience of flexible learning and to reduce the drop-out rate. However, the Griffith experience has yet to demonstrate that the flexible learning approach offers a better learning experience than the traditional approach. This is the problem. It can be expressed in more general terms by saying that:

> *no direct link has been established between delivery medium, levels of interaction and the effect of both on student achievement.*

As long ago as 1962 Schramm, in a meta-analysis of 393 studies comparing classroom teaching with televised teaching, found no consistent advantage of either medium. In 21% of studies television was found to be better, while in 14% it was found to be worse. This finding has been replicated in countless studies since – from meta-analyses of the effect of CAL to specific studies of the effects of, say, colour or moving images. Doubtless, in all studies there are many factors at work, which add noise to the data, but in an increasingly diverse curriculum and increasingly diverse methods of delivering that curriculum, one factor is becoming increasingly important – the individual learner.

3. The individual learner

Interactivity and learner control lie at the heart of the educational use of ICT. In a cognitive, constructivist model of learning – rather than a behaviourist model – interactivity and learner control include such elements as:

- Learner control of navigation
- Non-linear access t content
- Immediacy of response
- Availability of feedback

all of which give learners freedom, which they can use according to their individual needs and learning styles.

Learning styles matter. Learners learn in different ways and have different strategies, which differ in terms of efficiency and effectiveness. Matching and mismatching learning style to instructional materials can have significant effects on learning outcomes (Entwistle, 1981), in particular with online learning (Ford and Chen, 2001). Learning styles develop during a typical undergraduate course (Busato et al., 1998; Severiens et al., 2001), which implies that learning styles can be taught or changed, but studies have shown that some learners find adapting their learning style impossible and most find it difficult (Severiens et al., 2001; Smith, 2002; Vermunt and Verloop, 2000). Thus, if learners cannot easily adapt their learning style to match their learning material, it becomes important for teachers to be aware of:

- the relationship between learning style, content and teaching
- how learning style and learning material interact to impact on learning outcomes – student performance being the only quantifiable feature for comparison.

This paper focuses on these points. It summarizes a series of studies which were conducted between 1997 and 1999 using in total around 450 second year and 40 third year psychology undergraduates. Their detailed examination marks were obtained in order to establish whether examination performance was a function of teaching method. Two later studies are reported here, which extend the comparison of method of delivery and learning outcomes to include learning style.

4. Why study learning style? A summary of studies from 1997-1999.

Since the introduction of a multiple-choice section into a compulsory second year cognitive psychology examination, the marks of second year students from the multiple choice section of the examination were compared for questions based on material taught via lectures, CD-ROM, email and other methods and combinations of these methods. Results were inconsistent, but there was evidence to suggest that:

- lectures were the least effective teaching medium
- part-time learners show different patterns of performance to full-time learners
- specific aspects of a particular method of delivering learning material may affect the effectiveness of that material in terms of learning outcomes. For example, 450 word summaries of lectures of lectures were less effective than 1000 word summaries
- learning from a CD-ROM was effective and the combination of CD-ROM and lectures was no more effective than using the CD-ROM alone.

This approach produced sufficient data to allow comparisons to be made between the different methods of delivery, but it was limited methodologically by our inability to control for differences between teachers and for the relative difficulty of both the course material and the examination questions derived from it. Therefore, the failure to find clear differences between different methods of delivery was not surprising, especially given that it mirrored the literature over the past 40 years. Nevertheless, it seemed apparent that individual differences between students might account for a substantial proportion of the variability within the data. In particular, the differences between full- and part-time students – the latter being mostly older students with a less sophisticated approach to learning - suggested that the way

students learn might interact with the way the material to be learned is delivered. Accordingly, we sought to use an appropriate measure of individual differences, which might shed some light on the relationship between method of delivery and learning outcome. Learning style was an obvious choice.

5. Learning style, lectures and other forms of delivery.

In a subsequent study students learning styles were measured using the Cognitive Style Index (CSI) (Allinson and Hayes, 1991). The CSI gives a single score on an intuition-analysis dimension.

CSI scores were correlated with marks for the MCQ-assessed component of the examination for two cohorts of students for each of five delivery media, as is shown in Table 1.

Delivery medium	Correlations with CSI	
	Cohort 1 (n=51)	Cohort 2 (n=92)
Lectures	0.148	0.025
Lectures + CD-ROM support	0.064	-0.002
Lectures + emailed summaries	-0.265*	-0.078
CD-ROM	0.222**	0.015
Emailed full text	0.004	0.119

Table 1: Correlations between CSI and MCQ scores for five media (*p<0.01, **p<0.05)

Thus for Cohort 1 significant correlations were found between learning style and the MCQ examination performance which resulted from learning from both the CD-ROM and from lectures supported by emailed summaries (about 1000 words) of those lectures, but not from the other delivery media. In the latter case the correlation was negative, showing that intuitive students obtained higher marks on questions derived from material taught by lecture and supported by an email summary. Learning from the CD-ROM favoured analytical students.

In other words, learning style and delivery media sometimes interact. But why should this happen and how do we explain the particular interactions we found? Our explanation is two-fold. Firstly, MCQ examinations favour the analytical student, because they are based on detailed questions. Hence four of the five correlations are positive – favouring the analytical student. Secondly, an individual's learning style is pervasive and determines the first approach the individual makes to the material, which is to be learned. The email summary of a lecture is thus the only delivery medium which favours the intuitive student, because it is the only medium which provides an overview, subsequently facilitating learning the details of the material. Analytical students are less able to benefit from the summary and so are less able to learn the details of the material. Conversely, the CD-ROM allows the analytical student to obtain the information on which they are assessed more quickly than an intuitive student.

Failure to match in Cohort 2 the significant correlations found with Cohort 1 is not easy to explain, other than by saying that they were different cohorts, who attended different lectures and were given a slightly altered MCQ examination.

A second study used students from Cohort 2 a year later, using marks from 2 third year modules. 16 of these students studied a third year course on the psychology of reading (PS3404), which was taught using three different methods of delivery, as follows:

- Web-based independent learning – where the students researched a topic for themselves. This was assessed by a compulsory question given to students at the beginning of the course
- Web-supported learning – where the topic was largely taught using web-based material
- Traditional lectures

The course was assessed by three essay-type examination questions. When the marks were obtained for the three delivery methods and were correlated with CSI scores, the results shown in Table 2 were obtained.

Delivery medium	Mark	Correlation with CSI score
Web-based independent learning	63.00	0.226
Web-supported learning	60.43	0.334*
Traditional lectures	57.03	0.008
Overall mean	59.34	0.236

Table 2: Correlations between CSI scores and marks for course PS3404 (*p<0.05)

14 of the students from Cohort 2 studied the PS3403 Psycholinguistics module, which was also assessed by three essay-type examination questions, but which was taught slightly differently, having three delivery methods, as follows:

- Web-based independent learning – as for PS3404, but not assessed by a compulsory question
- Independent learning – assessed by a compulsory question
- Traditional lectures

The results for this module are shown in Table 3.

Delivery medium	Mark	Correlation with CSI score
Web-based independent learning	57.15	0.468*
Web-supported learning	65.43	0.002
Traditional lectures	55.38	0.109
Overall mean	59.00	0.291

Table 3: Correlations between CSI scores and marks for course PS3403 (*p<0.01)

Again the results suggest an interaction between learning style and method of delivery, with analytical students obtaining higher marks on web-based components of courses. However, the pattern of results between the tow modules was different, as were the modules themselves and most of the students on the two modules. It is thus clear that learning style is linked with the ability to benefit from teaching, but much work needs to be done to identify the detailed way in which learning style, teaching and learning interact to affect learning outcomes.

6. Conclusions and recommendations

The results indicate that the importance of learning style needs to be more widely acknowledged in higher education. The interactions between learning style and teaching medium mean that online learners, in particular, need to:

- be able to identify their learning preferences relative to the curriculum
- recognize when a particular experience may not meet their learning style
- be able to take steps to change their learning style to suit the situation, i.e. to consciously move out of their comfort zone and develop competence in a variety of learning styles, thus being able to update their learning skills as they progress through the curriculum.

Finally, ideally, learners need to be able to take steps to change the situation to suit their learning style.

References

Allinson, C. W. and Hayes, J. (1991). The Cognitive Style Index. University of Leeds, U.K.

Busato, V. V., Prins, F. J., Elshout, J. J. and Hamaker, C. (1998). Learning styles: a cross-sectional and longitudinal study in higher education. *British Journal of Educational Psychology*, 68, 427-441.

Entwistle, N. J. (1981). *Styles of Learning and Teaching*. Wiley. London.

Ford, N. and Chen, S. Y. (2001). Matching/mismatching revisited: an empirical study of learning and teaching styles. *British Journal of Educational Technology*, 32 (1), 5-22.

Severiens, S., Ten Dam, G. and Van Hout Wolters, B. (2001). Stability of processing and regulation strategies: two longitudinal studies of student learning. *Higher Education*, 42 (4), 437-453.

Smith, J. (2002). Learning styles: fashion fad or lever for change? The application of learning style theory to inclusive curriculum delivery. *Innovations in Education and Training International*, 39 (1), 63-70.

Vermunt, D. and Verloop, N. (2000). Dissonance in students' regulation of learning processes. *European Journal of the Psychology of Education*, 15 (1), 75-89.

5 Postgraduate Continuing Medical Education via Videoconferencing at the K.U.Leuven in Belgium: An Evaluation of Pentalfa

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Abstract

Traditionally medical specialists attended seminars organized by clinical university departments of the K.U.Leuven Medical Faculty. However due to increasing travel and traffic problems the Pentalfa project was initiated in an effort to replace face-to-face seminars.

We applied ISDN-videoconferencing technology to interconnect the video and sound signals of the different sites in real time. In all sites the session could be followed on two screens. On one screen, either the speaker/moderator or person involved in dialogue at a remote site could be seen or whatever else was being sent via videoconference. On the second one, which was linked to a multimedia computer, digitized images are projected. A voting system was used to interconnect all sites and allowed the participation in the various voting opportunities, which occurred during each session. For each session, a topic within a specific discipline was chosen and treated in a multidisciplinary way.

The Pentalfa project was initially planned for a period of 3 years. During each academic year, 2 to 3 periods of 8-9 sessions each were organized (total of 74 session). A questionnaire, completed with open questions, was given to all participants (over three years 13 489 participants). 28.2 % of the questionnaires were returned.

We reached 64.6 % male and 35.4% female participants with the program. The percentage female participants was higher at the central than at the guest sites. The mean age of the participants was 37.7 years. Male participants were older than female. At the central location the mean age was lower than at the guest locations. The percentage female participants decreased in the older age groups.

Timesaving was an important goal for starting up the project. Nearly 90% of the public at the guest sites said they saved time by attending the session. The averaged time saving per participant in these guest locations increased from 99 min in the first year to 145 min in the third year. This emphasizes the growing mobility problems of our society.

Globally, participants were satisfied with the pedagogical approach used in Pentalfa. More than 55 % of the participants found the Pentalfa session easier than classical seminars. Participants at the guest sites and older participants had a more positive appreciation than the average. In the evaluation we found that satisfaction about the technology was very high. The very excellent appreciation of the quality of the image, even in the absence of a lecturer, indicates that the concept of using 3 ISDN (6 lines) connections is sufficient for long-distance education

The global cost per participant at the guest locations was 44.5 euro/h broadcasting and their virtual saving was 64 euro/h. More than 85 % of the participants at the guest sites stated that they would no longer go to Leuven (the central location) for these sessions if they were to be organized in a traditional face-to-face manner, mostly due to time and/or traffic.

In order to come to a sufficient result for long-distance education via videoconferences from the participants, a lot of efforts are required. Once all those problems are resolved, this medium seems to be very suitable as an alternative for the increasing mobility- and accompanying time problems

The experience obtained with Pentalfa, will be used for other aspects of the medical service such as “second opinion” or “Telemedicine”.

Keywords: Videoconferencing, Medical Continuing Education, ISDN

1. Introduction

Due to the rapid evolution in the medical sciences, lifelong learning is required for everybody involved in the medical field. The overall intention of the Pentalfa project was to provide continuing professional opportunities for medical specialists in the Flanders region using telepresence. Many of the specialists are in fact graduates from K.U.Leuven’s Medical Faculty. It was with the intention of supporting these alumni that the project was started. Traditionally these specialists attended educational seminars organized by their various medical clinical departments. However the increased workload and the dramatic rise of problems with traffic and mobility heavily mortgaged the permanent education. As a consequence more and more doctors gave up and the permanent education suffered. However this type of interactive education had to be preserved and therefore other forms of transfer of knowledge had to be investigated. An integration of the telecommunication technology in the permanent education could help to resolve the problems in mobility. We took the option to offer a part of the medical permanent education in the form of long-distance education and named the project “Pentalfa”.

In weekly sessions during the academic year, a multipoint videoconference was organized dealing with a different medical topic, and with a different set of experts and audience. All the large hospitals in Flanders were contacted and visited in order to identify the most suitable sites for participation. In addition to the level of interest and willingness to participate, further criteria in this choice were suitability as a venue from the point of view of technical infrastructure and location, in order to enable us to provide a service to a widely dispersed geographic audience within Flanders. It was agreed that these educational evenings were to be offered without charge to participating doctors and therefore a sponsorship plan was put in place.

The goal of the Pentalfa project for long-distance education was to offer the same educational program to physicians at different locations in Flanders in an interactive way and using advanced equipment for videoconferencing.

In order to achieve our goal, a unique system had to be developed allowing optimal bilateral data transmission and processing of video- and high-resolution images. Also the system should be able to present, in a reliable, simultaneous and interactive way, the videoconferencing at different locations. In the evaluation of the efficiency of the project we first evaluated the audience reached by the program. We therefore identified the age, gender and specialization of the participants at the different sites and how they came into contact with the Pentalfa program. We were interested to know whether the evaluation confirmed the multidisciplinary nature of the sessions and also whether time saving was generated.

For the evaluation of the educational efficiency of this project we focused to somewhat more subjective aspects and analyzed whether a number of parameters about the scientific information content and pedagogic effectiveness of seminars were influenced by the use of a videoconference platform. Finally a financial cost/benefit of the project was made.

We conclude that the project continues to enhance the quality of medical treatment within Flanders.

2. Methods

2.1. Determination of the number of participants

The number of participants per session was determined by counting the audience by the technician at each site. This counting took place in a standardized way. At the start of the second presentation all technicians counted the number of participants. This counting was initiated via the chat box by the central technician.

The number of physicians requesting accreditation was determined via the accreditation lists filled out at all sites during each session. The forms of the questionnaire were distributed together with the handsets at the beginning of the session and collected afterwards. Participants could also return it by mail.

2.2. Methodology of Evaluation

A multiple-choice questionnaire, completed with open questions, was given to all participants. They were asked to fill out the questionnaire (anonymously if they wanted) and return it after the session or by mail. This questionnaire was used during these three years.

2.3. Calculation of the costs of the Pentalfa project

The calculations are based on 74 videoconferences over three years, each with duration of 2.5 hours. This gives 185 hours of real videoconference time in 3 years.

To determine the costs the following aspects were taken into account. The equipment at all sites, including the central site (Leuven) was purchased for 508 205 Euro with deprecation over three years. Per session we needed on the average 6 hours of continuous communication by phone (preliminary tests included). The communication costs of 444 hours over 21 ISDN lines was 94 763 Euro/3 years. The salaries of administrative and technical aid (including overhead) were 171 045 Euro/3 years. The working costs including technician's costs (paid on an hourly rate) and travel were 89 241 Euro/3 years. The costs of the brochure (first two years one, third year three brochures) and mailing and other direct costs were 91 494 Euro/3 years. The global costs were therefore 974 748 Euro/3 years. Catering costs were not taken into account since catering was also offered on classical seminars.

Following procedure was used to estimate the money saved per participant at the guest sites. First of all, the mean time saved per site was calculated based on the answers obtained from the questionnaire. We asked all participants to write down very precisely what was in their opinion their personal time saving. We calculated the average money saved for this time saved on the basis of a modest loss of an income of three consultations/hour for a specialist in Belgium (49.65 Euro/hour).

The travel expenses were calculated for all participants at the guest sites based on the official cost for a two-way travel by car from the guest sites to Leuven (0.29 Euro/km). The precise distance was determined by a route planner (http://www.alh.nl.alh/).

2.4. Statistical analysis

The statistical analysis of all data was done via SPSS. Significance was determined at $P < 0.05$. As age categories following groups were made: younger than 30 years; between 30 – 39 years; 40 – 49 years; 50 – 59 years and older than 59 years.

3. Results

3.1. Videoconference Equipment & Intranet.

In long-distance education the possibilities to interact have to be identical to the tools used in classical seminars. Furthermore the quality of image and sound has to be high. It is also required that different didactic tools can be integrated. In order to fulfill all these goals we chose to use two projection screens at all sites. On one screen the image of the videoconference and the videotapes could be shown. On the other screen high resolution-images used during the presentation could be projected via the use of an intranet. All other media used were integrated in this second circuit.

We applied ISDN-videoconferencing technology to interconnect the video and sound signals of the different sites in real time. Image and sound were hereby compressed and transmitted via digital phone lines to the other locations. For the videoconference the H-320-videoconference standard was used. Due to practical and financial concerns we excluded the use of satellite connections. We found that three "Basic Rate ISDN" BRI connections were required in order to generate a sufficient image quality and to be able to organize a meeting in optimal circumstances.

A 16-port videoconference bridge was used to link all sites in a multipoint videoconference. This bridge was attached to two Primary Rate ISDN (PRI) connections. The conference could operate in the Continuous Presence-option. This allowed the lecturer to view simultaneously the four other sites. At the different locations this option allowed to show the speaker, the moderator or the participant asking a question or to project on one screen simultaneously the four images of the other locations using the quad split. The central technician controlled the switching option.

At all locations a videoconference Codec with camera and T120 standard was present. The speaker and/or moderator could follow the event via individual monitors. From preliminary tests it was concluded that the transmission of the high-resolution images on the T120 standard proceeded very slowly and was of poor quality. We therefore decided to present the educational audiovisual material via an alternative circuit. A further 128 kbit ISDN connection (2 lines) was used to trigger locally available audio-visual presentations of all speakers. The speakers were encouraged to convert beforehand their normal audio-visual presentations into Power Point files. We hereby ensured a house style and the optimal audio-visual quality of all presentations.

3.2. Voting system

A voting system was used to interconnect all sites and allowed the participation in the various voting opportunities, which occurred during each session. The active communication of 300 participants was possible by typing an answer via the numeric keypad or by using the audio facility of the handset. Since radio based systems could interfere with a hospital environment, infrared technology was applied. The infrared signals of the handsets sent audio- and data information to the local PC at each site. This PC was connected via the intranet over the ISDN line with the central PC. When a lecturer wanted to know the participants' opinion about some subject, the voting system could be used. The questions appeared on the screen as part of the presentation. The multi-site software also allowed to calculate and immediately distribute all results.

3.3. Content of the evening

In all sites the session could be followed on two screens. At each peripheral site, a local moderator coordinated the session (especially the discussion) and controlled the process of issuing of the credit points (accreditation). A central moderator, in Leuven, coordinated the entire evening and had the final responsibility. He usually brainstormed beforehand with the different speakers in order to realize the final agenda. The speakers and the moderator eventually were given the opportunity to try out beforehand their presentations, either in the audio-visual center or in the hospital facilities in K.U.Leuven. In the first year the topics were chosen from specialist disciplines. From the second year on, also three sessions were organized specifically intended for general practitioners.

3.4. Videoconferencing Sites

Leuven was the central location for the Pentalfa project. An auditorium of the Teaching and Research building (Onderwijs en Navorsing) of the K.U.Leuven Hospital Gasthuisberg was completely reorganized and adapted to provide facilities for videoconferencing with the latest state-of-the-art technology. At this site the overall technical control of the session was supervised by the central technician.

The first year of the session of Pentalfa project were divided in two periods, where each time 4 hospitals were visited as guest site. At each site 12 sessions took place. The locations were chosen to obtain an optimal spread over Flanders. On demand of the participants, from the second year on, the year was divided into three periods, where each time 4 guest locations were visited. The number of sessions per period was reduced to 8 or 9 per period. During the three years of the project 20 different guest sites were visited (or revisited). For each session a local physician was moderator at his guest site. The speakers could give their presentation at each of the five locations but were usually present at the central site.

While at the central location the two screens made part of a fixed setup, this was not possible at the remote sites in the different hospitals, since the locations changed from period to period. Depending on the infrastructure of the hospital, the session could take place in a multifunctional room or in an auditorium. Usually the technical support was not in a separate room. Before a location could serve as a Pentalfa guest location, a blueprint of the set-up was drawn during a

preliminary visit http://www.avd.kuleuven.ac.be/bic/. Also the different ISDN lines were controlled for compatibility. We faced communication problems in nearly 40% of the guest locations during the setting up image connections. Pentalfa provided the videoconferencing equipment. Due to the multiplicity of situations at the different guest sites, we chose for a temporary and very adaptable, quickly installable and mobile setup at the guest locations. For every session the installation of the set-up at each guest locations took about 1 hour time for the technician coming from Leuven. The mean time to check image and sound quality between the different sites was 1.5 to 2 hours. If voting would take place the installation- and checking time was much longer. The different technical collaborators could exchange information via the chat box. Moving the set-up from one site to another took half a day for two technicians.

3.5. Participants

During our three-year program the total attendance of the 74 sessions, that were organized, was 13489 participants: an average of 182 participants per session. Initially we started with two periods of 13 Pentalfa sessions per year but at the request of the participants from the second year on three periods were organized. During the second year a 10% rise in participants was generated. The number of participants per session remained more or less constant during the third year. About 2/3 of the participants attended the session at a guest site. he spread in the absolute number of participants per session was quite large. Of the 74 sessions the lowest number of participants was 49, the highest number 402. Also presence of physicians at a particular guest site could vary between 8% and 22% of the total participation of a session.

These numbers indicate that there is a clear interest in long distance education via videoconferences. Also a rather constant number of participants preferred to go to a guest location.

Credit points have to be obtained by registered physicians in a regionally administered educational system (accreditation system) in order to obtain an optimal reimbursement by the Belgian social security system. Physicians attending the Pentalfa sessions could obtain credit points. More than ¾ of the participants applied for these credit points.

The multiple-choice questionnaire was given to all participants. 28.6 % of the questionnaires were returned over those three years. More than 60% of the reactions came from the guest sites. We obtained questionnaires from all sites and all sessions.

3.6. Profile of the participants

We asked the participants about their age and gender since it is possible that the attractivity and impact of video conferencing differs with age or gender (Pym, 1992).

Overall 64.6% of all the participants on the program were male and 35.4% was female (n = 3814). Over the three years also a slight rise in the percentage of female participants was found. At the central location more women were present (43.6%) than at the guest sites (31.5%). The mean age of all participants was 37.7 ± 0.3 years (n = 3814). The oldest was 79 year, the youngest 17 years. At the central location the mean age was statistically lower (34.8 ± 0.4 years) than at the guest locations (40.2 ± 0.3 years).

The age group also influenced the percentage of participants of each gender. Male participants were older (43.3 ± 0.3 years) than female (31.4 ± 0.3). Female participants made up 60.8% of the age category below 30 years (n = 582) while in the age group between 50 and 59 years old it was 14.5 % (n = 574).

From the second year on we asked the participants to specify their relationship with respect to the topic of the particular Pentalfa session of that evening. The possibilities were “specialist in the topic of that particular evening”, “specialist but in another field than the session of the evening”, “general practitioner”, “resident in training” and “paramedical or non-medical profession” (n = 3580 answers). 37.4% considered themselves specialist in the field of that specific session, 32.3% was specialist but in another field, 9.8% was general practitioner and 10.6% had a paramedical or non-medical discipline. A lower number “specialists in the particular field” was found at the guest sites than at the central site. Also the number of general practitioners and specialists of disciplines, not directly related to the session was higher and the number of trainees was significantly lower at the guest locations. No difference in the participation of paramedical or non-medical professions was found between the sites.

These results are compatible with the finding that the attendants were younger and that the percentage of residents in training was larger at the central location, which is the university hospital. It also shows that not only specialists of the subject of the session were reached. The large number non-experts in the item of the session (specialists and general practitioners) as well as the presence of residents demonstrated the multi-disciplinary character of the videoconferences.

3.7. Participation to videoconferences

The use of videoconferences is not widespread in the medical field in Flanders. On the question at the start of the program in 1998 whether the session was their first participation to a videoconference, more than 90% of all participants gave a positive answer. The percentage participants having their first Pentalfa session gradually decreased from 70% in the first year to 40% at the end of the third year. Also the percentage of participants attending a second session was reduced during the last year. This was mainly caused by the rise to 60% of the number of participants having already attended 2 or more sessions. A similar evolution was found for both genders.

However, male participants had attended a higher number of sessions than women.

3.8. Time Saving Effectiveness

The participants at the guest locations were asked whether a time saving was generated and eventually how much. The results confirmed largely the expectations. Nearly 90% of the public at the guest sites claimed they saved time by attending the session. The mean time saved per participant in these guest locations increased from 99.3 ± 2.4 min (n = 596) in the first year to 121.4 ± 2 min (n = 648) in the second year and 145.1 ± 2 min (n = 704) for the third year. This demonstrates the rapid rise of mobility problems in our society. On the level of the individual return of questionnaires the spread of the answer was much larger: it varied between some minutes to 7 hours for the most distant sites. We found no difference in time saving as a function of age or gender.

At the start of the second period of the first year we asked all participants at the peripheral sites whether they still would come to go to the central location if this post graduate program only would take place in Leuven (central location). 67.5% of all participants answered negatively in the first year. This amounted to 89.8% in the second year and 86% in the third year. The most dominant arguments were (in decreasing order of importance): distance, no time, traffic, no interest in the session and/or the job.

3.9. Evaluation of the technical aspects

We were interested in the evaluation of the technology and we asked all participants to express their opinion about the quality of sound and of image using a score from 1 (poor quality) to 5 (excellent quality). The global score for the quality of the image was 3.72 ± 0.01 and for sound 3.87 ± 0.01 (n = 3743). For voting the score was 3.76 ± 0.02 (n = 3119). For sound, image quality and the voting respectively 73.4 %, 65.2 % and 69.7 % of all participants gave as appreciation “very good or good”.

We detected no gender differences or shift in the appreciation of the quality of the images over the consecutive years. At the remote sites the evaluation was slightly but not significantly higher. For the quality of the sound, the appreciation at the remote sites (3.93 ± 0.02) (n = 2580) was more positive than for the central site (3.70 ± 0.03) (n = 1167). This could be due to the fact that a large effort was made before every session to optimize the sound at the remote sites. It should be noted that the older participants had a slightly more positive appreciation. In the age group < 30 years the score for image, sound and voting was respectively 3.74 0.01; 3.83 ± 0.02 and 3.80 ± 0.02 (n = 566). For those above 59 years values were 3.97 ± 0.03; 4.09 ± 0.02 and 4.05 ± 0.02 (n = 276).

The very excellent appreciation of the quality of the image, even in the absence of a lecturer, indicates that the concept of using 3 ISDN (6 lines) connections is sufficient for long-distance education. The evaluation as a function of the age category also showed that the evaluation is more positive for the older than for the younger participants.

3.10. Scientific Content of the program

Pentalfa offered the physicians the possibility to get an up to date overview of several medical topics. The clinical department of the central moderator, in agreement with all speakers, was the organizer of the session and took the final responsibility of the scientific content of the session. Pentalfa functioned as a logistic, pedagogic and technical intermediate for the organization of the long distance education via videoconferences. For the evaluation of the educational efficiency of this project we focused some of the questions to somewhat more subjective aspects, for instance on how participants felt about the quantity of information received, their ability to memorize it, etc, and analyzed whether a number of parameters about the scientific information content and pedagogic effectiveness of seminars were influenced by the use of a videoconference platform.

We therefore asked the participants to evaluate the way they were able to follow the session compared to classical continuing education programs. 92% of the participants (n = 3567) answered this question. 56.4% of which found it “much easier or easier” than classical continuing education programs. There was no shift in opinion during the program or also no gender difference. However a higher value (59,5%) (n = 2476) was found at the guest sites than at the central site (49.3%) (n = 1091) although the speakers were mostly not present at the guest sites. Also older participants had a more positive opinion while 52.3% participants younger than 30 years (n = 509) answered “easier” or “much easier”. The percentage increased to 64.3% for specialists older than 50 years. Especially this latter group was more favorable towards the statement “much easier”.

We also tried to evaluate whether the videoconference positively influenced other aspects of the learning process. In addition to a question about the pedagogical quality of the lectures apart from their scientific value we asked whether the videoconference had a positive influence on: (1) the amount of information received, (2) the understanding of the information received, (3) the capacity to memorize the information received and (4) the capacity to apply the information received in their personal life. Participants had the possibility to “agree absolutely”, “agree”, “have no opinion”, “disagree” or “absolutely disagree”.

We received a very positive response about the subjective effects on the learning process. Overall 74% “agreed or completely agreed” that the videoconference positively influenced the amount of information received (n = 7627 respondents); for the understanding of the information received it was 72.6%, for the capacity to memorize the information received this was 60.4%, for the possibility to apply the information received in the professional life it was 62.2% and finally for the pedagogical quality of the lectures 72.3%.

From these data it can be concluded that the possibility of memorizing and the practical application of the information received a slightly less positive appreciation than the other aspects. We found no gender differences. However participants of the group older than 49 years had a more positive feeling than the younger (<30 years) participants although the same items scored higher or lower for all age groups. Specialists at guest sites were also more enthusiastic than at the central location.

We found important differences regarding age. Older participants (group of people over 49 years) were more enthusiastic about an improvement of the learning process than younger participants. This contrast with the preconceptions that one might have about this kind of learning for this age group.

3.11. Different aspects of the interaction

Several strategies were developed to obtain an optimal interaction between the different sites. First of all the software of the videoconferencing was equipped with the "continuous presence" option. This software allowed to project the different locations onto one single split screen image and to have a discussion with all sites. As a consequence of this option the number of participating locations was limited to five in order to optimize the visible interaction.

At all the locations a moderator was present to encourage and control the discussion. An excellent moderator is indispensable in interactive discussions via videoconferences, probably even more then in classic face-to-face debates, since direct knowledge of what is going on in a guest location is less evident. Of course the split screen resolved part of the problem, since all locations could see each other. But part of the problem remained and therefore an excellent moderator remains the cornerstone of the debate.

Thirdly cameras and monitors were provided for all moderators and for the public in order to optimize the visual contacts between the different sites. Also everybody obtained the opportunity to ask questions since a microphone was present in the handset of the voting system. This wireless microphone allowed everybody to ask questions that could be heard on all other locations. Previous experience has taught us that individual microphones are indispensable for efficient discussion and question sessions. Finally the voting system encouraged and improved in an efficient and anonymous way the active contribution of the public.

We investigated how the participants evaluated the thus created interactivity of the Pentalfa sessions. The possible answers were "very poor", "poor", "moderate", "good" and "very good". 60.2% of the participants rated the interactivity as good to very good (3586 answers). No difference was found compared to the sites or over the three years of the project. It was however noticed that more female (65.6%) (n = 1261) than male participants (57.3%) (n = 2489) had this point of view. An important negative remark, frequently cited, was that participants could not understand that questions from one location were not discussed, while a moderator tried unsuccessfully to encourage a discussion at another location. This emphasizes again that moderators play an important role in multipoint videoconferences.

3.12. Analysis of the costs and returns of the Pentalfa project

Also the economic implications of the Pentalfa project were investigated. The global costs were 974 748 euro for three years or 5 269 euro per hour broadcasting (74 sessions of 2.5 hours). The individual cost per participant at the guest locations was 44.5 euro per hour broadcasting (n= 8745).

We performed also a simulation of the average (virtual) money saved by the participants on the guest locations. Therefore, the overall money saving due to decreased loss of time (927 849 euro) and cost of transportation (481 831 euro) were determined for those three years, as discussed in the Methods section. The virtual saving per participant on the guest locations was 64 euro per hour.

We therefore estimated a virtual gain of about 19.5 euro per participant per hour broadcasting. These results demonstrate that the cost per hour broadcasting is very high. This is mainly a consequence of the quality that has to be offered. From an economic perspective it is however important that the virtual return exceeds the cost of this for the participants free long distance education project.

4. Discussion

Long-distance education via videoconferences is still a rather recent concept in the landscape of the permanent education. Due to the growing mobility problems the need for this type of long-distance education is expected to explosively increase. The faculty of medicine of the K.U.Leuven therefore decided in 1998, to offer part of its programs via videoconferences. In collaboration with the audiovisual service of the K.U.Leuven a new organization was started. Based on the experience of the audiovisual service and of the projects "Big" and "Savie" the Pentalfa project was set up http://www.avd.kuleuven.ac.be/bic/. The purpose of Pentalfa was to offer on a regular basis simultaneously long-distance education at different sites and via videoconferencing.

An auditorium was transformed at the campus Gasthuisberg especially for this purpose. This auditorium was completely adapted to the new forms of education. We made contacts with several hospitals in the Flemish region of Belgium. We were convinced that auditoria in hospitals were the perfect place for the medical permanent education and spent time to ensure an optimal spread of the remote sites over Flanders in order to limit the traveling time of the participants to a minimum.

For these videoconferences we used ISDN technology. Digital phone lines have the advantage that they could be

installed everywhere, can be used much longer than the scheduled time of the session and also have a reasonable cost. This technology also allows the participants to debate continuously with each other. Finally the digital phone lines also appear to be very reliable since we encountered only very few problems with the data transmission to guest sites. The technology we used for data transmission was however not sufficient for the transmission of high-resolution images. This was something we knew from the beginning. Therefore a second circuit that was controlled via an intranet was installed. Hereby the main computer triggered the individual computers at all sites to present the same sequence of Power Point slides. This way the presentation and messages of the speaker, including the movement of his computer mouse-arrow could be followed at all the locations. (Baak et al., 2000). This intranet also served as an chat box for the technical collaborators and for the control of the voting system. The whole system was flexible so that parts of a session could be presented at different locations.

There was a clear interest for the Pentalfa sessions, as can be deduced from the number of participants. This number increased from 173 participants per evening in the first year to 188 participants in the second year and then saturated to a similar level. From the remarks on the open questions of the questionnaire it was clear that a very large number of participants really needed this type of multidisciplinary long-distance education. An important number of participants (2/3) wanted to attend those sessions at the guest sites near their homes. The established physicians wanted to obtain their study points in the context of maintaining their accreditation. The percentage even increased from 73% in the first year to 83% in the third year. The applications for credit point for the accreditation were especially very high at the guest sites. Our evaluation of the Pentalfa project is based on a very large number of questionnaires answered by the participants over a three-year period.

The data were obtained from all guest sites and of all 74 sessions investigated. Over the three years the number of questionnaires sent back was 28.6%. This number was higher in the first year (35%) while during the last year it was only 23%. Especially at the central location we received frequently the remark during the third year that participants had already filled out the questionnaire before. The nearly 30 % return of the questionnaires may indicate that the participants had a clear interest in the program and in the concept. Analysis of the forms learned that two thirds of the results were coming from the guest locations. This correlated well with the number of participants present at the guest sites.

The participants of the Pentalfa sessions are representative for, or at least compatible with the changing profile of the physician in Flanders. First of all the distribution - two third men and one third women – fits very well with the gender distribution in the medical profession. The mean age of the women, a group that only recently joined the medical profession in large numbers, is therefore lower than for their male colleagues. Also in the age category below 30 years, more women are represented. This fits with the distribution of the medical students at the Flemish universities in general. The data also demonstrate that there is a gender difference between the central and the guest locations. More female participants were present at the central location than at the guest sites. Also the mean age was lower at the central than at the guest sites. This correlates with the fact that at the central location more doctors in training participated in the programs.

The data demonstrate that long-distance education in Flanders is a rather recent phenomenon. It is nevertheless clear that gradually more and more participants attended more videoconferences. Male participants attained the highest number of sessions. Due to the large variation in items, the rotation of the sites and the multi-disciplinary character of the sessions, it is clear that even after three years a large number of attendants participate for the first time in a videoconference. However the rotation between guest sites makes a clear analysis of this point not easy.

Our data clearly demonstrate that physicians attending educational evenings at the K.U.Leuven face more and more problems due to traffic congestion and subsequent time loss. The Pentalfa project was initiated in an effort to replace a number of these face-to-face seminars. Most of the participants agreed that they saved time by attending the session at a guest site. The average time saved also increased with about 46% from 99 minutes in the first year to 145 minutes in the third year. Our data confirm the fact that today the mobility problems explode, and Pentalfa, and video-conferencing in general, can contribute to the partial solution of these problems in Flanders. Pentalfa helps them to keep contact with the university and its hospital.

We also investigated whether we fulfilled our goal of organizing multidisciplinary sessions. In spite of the fact that one clinical service assumed the final responsibility over each session, mostly speakers of different disciplines were participating. Also the profile of the participants gave information. In the questionnaire we asked how the participants related to the subject of the session. From the answers it can be concluded that the number of general practitioners and specialists of disciplines not directly related to the session were lower at the central site, but that the number of trainees was significantly higher. These results also explain why a younger and more female public was found at the central site.

We were interested to have the feedback of the public on the technical aspects of the videoconferences. For that purpose the participants had the possibility to score the quality of image, sound and voting via a questionnaire. In global over the three years 27,74% of all participants (3743 on 13489) answered on this evaluation. The result of this evaluation was quite positive and promising. The evaluation of the audio- and image quality using 3 ISDN lines was very good. It was even clear that the evaluation at the guest locations was even slightly better than at the central location. This indicates that the efforts done at the guest sites, such as installation of uniform equipment, presence of a technician etc, have

attained their goal. The technical aspect proved to be good and did not change during the project. While there were no gender differences in the evaluation of the technical aspects some age differences were observed. The group of 60 or more years old, gave higher scores on the technical aspects of the sessions than younger participants.

Because the technology is transparent, it was possible for the speakers and the participants to select or to direct their attention to the content of the session. Technical problems only very rarely occurred and the participants also found the voting system easy to use. Overall participants were very satisfied with the pedagogical approach of Pentalfa. Videoconferences were seen as a very effective tool to transmit information, to understand it, to memorize it and to apply it in their daily work. It was clear that especially the information transfer was more successful than the possibility to apply everything into daily professional life. Our results suggest that it would be useful to instruct the speakers not to overload their presentation with information in order to make it for the audience easier to remember the data presented.

Younger doctors make less difference between videoconferences and face-to-face classical seminars, probably because they are more familiar with these new information technologies. But more mature professionals, who are more used to classical face-to face lectures, especially appreciated the quality of the seminars (speeches, documents ..), which were often better than ordinary training, and realized how much time they were saving. Maybe this is an explanation for their deep enthusiasm. That the lecturer is not present at a location is not a problem: the evaluation was even more positive at the guest sites. No specific gender related behavior patterns were found for these aspects and results prove that neither gender nor age are factors that can limit the impact of this kind of system on the target audience.

The economic aspects were also very important for the evaluation, and for money and time saved by the participants. It is important to know that nearly 90% of all participants at the guest sites said they were no longer willing to come to the central site if the session was only organized in a classical way at the central site. The costs of the videoconferencing remain high, but are mainly due to the high requirements of the quality imposed by the target group. Videoconferences require a very intensive preparation: organization and preparation of the sessions, as well as preparation of the individual presentations. In line with this, speakers and moderators find they need much more preparation time compared to classical lectures. However their efforts were really appreciated by the participants of these sessions.

In order to come to a sufficient result for long-distance education via videoconferences from the participants, a lot of efforts are required. This is certainly the case for projects where videoconferences are held including more than two sites. If multipoint videoconferences are organized in a regular way, the technical logistic and interactive requirements increase enormously. Problems with multi-site videoconferences include the complexity of the system, timing and the need for booking sites, coordination of speakers and presentations, and the time needed to organize sessions, set up linkages, advertise sessions etc. Successful meetings are also associated with effective linkages and trouble-free hardware. In our evaluation we found that satisfaction about the technology was very high. Once all those problems are resolved, this medium seems to be very suitable as an alternative for the increasing mobility- and accompanying time problems (Hebert, 2000). It is important to note that the experience obtained with Pentalfa, can be extended to other aspects of the medical service, such as "second opinion" or "Telemedicine".

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References

Baak, J.P., P.J. van Diest, et al. (2000). Experience with a dynamic inexpensive video conferencing system for frozen section telepathology., *Anal Cell Pathol* 21(3-4): 169-75.

Hebert, M. (2001). Telehealth success: evaluation framework development, *Medinfo* 10(Pt): 1145-9 http://www.avd.kuleuven.ac.be/bic/ (Last checked 25 June 2002).

Pym, F. R. (1992). Women and distance education: a nursing perspective, *J Adv Nurs* 17(3): 383-9.

6 Introducing Technology onto a Traditional Course: Turning the Classroom Upside Down

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Abstract

This paper reports on the integration of a wide range of information and communication technology (ICT) tools into an undergraduate module in biosciences. The aim of the integration was to shift the balance of talk during classroom sessions, away from the lecturer and to the students. Over the four-year period covered by the data presented two distinct approaches to achieving this aim were taken. One of these exploited the use of a web site to facilitate preparation for face-to-face discussion during classes. The other relied on the use of asynchronous threaded discussion boards to promote interaction outside of timetabled classes. In the latter approach classroom sessions were used mainly for group work and to provide one-to-one feedback to students. In both approaches traditional lecturing was reduced to virtually nil. Both approaches were on the whole welcomed by students and tutor. However it was clear that during the semester, the majority of students only made use of the electronic tools and materials provided when they were needed for the completion of assessed coursework.

1. Introduction

Larger class sizes, coupled to a more diverse student population have both acted as stimuli in recent years for an examination of approaches to teaching and learning (Bourners and Flowers 1997; Saunders 2000). Increasingly such examination is leading to attempts to more effectively exploit ICT so as to better respond to a situation where students are finding it increasingly difficult to attend regularly on campus (Hudson et al., 1997; Saunders et al., 1999; Collis and Moonen 2001). Whilst this is a laudable response to genuine student difficulties, such a driver for change can detract from the debate about whether increased use of ICT can actually enhance the quality of the learning experience.

There is indeed much active discussion within the academic community as to the value of ICT in teaching and learning. Whilst it is almost universally agreed that ICT has much to offer distance learners there is much less agreement about the role of ICT to deliver hybrid courses and benefit more traditional campus based students. Those who are ardent supporters of the use of ICT can point at a considerable body of research which suggests it can be effective. Some recent examples include a study of the teaching of mathematics (Wenglenski 1998) which concluded that ICT does promote academic achievement. Many other studies have reached similar conclusions (e.g. Salpeter 1998) but almost all will make the point that the effectiveness of the use of ICT relies heavily on the context within which teaching and learning takes place (Healey 1998).

Critics of the use of ICT are quick to point out the potential pitfalls involved in increasing the use of technology. Some of this criticism relates to the fact that many of the studies extolling the positive features of ICT are extremely context specific and cannot therefore be considered generically applicable. Since many reports of the use of ICT to support teaching and learning now qualify their conclusions within context, it seems as though proponents and critics alike are moving towards the middle ground that suggests ICT can help if used in a way that takes full account of both the subject area and students involved. Despite this what often is expressed as a great concern is that staff teaching at a traditional university will somehow misuse technology, and as a consequence students will experience a worse form of learning.

At the University of Westminster, within the School of Biosciences, a range of ICT tools have been used to progressively increase the flexibility of delivery of a final year undergraduate module in microbial genetics. This module was for many years taught with students receiving a mixture of lectures and tutorials (approximately 70% lectures and 30% tutorials with 1 member of staff to support around 30 students). The most obvious change in delivery brought about by the integration of ICT tools has been the effective loss of all ‘traditional’ lecturing on the module (for the purposes of this paper traditional lecturing is considered to be an event where one person does all or most of the talking). Over a period of four years the lecturing formerly done has been replaced initially by text based materials and then most recently, recorded slide presentations distributed on CD. In 1998/99 one 30-45 minute ‘interactive’ lecture was given each week (for the purposes of this paper and interactive lecture is considered to be one where students are encouraged to and make periodic intervention in the teacher talk). This was reduced gradually over the next 2 years until in 2001/2002 only 6 X 20 minutes overview lectures were given. The classroom time formerly used for lecturing has been instead devoted to provision of feedback and other discursive activities such as student led group work.

In each of the four years the mixture of ICT tools used has changed, as increasingly sophisticated the technology has become available and in response to feedback from students. At the end of each academic year concerned the approach taken was thoroughly evaluated. A combination of questionnaires, interviews with individual students conducted by staff not involved in delivery of the module and student led group discussions have been used.

2. Context of module delivery

A module in microbial genetics has formed a part of a number of undergraduate degrees within the School of Biosciences for over 15 years. For most of that time the module has been delivered in a similar way to other modules on the degree. The general approach on the degree is to provide students with a mixture of lectures, tutorials and a few laboratory classes. Generally the emphasis in classroom based sessions has been the lecture. On the microbial genetics module there was no laboratory classes. This is because at this stage of the degree students are separately engaged on their laboratory based research project module. Assessment on the module was also typical of that found for most modules on the degree, comprising a mixture of continuously assessed coursework and an end of module written examination. There were four items of coursework, collectively worth 50% of the module marks, with the final written examination accounting for the other 50%.

Normally the module would be taken by between 30 and 40 students studying one of a number of related degree pathways (for example biomedical sciences, biochemistry and microbiology, biotechnology, medical biotechnology) within Biosciences. The module in microbial genetics comprised one eighth of the final year of study (fifteen credits out of a total of 120 credits for the year). Therefore, the students concerned would typically be taking a further 45 credits, comprising (depending upon the particular pathway they were on) either three further 15 credit taught modules or one other 15 credit taught module and the 30 credit laboratory based research project.

In academic year 1998/99 all timetabled classes except for one took place in a normal classroom. In the other three academic years of this study (1999/00, 2000/01 and 2001/02) all timetabled classes took place in a networked PC laboratory with each student having access to a PC.

In the first year of this study, (academic year 1998/1999) students were provided with a set of web pages comprising notes and exercises for each week of the course. Students were expected to come to each classroom session having read the notes and tried the exercises. In between classroom sessions students were also asked to send the tutor at least one e-mail or question or comment about the forthcoming week's topic. They were encouraged to work in small groups to do this. The content of these e-mails was used whenever possible to shape the classroom discussions.

In academic year 1999/2000 students were also provided with a set of interactive multimedia tutorials covering most topics on the module. The tutorials were designed to complement the notes available on the module website. Typically each tutorial took about 20-30 minutes to work through and comprised a series of screens containing a mixture of text, diagrams and areas for direct student input. Movement through the tutorial was always directly linked to some positive student input. Thus for example a student might see on screen a diagram of a complex biological process and they would be able to reveal information about each stage of the process by moving the mouse arrow through the different parts of the diagram. Movement to the next stage of the tutorial would normally require students to complete an on-screen task requiring either pointing at the correct part of the diagram or entering some text into a text box. These interactive tutorials were made using the multimedia authoring tool called Mediator (Matchware Ltd). Authoring took some time despite the user friendliness of the software concerned. In addition to the interactive tutorials this year also saw the introduction of formative on-line short answer tests to supplement the notes and tutorials.

Typically for each week of the course there was at least one test containing a mixture of multiple choice, multiple response, true false and fill in the blank questions. The on-line assessment tool used was QuestionMark Perception and students taking the tests were provided with instantaneous feedback on each question in addition to their overall score. There was no limit to the number of times a student could take a test. This year also saw the first attempts to use an asynchronous discussion board (actually a Microsoft Frontpage Discussion web) to facilitate communication between students on the weekly topics. In the following year (2000/2001) all of the above were further supplemented with two in-house developed communication tools. One was a web based messaging system that enabled targeted delivery to all students on the module of news and information. The other was an interactive frequently asked question (FAQ) database which allowed students to search amongst an existing bank of categorised questions and answers. However the system also allowed students to ask new questions when they wished to and provided the capability for the tutor to both answer and at the same time add the question and answer to the growing database of FAQs.

In 2001/2002 all module materials and communications between students and between students and tutor, were 'packaged' within the virtual learning environment (VLE) Blackboard. The use of Blackboard effectively replaced the existing module website, the web-based messaging tool and web-based discussion board generated by Microsoft FrontPage. The FAQ tool continued to be used as there was no equivalent within Blackboard, however all on-line assessment was moved from QuestionMark Perception into the assessment system built into Blackboard. In addition, for the first time student use of the asynchronous discussion boards was assessed. In this academic year a CD containing audio slide presentations, each of about fifteen to 20 minutes

duration, and covering all the major topics on the module was also provided to students. The mixture of ICT tools used over the four years are summarised in Table 1.

In all four years the amount of face-to-face contact with students in a classroom or a computer laboratory was not significantly reduced, relative to that which the module contained prior to 1998/99. However, there was no formal lecturing and students were required to either take part in small group work, whole class tutor led discussions or computer mediated learning, assessment and communication. The exception to the general rule of no one (tutor) to many (students) discourse was the delivery by the tutor of a fifteen to 20 minute overview presentation every two weeks. The aim of each overview presentation was to place into context the topics to be covered in the following two weeks and to highlight key concepts that the students should focus on in their self directed work.

ICT Tool/Materials	Function	Academic year(s)
Web site	Providing information, notes.	98/99, 99/00, 00/01
WNN	Web based messaging	00/01
WNF	FAQ tool	00/01, 01/02
QMark	Assessment	99/00, 00/01
Multimedia Tutorials	Promote understanding	99/00, 00/01, 01/02
Recorded slide presentations	Overview of major topics	00/01
Blackboard	VLE	00/01

Table 1: List of ICT tools and materials used indicating their major function and the year(s) in which they were used.

Over the four-year period of study, whilst the number and type of coursework exercises remained largely unaltered, the relationship of the coursework exercises to the electronic materials and tools was changed. In the first and second years of this study, (1998/99 and 1999/00) no explicit link between the coursework exercises and the interactive tutorials was made by the tutor. However in the last two academic years (2000/01 and 2001/02) the subject matter of the coursework exercises was much more closely integrated with the tutorials and students were explicitly told which tutorials to focus on for each coursework exercise. The way in which the use of the ICT tools and materials changed in relation particularly to coursework, is summarised in table 2.

3. Evaluation of the approaches taken

At the end of each year most students completed a detailed questionnaire. The questionnaire sought statistical information about PC ownership and understanding of relevant software and hardware but in addition gave students some scope to describe their overall approach to learning at university.

Academic Year	Ways in which ICT tools were used
1998/99	Course notes/tutorial exercises available on website. Students expected to prepare for classroom sessions and to use e-mail to communicate with the tutor.
1999/00	Web pages supplemented by interactive tutorials on CD, on-line tests for formative purposes and asynchronous discussion board.
2000/01	Coursework for the first time explicitly linked to the interactive tutorials. FAQ tool introduced. To support coursework.
2001/02	Module materials and communications packaged in the VLE Blackboard. Use of asynchronous discussion boards linked to coursework and also directly assessed.

Table 2: Summary of the use of the ICT tools across the 4 years and relationship to coursework and assessment

Inevitably the information students provided on the latter point was limited on the questionnaire. As a consequence feedback was also obtained through interviews with a sample of students from each year (on average 7 students from each academic year were interviewed on a one-to-one basis by a member of staff who had not previously met the students). The main purpose of the interviews was to focus on the ways in which students used the materials and tools provided. As well as these staff led interviews, in 1999/00 and 2000/01 student led discussion groups were also used to gain additional insight into the views of students about the way in which the module was delivered. Although not originally an aim, the student led discussions turned out to be extremely useful in gaining a fuller understanding of the way in which modern students approach their degree work.

4. Student access to essential hardware and software

Apart from concerns about the pedagogic value of ICT, detractors of the use of ICT also often cite the potential problem arising from a lack of availability to students of appropriate hardware and software. Obviously this is a serious issue particularly as most campus based universities are not able to provide anywhere nearly enough computers to satisfy demand, especially at certain times of year when

coursework deadlines enter the equation. Accordingly, with the use of ICT to support module delivery on the increase it is often necessary to rely to a degree on students having access to a PC outside of the University.

Over the period of this study, it is evident that student ownership or access to a PC outside of the University has increased substantially. In addition the number of students having access to the Internet from home (including access to the World Wide Web and e-mail) has also steadily increased (see Table 3).

	98/99	99/00	00/01
Percentage with an Internet connection at home	57%	67%	75%
Percentage with PC at home	75%	96%	92%
Percentage making regular use of WWW in their studies	46%	95%	100%
Percentage using e-mail on a regular basis	50%	95%	98%

Table 3: Student access to a PC and Internet connection away from the University and their use of the WWW and e-mail in academic years 1998/99, 1999/2000 and 2000/2001. Figures for 2001/2002 are not presented as they are not significantly different to those for 2000/2001

5. Electronic materials and tools - the overall student view

In all four years of the study it was quite clear that the majority of students welcomed the availability of electronic materials. However it was also apparent that the materials which they favoured most were those that resembled pages of text from a book. In the first year of this study (1998/99) there was considerable concern expressed by the students at the beginning of the module regarding the lack of formal lecturing. Indeed the concern was so great that the issue was raised at the student/staff course committee meeting early in the semester. Interestingly in the last three years no concern was expressed by students taking the module regarding the lack of lectures. However in all four years the students highlighted the value they found in the brief overview presentations given by the tutor. A majority of students were very clear that the ICT resources and tools were useful as a supplement but not as a replacement for face-to-face activities.

The interviews and student led discussions revealed that whilst many students appreciated the resource materials, very few saw their availability as a reason not to attend classes. However it was very noticeable that attendance in the last three academic years of study, when classes were held in computer laboratories, was higher (80-90%) than in academic year 1998/99 when attendance was usually between 60% and 70%. In that year all classroom sessions were in a normal classroom bar one held in a computer laboratory.

In the student led discussions most students said that they preferred a standard lecturing approach to module delivery. However most also agreed that they saw advantages in the use of on-line materials and tools, and thought that they would be more positive towards this type of delivery method if it had been introduced gradually during the first year at university.

6. Student use of the ICT materials and tools

Evidence obtained from the one-to-one interviews supported the view that most students preferred classroom sessions where they were active. However, relatively few students ever used the ICT materials in advance of a classroom session. In the first year of this study, 5 out of a total of 20 students interviewed stated that they had tried to prepare for classroom sessions as requested by the tutor. However they all pointed out that such preparation became more difficult as coursework pressures on other modules built up and as work on their research project came to a climax.

In 1998/99 and 1999/2000 most of the students interviewed referred to the fact that they listened more during classes whilst very few found that the way the module was delivered had encouraged them to contribute more during face-to-face tutor led discussions. The students who placed importance on listening felt that the availability of the on-line module resources had a significant impact on the classroom experience. One student stated, “I didn’t have to panic about writing it all down and was therefore able to listen more”. All students who were interviewed felt that such on-line based resources should be used more widely on the degree course.

In all years, students inevitably printed off as much of the on-line resource material as they could. In academic year 1998/99 all of the materials were made available at the beginning of the module. This tended to focus many students on the need to print off everything as quickly as possible. In the last three years materials were provided on a more incremental fashion, and in the last year, on a weekly basis. This need to print made the interactive tutorials, which first became available in academic year 1999/2000, somewhat unpopular as they were difficult to print out.

The most revealing insights into the way in which the students used the module resources, and indeed the way in which they approached studying at university generally, came from the student led discussions first conducted in academic year 1999/2000. The reports from the two students leading each of the two discussion groups in that year (each comprising 10-12 students) showed clearly that most made little use of the interactive tutorials on CD during the semester or indeed for revision. Equally most students were not interested in using the on-line formative tests during the

semester. This was confirmed by the statistics generated by the assessment package which showed that only about 25% of students regularly tried the tests.

The reports from the student-led discussion groups left little doubt that most students spend the majority of their time on the degree course compiling learning resources (notes from lectures, copies of articles, handouts given to them by lecturers). In general such compiled learning resources were not used during the semester unless required explicitly for an assessed coursework exercise. It was frankly admitted by students that unless the compiled resources were needed in this way then they would normally not be looked at until very near to the final written examination. It was clear that the major difference for students with respect to the microbial genetics module was that they essentially generated course handouts themselves by printing material and that in timetabled classes, instead of taking notes, they spent their time listening more both to the tutor and each other. In a sense it appeared that the on-line resources were just like any other compiled learning resource. The only difference was that students needed to work less to compile them. As one student put it, "the majority of us went from not using the module resources at all during the semester to an almost frantic use of the web-based material for exam revision".

In academic year 2000/01 the subject matter of the coursework was altered so that it could be more closely related to the content of the multimedia tutorials. This close link between assessed coursework and the multimedia tutorials was preserved for the subsequent academic year as well. Student use of the CD based material rose dramatically with almost all students stating in the questionnaire that they had used the CD on an almost weekly basis outside of timetabled classes. Whilst use of the CD increased during the semester, the frequency with which students tried the on-line tests did not however change markedly.

In both 1999/2000 and 2000/2001 an asynchronous discussion board had been made available for students. However in these years use of the discussion boards was very disappointing, with hardly any students using the facility. In the last academic year however (2001/2002) the use of the asynchronous discussion boards available within Blackboard was closely related to the normal coursework exercises and was also directly assessed. This led to intensive use of the discussion boards by all students.

The FAQ system and, in the last year, the discussion boards were more intensively used whenever a coursework deadline approached. Indeed the major use of the FAQ system was to ask questions related to the subject matter of these exercises. The usage statistics generated by Blackboard in academic year 2001/2002 clearly showed how activity, particularly in the discussion and communication areas, rose dramatically a few days prior to submission of a coursework exercise. Equally, it was clear from the statistics generated by Blackboard that by far the greatest amount of time spent by students within the VLE was devoted to the discussion and communication areas.

7. The tutor's view

In the first year of this study, the tutor felt considerable apprehension especially after the first few face to face classroom sessions. This feeling came about mainly as a consequence of the number of worried remarks and comments made by students who had come to the module expecting to be listening to the tutor for most of the class. It became quite clear very quickly that some students disliked the approach much more than others and at times, because of this, it was very tempting for the tutor to slip back into a much more didactic form of teaching.

Of considerable encouragement however was the receipt by the tutor, in the first few weeks of the module during 1998/99, of an appreciable number of e-mail messages from students which tended to suggest that as many as half at least of the class were trying to work through the materials and ask questions prior to timetabled classes. Many of the e-mail questions received were extremely good ones, and the tutor derived considerable satisfaction from this fact. It was noticeable however that the frequency of e-mail messages did fall after the first three or four weeks. When questioned students stated that time pressures generated by coursework on other modules had led to them having less time to look at the on-line materials. This meant that classroom sessions slowly became increasingly tutor led, especially in terms of identifying the major issues for discussion.

In the last three years of this study the students did not give any collective indication of being concerned by the very different approach to delivery. However in every year there were always 1 or 2 students who required more re-assurance than others and even in 2001/2002 there were still some who were worried because of their limited experience of the use of computers in the learning process.

Introduction of the VLE Blackboard in the final year of this study provided for the first time a capability to track and monitor student access to the materials and communication tools. The tutor reported that the availability of this tracking felt like a big advantage. Unlike in previous years, where by and large he had to hope that students were actually making use of the materials and tools outside classes, it was possible to check whether they were, at least to a degree. This had some immediate benefits. One was that early in the semester it was possible to identify students who by virtue of their limited virtual presence, might be struggling with the subject matter or experiencing personal problems. This monitoring led to the tutor sending an e-mail to 4 students, two of whom responded immediately and came to talk to the tutor about their respective situations. Another advantage felt by the tutor was that it was possible, by including measures of virtual attendance, to report for the first time in many years almost 100% student involvement in the module on a weekly basis.

8. Overall student performance

Almost all students who were interviewed in the evaluation process stated that they did not think the approach to module delivery would significantly affect their performance in comparison with other modules that were being delivered in a more traditional fashion. There was however a general view that the availability of the on-line module resources would help them when it was time to revise for the exam.

Over the four-year period a total of 131 students took the module. Out of this total 7 failed the module. The average examination mark achieved over the four-year period was 51%.

Both the failure rate and average examination mark compare well with those found for other modules taken by the same students at the same time. In addition the figures are comparable to those found on similar undergraduate courses at other UK universities. If anything the average written examination mark is higher than is often found on UK undergraduate courses.

9. Discussion and conclusions

It seems clear from this study that it is possible to dispense with most formal lecturing and replace this with other means of delivering information to students (e.g. web pages, audio/slide presentations). Indeed others have previously demonstrated the feasibility of doing this (e.g. Matthew 1994) The time saved by not lecturing can be used for other more interactive activities, such as the provision of feedback to students.

Eventually, most students did not seem unduly perturbed by the lack of emphasis on lecturing. Equally most of the students involved in this study were very positive about the use of technology. What they were not entirely positive about was a shift in emphasis from didactic methods and 'black or white answer' coursework assignments. Some students seemed genuinely intimidated by the individual attention they received in classes. However there were enough comments through the evaluations to show that a majority welcomed the greater freedom and responsibility they had during classroom sessions. It is of course possible that some of the 'positiveness' shown by students was directly due to the technology in its own right. Others have previously reported that the very use of ICT in a traditional university environment can stimulate student interest merely because of the novelty aspect of its use (Kulik and Kulik 1991).

Understandably the major focus for all students was to pass their course and this desire was strongly manifested in their behaviour. The basic rule seemed to be 'if it isn't assessed leave it alone'. Such a focus is perhaps hardly surprising. After all, in the busy World of the 21st Century how many of us have the luxury of time to do something extra, unless of course we are exceptionally passionate about the subject matter or about learning in general. An assessment focus has been reported before by others for more conventionally delivered courses (Carpenter 1975; Chansaker and Roundtray 1980).

Students on the module gave every impression, during discussions in class and at feedback, of feeling totally swamped with information and coursework at university. In that sense they saw this module as a form of 'light relief', not because the module was perceived to be any easier but because it facilitated the collection by students of learning resources. Indeed many students commented that if anything the coursework on this module was harder than that on other modules, citing particularly the fact that coursework exercises were too 'open ended'.

Overall the outcomes from this work could be presented most favourably. Students spent more time in classes working independently and actively, relating what they did to the information and insight provided to them through the module learning resources and overview presentations. Many students professed to seeing the advantages to them of such an approach. However, it might be unwise to readily extrapolate the findings of this work to other subject disciplines or even other topics within the Biosciences. The highly context dependent nature of learning has been previously pointed out as a reason to be very cautious about positive reports of ICT use (e.g. Healey 1998). Nonetheless, positive reports continue to grow in number and it begins to become clear that most learning contexts can find benefit from the judicious use of ICT to deliver information and/or promote communication.

There have been many 'uncomfortable' changes in higher education in the UK over the past 10 – 15 years. Both students and staff, have been affected by the increases in class size, diversity and costs. Undoubtedly staff now have less time to provide individual or even small group help to students and increasingly students are associating university learning with lectures (Lammers and Murphy 2002). Perhaps as a consequence of this, more and more students are failing to even begin to grasp the fundamentals of independent and critical thought and there are signs of a slide towards increased success for rote learners.

In conclusion it seems undeniable that using ICT can provide information so that classroom sessions can be used differently. Equally the on-line communication possibilities that ICT affords provides further ways to stimulate the student activity that is so sought by teachers and employers alike. The precise way in which ICT is used and can benefit will probably always be context specific to a degree. However the fundamental capability of ICT to deliver information and organise communication outside of the classroom is generic and should therefore be applicable in some way across all subjects and circumstances. ICT presents itself as an opportunity to begin reversing the unfortunate trend towards a 'unidirectional' model of higher education brought about largely by increases in student numbers and a decline in the unit of resource.

It is not clear whether approaches such as the one described in this paper will lead to higher levels of achievement by

students. What is clear though is that using ICT can lead to a more enjoyable and fulfilling experience for both students and staff in the 21st Century. A deeper goal should of course be the attainment by students of higher level skills. This may eventually come as more and more staff experiment with the opportunities that ICT offers and assessment regimes change to reflect higher level thought. For the immediate future though we should perhaps simply accept the enjoyment factor which using ICT can bring to potentially monotonous and depressing higher education experiences.

References

Bourners, T. and S. Flowers (1997) Teaching and learning methods in higher education: A glimpse of the future. *Reflections on Higher Education*, 9, 77-102.

Carpenter, N. (1975) Continous assessment and student motivation in management studies. *International Journal of Electrical Engineering Education*, 71, (2), 205-210.

Chansaker, B.A. and Rautray, V. (1980) How relevant is continous assessment? A business studies experience. *Assessment and evaluation in higher education*, 6, (1), 49-56.

Collis, B. and Moonen, J. (2001) Flexible Learning in a Digital World : Experiences and Expectations (Open and Distance Learning Series), Kogan Page.

Healey, J. M. (1998). Failure to connect. New York: Simon & Schuster

Hudson, R., Maslin-Prothero, S. and L. Oates (1997) Flexible Learning in Action, Case Studies in Higher Education, SEDA

Kulik, C.L.C. and J.A. Kulik (1991) Effectiveness of computer based instruction: an updated analysis, *Computers in Human Behaviour*, 7, 75-94.

Lammers, W.J. and J.J.Murphy (2002) A profile of teaching techniques used in the university classroom: a descriptive profile of a US public university. *Active Learning in Higher Education*, 3, (1), 54-67.

Matthew, B. (1994) Replacing the lecture by using audiotapes and written materials In: Exley, K. and Gibbs, G. (eds.) Course Design for Resource Based Learning - Science Oxford: Oxford Centre for Staff Development.

Salpeter, J. (1998). Taking stock: What's the research saying? *Technology and Learning*, 18 (9), 24-25, 28-30, 32, 34, 36, 40.

Saunders, G. (2000) Getting Started with On-line Learning, Learning Partners.

Saunders, G., Rumpus, A. and McShane, D. (1999) An evaluation of the use of the WWW for module delivery, In: P.Marquet, S. Mathey, A.Jailet and E. Nissen (Eds), Internet Based Teaching and Learning (IN-TELE) 98, pp545 – 550, Peter Lang, GmbH

Wenglinsky, H. (1998). Does it compute? The relationship between educational technology and student achievement in mathematics. Princeton, NJ: Policy Information Center, Educational Testing Service.

7 Suggestions for Better Integrating ICT enhanced Instructional Approaches into Campus-Based Higher Education

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Abstract

The particular situation of academic teachers and learners in campus-based Higher Education today gives rise to the idea of an integrated dimensional framework for instructional design (ID). We will relate it to the potential of ICT, especially for blended learning. It is argued that the framework can become the kernel of an advisory system addressing current needs of practitioners in campus-based Higher Education by taking advantage of research evidence.

Keywords: Instructional Design, Blended Learning, Advisory System

1. Introduction

"Only a rare few master the skills required to effectively integrate technology into learning and instruction" (Spector, 2000). This is a recent alarming statement of one of the most involved scholars in instructional design, development and evaluation; still more alerting when contrasted with the analysis of the current vice-president of the International Association of Universities, that technological change and lifelong learning are among the most deep-reaching challenges for Higher Education today (Weber, 1999).

Multimedia, hypermedia, virtual reality and telematics offer an ever vaster array of new opportunities for teaching and learning in Higher Education. It is a huge endeavour however to develop and implement approaches which are psychologically sound, pedagogically effective and practically relevant at the same time.

Genuine distance education institutions and virtual universities have strategically adopted organizational, instructional and technological approaches for online learning. In need of coping with high drop-out rates and growing competition their professional teams continually improve the learning experience drawing on performance support systems, defined workflows and task specialisation.

The setting of campus-based universities however is quite different and they cannot simply copy the approaches developed for pure distance education. Blended learning approaches that combine face-to-face settings and technologically enhanced learning environments seem to be more promising for them (Kerres, 2002; Milrad et al, 1999; Olson & Olson, 2000; Spector, 2000). For organisational reasons, however, task specialisation in the development of technologically enhanced learning environments remains low. Therefore in most cases it is up to the individual academic teacher to realize such models.

Generally, in European campus-based universities there are less of the "rare few" persons adequately dealing with educational technology than necessary, and this for two important reasons. First, a lack of state-of-the-art training and support can be suspected in the majority of traditional universities. But we have to take into account that development of suitable structures, procedures and information generally exceeds the capacities of single faculties or even entire universities. Hence, interinstitutional and international cooperation is paramount, but still sparely developed in this area.

Second, "those who might reap the most benefits (educators and students) are not convinced that instructional theorists have much of benefit to offer" (Spector, 1998: 117). Unfortunately, their impression cannot be discarded as misleading. Prominent scholars in instructional theory and research in Europe and the United States agree that there are serious shortcomings in the field. It suffers from a lack of coherence, integration and service-oriented dissemination of its results. Important joint efforts need to be undertaken in order to bridge the theory-practice gap from the research side (Duchastel, 1998; Niegemann, 2001, Reeves, 1999; Seel et al, 1998, Spector, 1998, Tennyson, 1994a).

"What is more amazing than the wealth of educational resources that we have produced and accumulated is how far we have *not* come in improving learning and instruction" (Spector, 2000; italics by the authors of this article). This is another dramatic conclusion if we take into account the amount of funding educational technology has taken advantage of and still does.

In this situation we consider two huge tasks as being essential for substantial improvements: (1) strategically integrating instructional design theory in a coherent conceptual framework and (2) transferring knowledge from research into practice combined with feedback from practice. In the following chapters we will introduce ideas on how these two tasks can be tackled drawing on the already existing body of knowledge.

2. ID and ICT in Higher Education

"While technology is decidedly the driver of this evolution, the principle challenges we face in ensuring the design of

optimum systems lie not in technology itself, but rather in the realms of learning psychology and instructional design (Duchastel & Lang, 1995: 56).

There is sufficient evidence to share this perspective. From our point of view three important and heavily debated questions can be derived from it:

- Which are the crucial ID decisions linking instruction to learning?
- What are the variants of ICT use in Higher Education?
- Where are the links between ID and ICT?

We will deal with these questions in the subsequent subchapters by summarising our view of the state of the current discussion through minimal necessary distinctions, and by suggesting directions of further development.

2.1. Dimensions of ID crucial for learning

ID is quite a complex process requiring decisions concerning many issues on several interrelated levels. Therefore ID-models are helpful devices for practitioners provided that there is research evidence that their prescriptions really result in what they pretend to bring about. There are important barriers, however, substantially impeding the desired and desirable impact of ID-models on actual teaching and learning practice in campus-based universities (and beyond):

First, there is a confusing number of different ID-models (Dills & Romiszowski, 1997; Reigeluth, 1999a; Ryder, 2002; Seel et al, 1998, Tennyson et al, 1997). Evidently they have blind spots, fuzzy zones, and overlaps, but systematic comparison of value for practitioners is still lacking (Duchastel, 1998). Second, even with these many ID-models often none of them fits exactly to the given situation. As scope and conditions of use are generally unspecified or underspecified (Duchastel, 1998), it is actually hard to know how to combine different models or parts of them, and whether parts cut apart from the rest still work.

As a consequence it can be presumed that more often than not academic teachers don't explicitly use any of these models in their ordinary practice, and if ID-models are used than rather in an eclectic manner and an unsystematic associative way.

There are three perfectly complementary ways to uncover the real impact components of instructional models have on learning under different conditions. The first reductionist one is to submit single features to comparative empirical testing in controlled laboratory settings. The second, more holistic one is to realize complex design experiments or development research including practitioners (Reeves, 2000, van den Akker, 1999). The third one is to systematically analyse and compare instructional design models, their prescriptions, explanations and empirical evidence.

We would like to outline the third alternative in more detail because it is the least pursued for the moment being, even if design experiments are rarely conducted as well (Reeves, 2000). Our main hypothesis is that the multitude of ID-models hides a much smaller set of universal dimensions of fundamental design decisions. These decisions have to be made in any case, be it explicitly or implicitly, following a particular ID-model or not.

First of all hierarchical levels of design decisions have to be differentiated, where upper levels are defining constraints for lower levels, and lower levels are specifying features in the pre-existing frame set by upper levels. As an alternative lower levels can trigger expansion of the preliminary frame, or inductively generating a new frame. The process is top-down and bottom-up until reasonable fit of all layers to each other is reached.

We differentiate between three layers, consistent with the most simple systems capable of cybernetic regulation. We will indicate a static and a dynamic aspect, and we add the sources from which the main insight stems for each layer:

1 strategy layer: basic ID-decisions and sequencing of instructional event modules, including performance assessment consistent with instructional goals and strategies (insight coming from developmental psychology, assessment research and expertise development research).

2 information layer: content segmentation, clustering and sequencing (insight coming from domain knowledge and task analysis, see Jonassen et al. 1999).

3 presentation or operation layer: selection and combination, design and sequencing of formats, codes and modes, plus, if necessary, screen and interaction design (insight coming from universal laws of human perceptual and cognitive processing on the one hand, and aesthetic and cultural aspects on the other).

Existing ID-models already diverge because they stress different layers. Elaboration theory (Reigeluth, 1999) e.g. is strong on content sequencing, fairly good on strategy and poor on the presentation questions. The cognitive apprenticeship approach (Collins, Brown & Newman, 1990) is very well developed on strategy in all phases of the instructional process, but relatively indifferent about the other two layers. The theory of multimedia learning (e.g. Mayer & Moreno, 2002) derives prescriptions for the presentation layer from what has been found in cognitive psychology about processing multiple representations, quite independently of any specific content or instructional strategy.

Hence, ID-models can be split in what they prescribe (or omit to prescribe) on each layer, and only then be submitted to comparison on one layer at a time. Comparisons are crucial for advancements in instructional design theory and its dissemination, because shared conclusions as well as contradictions or lack of evidence can only be detected in this way.

Analysis should include the prescriptions per layer, the conditions under which any prescription holds true, the theoretical explanations given, why any prescription is considered to promote learning, and the supporting empirical evidence. The analysis can be done on the basis of the public-

cations presenting an ID-model and the related empirical research, additionally including prominent examples of implementation. It should be complemented and validated through a questionnaire study addressing the authors of ID-models directly, or instructional designers with experience of using a particular model. The questionnaire needs to be constructed in a way allowing representation of both the universal and the unique aspects of a model.

We modestly started this research programme recently by analysing eight theoretically founded and widely used ID-models (for more details see Molz et al, 2002) in order to get a first grip on basic dimensions of instructional strategy decisions (first layer). The goal was to come closer to a framework potentially more widely applicable and more easy to communicate to practitioners than the current panacea of dozens of ID-models. The models considered in detail were:

- direct instruction (Engelmann, 1997)
- elaboration theory (Reigeluth, 1999a)
- inquiry teaching (Collins & Stevens, 1983)
- cognitive apprenticeship (Collins, Brown & Newman, 1990)
- instructional transaction theory (Merrill, 1999)
- goal-based scenarios (Schank, 1994)
- anchored instruction (Bransford et al, 1990)
- learning communities (Bielaczyk & Collins, 1999)

In order to determine dimensions of instructional decisions we have adopted an iterative procedure. On the one hand we have induced self-ascribed characteristics from the above set of ID-models, and determined which more general design issue they concern. On the other hand we couldn't but keep in mind the well-known and long-lasting debates in educational research and instructional design following the advancement of constructivist thinking.

The result is what we call the knowledge space and the participation space of instructional strategy decisions - following Sfard's (1998) two metaphors of learning: learning as knowledge acquisition and learning as increasing participation.

The knowledge space of instructional strategy decisions is composed by the following three bipolar dimensions:

- explicitation – automatisation
- contextualisation – decontextualisation
- canonical – problem-oriented knowledge organisation

The instructional strategy decisions concerning participation have to be made along the following three dimensions:

- one-way – multi-way interaction
- external regulation – self-regulation
- receptive mode – productive mode

The dimensions are independent from each other. In each dimension in both spaces the instructional designer respectively the learner himself (in the more self-regulated case) can choose more extreme or more median positions. For each successive instructional event module the precedent instructional strategy decisions can be revised or reproduced.

The next step in our approach consisted in mapping the characteristics of each model considered to sections of the dimensions. This has been done tentatively by the authors first separately and then jointly until consensus was reached. The comparison of the above mentioned ID-models on the six dimensions have produced the following general results:

On each dimension there are similarities, overlaps and differences, depending on the models compared. So, each dimension contributes to the differentiation between some instructional approaches, and at the same time uncovers similarities between others. A comparison between two models in general reveals some similarities, some overlaps and some differences, depending on the dimension considered. This is a supportive argument for the singularity and potential usefulness of all the different ID-models.

There are locations in the two spaces which are not completely covered by the considered set of models. It remains to be further investigated whether models not yet submitted to dimensional analysis will fill these gaps or whether there is potential for learning not yet exploited by instruction. From our point of view there is no a priori reason to exclude combinations of strategic decisions not yet merged into an ID-model.

Taken together a few models already suffice to cover the whole range on each singular dimension. If the models don't contain unnecessary features it could be supposed that the whole range on each dimension, the most opposed extremes included, have valuable contributions to offer to learning. It remains to be clarified however under which conditions which instructional approach is most adequate.

This brings us back to the absolutely necessary linking of the results of situational and goal analysis to instructional decisions. Furthermore they need to be backed by explanative elements from one learning theory or another. These are the very foundational but often forgotten concerns of instructional design theory (Gagné & Briggs, 1979, Tessmer & Richey, 1997). Tennyson (1988, 1994b) is one of the rare scholars advancing this type of work for a good deal of time now. In the future it is of the utmost importance for the relevance of instructional design to deepen and refine it, and formalise its results in falsifiable rules.

Up to here we tried to make evident through a first partial analysis of the design variables of the first layer how we would suggest to proceed on the other two layers and on the side of the conditional variables as well. The overall goal is to create easier conceptual access for practioners to ID compared to the opaque range of ID-models and their different vocabularies and various scope. We claim that this

goal can be reached without diminishing the differenciations necessary to tune instruction to learning.

2.2. Dimensions of ICT relevant for education

There are various suggestions for taxonomies of ICT use in Higher Education (e.g.; Bonk et al., 2000; Paquette, 2001). In order to put it most simply for practitioners without missing the essentials we tied them down to two basic dimensions: the physical – virtual continuum, and the information product – communication process complementarity, communication being either synchronous or asynchronous.

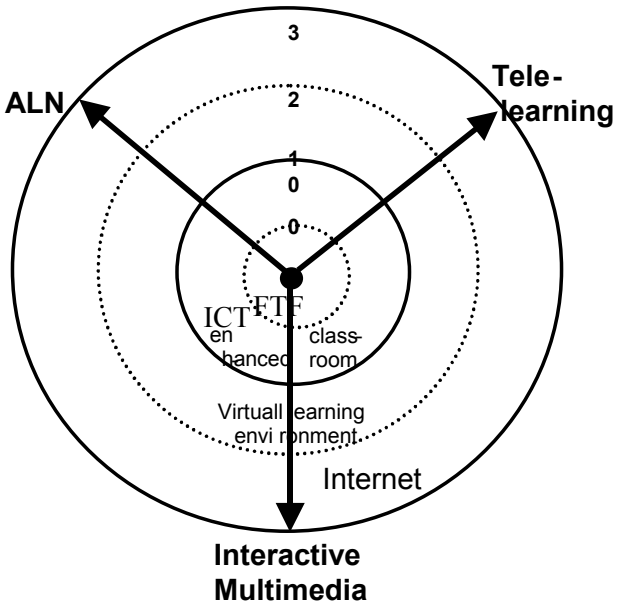

Figure 1: Types and levels of ICT use for

Figure 1 displays the various types of ICT use for educational purposes. We are starting form the face-to-face-situation (FTF) in the traditional classroom setting (level 0). Without altering the basic classroom setting instructional events can be enhanced with ICT (= level 1), e.g. by integrating already well-known (multi-)media presentations (downwards arrow), asynchronous messages as in interactive lectures (Wessels et al, 2002) with large audiences (upper left), or may be an expert invited to join per videoconferencing (upper right). These additional possibilities allow for more flexibility, more variety and better use of cognitive capacity, with potentially positive effects on motivation and understanding.

On level 2 an organised and circumscribed virtual learning environment is involved, either with multimedia or hypermedia information resources or interactive educational programmes (arrow downwards), with e-mail, newsgroups and commenting / rating of documents of others (upper left), or chat respectively videoconference utilities (upper right), or diverse combinations integrated in a platform. Level 3 is the Internet with all its opportunities and pitfalls. Moving downwards we come to the largest interconnected multimedia library of mankind (and an even larger collection of useless, ridiculous, misleading or harmful information). Moving to the upper left means asynchronous learning networks (ALN) or virtual communities with members all over the world sharing particular interests and working with advanced collaboration tools. And last but not least moving to the extreme upper right means distributed synchronous Tele-learning, e.g. through desktop videoconferencing or desktop sharing.

The FTF campus setting can become enhanced with either level of virtualisation 1, 2 or 3, or several combinations, and in either direction, multimedia / hypermedia information, asynchronous communication or synchronous communication, or several combinations thereof. Different blended scenarios can be derived from this picture, combining levels 1, 2 and 3. In the first blended scenario the virtual becomes part of the classroom experience during FTF lectures and meetings. In the second scenario physical presence can be complemented by learning tasks to be accomplished in the virtual realms between FTF sessions. And finally a curriculum can be built combining traditional or technologically enhanced FTF courses on the one hand and 100% virtual courses on the other. But there are as well blended approaches which operate the other way round. With presentation recording e.g. FTF lectures can be quite quickly transformed in net-based materials (Kandzia, 2001).

Even if the proposed framework allows to derive the different possibilities of blended learning the question remains which approach should be used for which purpose? This will be dealt with in the next subchapter.

2.3. Relationships between ID and ICT

For two decades there has been a controversy on the question whether media influence learning (a summary can be found e.g. in Tennyson, 1994). It seems to us that there are no substantial contradictions if, once more, levels to which statements belong are properly differentiated.

On the level of cognitive processing there is in fact impressive evidence that media cannot account for differences in learning (if the still inconclusive results concerning learning styles are suspended). On this very level Spector (2000) is quite right to state: “Many have implicit faith that technology will make education better. Such faith is ill-founded”. As a consequence it cannot be expected to improve learning directly by introducing new media in education.

On the content level it is clear that a particular content won’t be represented in different media in exactly the same way or with the same ease. Transposition from one medium into another affects the content, or may sometimes turn out not to be possible at all. E.g. a script, a theatre presentation and a movie will differ, even if they follow the same story line. But if their specific potential is used properly they simply won’t be used for the same purpose. Comparability is limited. In this respect the famous statement of Marshall McLuhan holds true that the medium is (also) the message.

On the level of instructional strategy it seems clear that media can enable or restrict the use of the best fitting instructional approach in a given situation. In general more than one medium will be able to properly support a method. In this case the least expensive can be chosen. Often the medium best supporting a method cannot be used for lack of resources, lack of competence, or lack of information about affinities between media, methods and situational constraints. On the other hand internet platforms often convey a lot of ready-made tools which are useless if no instructional function is attributed to them.

Newsgroups e.g. are an excellent tool for medium-sized distributed learning communities, but if the students personally meet each other every day on campus they will hardly be used. Videoconferencing is not the best choice for multilateral interaction but acceptable for the transmission of ordinary lectures. CBT is good to deliver standard content to an important number of individual learners. At first sight this appears to be a good deal for undergraduate studies. But a closer look reveals that CBT use requires developed competencies for self-regulated learning often still insufficiently acquired by undergraduates. Access to the Internet diminishes the need for the teacher to be the most important channel for distributing information. Complex problem solving can thus more easily be used as an instructional strategy. On the other hand new problems arise, like information overload.

As a summary it can be said that the context factors (Tennyson, 1994b; Tessmer & Richey, 1997) induce constraints on the instructional design options and the set of media which can be used, however without determining the final selection. The instructional decisions have an affinity to certain choices of use / non-use of certain types of technology and media, without determining them either. What we still need as complement of dimensions of instructional design decisions are media profiles and their own dimensional underpinning.

Every ID-model can be realised with or without ICT, even if some are regularly implemented with ICT (like goal-based scenarios). We couldn't detect any ID-model exclusively useful for ICT enhanced settings, nor did we find any model which could not be enhanced by ICT in one way or another. The decisive question remains in which cases ICT enables a desired method. If new media enable new methods or old methods better then learning may indeed start to benefit from media. After thousands of years of instruction however one is much more unlikely to invent a new method than to invent but just a tiny new tool without additional value for learning. For this reason the rhythm of improvement of learning remains much slower than the rhythm of technological innovation.

On the societal level the spread of new media undoubtedly induces social change. New tasks, new experts and new practices arise, new visions and ideals can be hold or even realised, a reorganisation of labour division and social life occurs (Debray, 1991). The acquisition of the competencies necessary to use the dominant media becomes a strategic learning goal in its own right for everybody, not less important than the acquisition of domain knowledge. This is true today for computer literacy and (multi-)media competency. In this particular case, the goal and the medium to be used coincide and precede the method. In the long run the whole set of educational goals will likely to be expanded or modified. With overall change in labour organisation the roles in the formal teaching-learning process have to be adapted as well. In all these respects media in fact influence learning, but this occurs indirectly, slowly and meshed with numerous other causal factors.

2.4. Building an advisory system for blended learning

"The design and planning of instructional systems and learning environments have not become simpler on account of advances in technology. Rather, they have become significantly more difficult" (Spector, 2000).

In campus-based Higher Education these difficulties exceed a level which can be handled on a hands-on basis. There is tremendous need of qualified support. Support can consist in reliable and up-to-date information, in training and networking opportunities, and in just-in-time performance support. Information is even more useful if integrated in performance support. We see basic awareness raising and kick-off training as an initial need, and performance support and networking as continuous needs.

We will turn to performance support as an largely unexploited possibility to promote ID and ICT in campus-based Higher Education. Performance support can be given individually by an experienced advisor or coach, or by an electronic performance support system (EPSS – Gery, 1991). As there is a shortage in personal advisors at the crossroads of ID and ICT, and coaching is not usual at universities, an EPSS seems worth considering. In fact, an EPSS is useful if

- performers have easy access to computing (true for academic staff in European Higher Education)
- computer literacy is given (basically true for academic staff)
- the task is complex (absolutely true for ID with technology)
- the task is critical (ID is indeed crucial for formal learning)
- the rate of change for the task is high (content, conditions and learners change all the time, and research evidence as well)
- the task is not extremely time-critical (preparing courses and lessons is no immediate urgency business)
- turnover rate is high (true for the majority of staff without tenure track)
- alternatives are difficult to realise (training is possible as well, but scaling while maintaining quality is difficult, an

EPSS would be rather complementary to some initial training, but not dependent on it)

- empowerment is a goal (true for ID and ICT competence)
- the task is not frequently repeated (as one of the main tasks of academic staff teaching is frequently repeated, but blended learning is still considerably less frequent as long as the current transformation process lasts)
- there are complex decisions involved (true for ID)
- the system can be maintained and updated (true if universities cooperate with each other)

These criteria (Reeves, 1995) apply perfectly well to the ID-tasks with which academic staff in campus-based universities has to cope while adopting blended learning scenarios. Hence, the development of an EPSS to support teaching and learning with ICT seems well justified and the number of professionals in European universities which can be potentially addressed with such a system is impressively high.

There are different types of EPSS: expert systems, advisory systems and tutoring systems (Duchastel, 1990). Expert systems are intransparent for the user concerning the reasons which lead to a certain conclusion, and they automatically take decisions on the basis of their in-built intelligence. Tutoring systems give feedback on a simulated task and not on the real one at hand. Only advisory systems fit to the needs of ID in Higher Education. They are immediately useful for the accomplishment of the real task, providing hints, background information and feedback on inconsistencies, giving explanations on demand, and making alternatives comparable. But the decisions are always to be taken by the user himself as ultimate authority.

In the 1990s several EPSS for ID have been developed for particular purposes, like the development of online courses, of interactive multimedia programmes, or of simulations. Some have implemented one particular ID-model, others are overtly eclectic (Paquette, 1999; Spector et al, 1993; Tennyson, 1994c; van den Akker et al, 1999). None of these systems however addresses the far more numerous academic teachers of campus-based universities, which have far more modest needs, but generally far more heterogeneous situations to cope with. The goal is to enable persons with various prior knowledge in ID and ICT to generate valid instructional approaches for blended learning scenarios and to make adequate media choices.

As far as the dimensional analysis advances and the rules can be derived and formalised step by step, in time the conceptual framework will become the core of what we would like to call the online advisory system TELEMAP (standing for "teaching and learning with multimedia applications"). As an EPSS it will contain five hierarchical levels (Duchastel & Lang, 1995), which can be built successively. More details can be found in Niegemann (2001) and Niegemann et al (2002):

- basic online help (direct access to topic modules and descriptions of fundamental procedures)
- extended help (access structure follows dimensional approach, there are forms and pop-up reminders signaling inconsistencies)
- demos and examples
- customized help and training (relating to domain specific resources)
- process illustration: conditions, rules and design decisions

The content of TELEMAP will be entirely based on current research evidence, to counter misconceptions and discard unfounded advice. Development, implementation and maintenance of TELEMAP will need an interinstitutional effort which, however, can be considered worthwile because of the far-reaching benefits of quality just-in-time support and the shared costs. TELEMAP could potentially interface with a virtual community for blended learning in Higher Education.

3. Conclusion

Twenty years ago, during the early history of the personal computer and the Internet, the visionary John Naisbitt (1982) already announced the famous formula: "the more high tech the more high touch". Recently he found interest in reissueing and extending this very same basic tension (Naisbitt, 2001). Blended learning as the future of the campus-based university is promising the best of both worlds. The profound transformation towards this end has already begun. Academic teachers and learners have to be actively supported to positively cope with their changing roles, tasks and tools. They have to learn smoothly to adapt to the requirement of becoming more techie and more touchy at once.

To be able to do so, we have to dig for what is already known in scientific discourse on ID, ICT, learning and their complex interrelationships. We have to look behind and above the controversies in order to carefully salvage the essentials like a treasure. We have to clean and sort them in order to finally present them in a useful manner to the public. An online advisory system for teaching and learning with multimedia applications is a coherent way to promote blended learning at the university. It would be impossible without ICT merged with an innovative instructional approach. It becomes itself an example for what it is designed to promote: a new medium usefully enhancing and democratising a former method, best complemented with FTF training.

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References

Bielaczyc, K. & A. Collins (1999). Learning Communities in Classrooms: A Reconceptualization of Educational Practice. In C.M. Reigeluth (Ed.) (1999). *Instructional-Design Theories and Models, Vol. II: A New Paradigm of Instructional Theory*. Mahwah, NJ: Erlbaum.

Bonk, C.J., J.A. Cummings, N. Hara, R.B. Fischler & S.M. Lee (2000). A Ten-Level Web Integration Continuum for Higher Education. In B. Abbey (Ed.), *Instructional and Cognitive Impacts of Web-Based Education*. Hershey: Idea Group Publishing.

Bransford, J.D., R.D. Sherwood, T.S. Hasselbring, C.K. Kinzer & S.M. Williams (1990). Anchored Instruction: Why We Need it and How Technology Can Help. In D. Nix & R.J. Spiro (Eds.). *Cognition, Education, and Multimedia: Exploring Ideas in High Technology*. Hillsdale, NJ: Erlbaum.

Collins, A., J.S. Brown., & S.E. Newman (1990). Cognitive Apprenticeship: Teaching the Crafts of Reading, Writing, and Mathematics. In L. B. Resnick (Ed.), *Knowing, Learning, and Instruction*. Hillsdale, NJ: Lawrence Erlbaum.

Collins, A. & A.L. Stevens (1983). A Cognitive Theory of Inquiry Teaching. In C.M. Reigeluth (Ed.), *Instructional Design Theories and Models: An Overview*. Hillsdale, NJ: Erlbaum.

Debray, R. (1991). *Cours de médiologie générale*. Paris: Gallimard.

Dills, C.R. & A.J. Romiszowski (Eds.) (1997). *Instructional Development Paradigms*. Englewood Cliffs, NJ: Educational Technology Publications.

Duchastel, P. (1990). Cognitive Design for Instructional Design: *Instructional Science*, 19, 437-444.

Duchastel, P. (1998). Prolegomena to a Theory of Instructional Design. *ITFORUM*, Paper 27. http://itech1.coe.uga.edu/itforum/paper27/paper27.html [June 24, 2002].

Duchastel, P. & Lang, J. (1995/96). Performance Support Systems for Learning. *Journal of Educational Technology Systems*, 24(1), 55-65.

Engelmann, S. (1997). Direct Instruction. In C.R. Dills & A.J. Romiszowski (Eds.), *Instructional Development Paradigms*. Englewood Cliffs, NJ: Educational Technology Publications.

Gery, G. J. (1991). *Electronic Performance Support Systems. How and Why to Remake the Workplace Through the Strategic Application of Technology*. Tolland, MA.: Gery Performance Press.

Gagné, R. M., & L.J. Briggs (1979). *Principles of Instructional Design*. New York: Holt, Rinehart & Winston.

Jonassen, D. H., M. Tessmer, & W.H. Hannum (1999). *Task analysis methods for instructional design*. Mahwah, NJ: Erlbaum.

Kandzia, P.-T. (2001). Course Production – Quick and Effective. Presentation at the *3rd NLT conference*, September, 13-14, Fribourg, Switzerland.

Kerres, M. (2002). Online– und Präsenzelemente in hybriden Lernarrangements kombinieren. In A. Hohenstein & K. Wilbers (Eds.), *Handbuch E-Learning*. Köln: Fachverlag Deutscher Wirtschaftsdienst.

Merrill, D.M. (1999). Instructional Transaction Theory (ITT): Instructional Design Based on Knowledge Objects. In C.M. Reigeluth (Ed.), *Instructional-Design Theories and Models, Vol. II: A New Paradigm of Instructional Theory*. Mahwah, NJ: Erlbaum.

Molz, M., A. Eckhardt, W. Schnotz, H. Niegemann & D. Hochscheid-Mauel (2002). Deconstructing Instructional Design Models – Towards an Integrative Conceptual Framework for Instructional Design Research. Paper Presented at the Workshop *Instructional Design for Multimedia Learning* of the EARLI Special Interest Group 6, June, 27-29, Erfurt, Germany.

Mayer, R.E. & R. Moreno (2002). Aids to computer-based multimedia learning. *Learning and Instruction*, 12, 107-119.

Milrad, M, A. Broberg & T. Pederson (1999). Challenges for Design: Seeing Learners as Knowledge Workers Acting in Physical – Virtual Environments. *Journal of Courseware Engineering*, 2, 22-33.

Naisbitt, J. (1982). *Megatrends. Ten New Directions Transforming Our Lives*. New York: Warner.

Naisbitt, J. (2001). *High Tech / High touch. Technology and our Accelerated Search for Meaning*. London: Nicholas Braely.

Niegemann, H. (2001). Instructional Design Hypertheory - – A Knowledge Management Approach to Make Results of Research Accessible and Usable. Presentation at the *9th Conference of the European Association of Research on Learning and Instruction* (EARLI), August, 28 – September, 1st, Fribourg, Switzerland.

Niegemann, H., D. Hochscheid-Mauel, M. Molz, A. Eckhardt & W. Schnotz (2002). Reconstructing Instructional Design Models – Developing a Heuristic Advisory System as a Tool for Instructional Design Research. Paper Presented at the Workshop *Instructional Design for Multimedia Learning* of the EARLI Special Interest Group 6, June, 27-29, Erfurt, Germany.

Olson, G.M. & J.S. Olson (2000). Distance Matters, *Human-Computer-Interaction*, 15, pp. 139-178.

Paquette, G. (2001). TeleLearning Systems Engineering – Towards a new ISD model. *Journal of Structural Learning and Intelligent Systems*, 14(4), 319-354.

Paquette, G., C. Aubin & F. Crevier (1999). MISA, a knowledge based method for the engineering of learning systems. *Journal of Courseware Engineering*, 2, 63-78.

Reeves, T.C. (1995). Do You Need an EPSS ? http://it2.coe.uga.edu/EPSS/Need.html [July 07, 2002].

Reeves, T.C. (1999). A Research Agenda for Interactive Learning in the New Millenium. Paper Presented as Keynote Address at the *Ed-Media*, June 19-24, Seattle, Washington.

Reeves, T.C. (2000). Enhancing the Worth of Instructional Technology Research through "Design Experiments" and Other Development Research Strategies. Paper Presented at the *Annual Meeting of the American Educational Research Association,* April 24-28, 2000, New Orleans.

Reigeluth, C.M. (1999a). The Elaboration Theory: Guidance for Scope and Sequence Decisions. In C.M. Reigeluth, (Ed). *Instructional Design Theories and Models Vol. II: A New Paradigm of Instructional Theory*. Mahwah, NJ: Erlbaum.

Reigeluth, C.M. (Ed) (1999b). *Instructional Design Theories and Models Vol. II: A New Paradigm of Instructional Theory*. Mahwah, NJ: Erlbaum.

Ryder, M. (2002). Instructional Design Models. http://carbon.cudenver.edu/~mryder/itc_data/idmodels.html [June 24, 2002].

Schank, R.C. (1994). Goal-based Scenarios: A Radical Look at Education. *Journal of the Learning Sciences*, 3(4), 429-453.

Seel, N.M, S. Al-Diban, S. Held, & C. Hess, (1998). Didaktisches Design multimedialer Lernumgebungen. In G. Dörr & K.J. Jüngst (Eds.), *Lernen mit Medien*. Weinheim: Juventa.

Sfard, A. (1998). On Two Metaphors for Learning and the Dangers of Choosing Just One. *Educational Researcher*, 3, 4-13.

Spector, J.M. (1998). The Future of Instructional Theory: A Synthesis of European & American Perspectives. *Journal of Structural Learning & Intelligent Systems*, 13(2), 115-128.

Spector, J.M. (2000). Trends and Issues in Educational Technology: How Far We Have Not Come. *ERIC IT newsletter*, 12(2). http://www.ericit.org/newsletter/docs/volume21issue2/spector.shtml [July 05, 2002].

Spector, J.M., M.C. Polson & D.J. Muraida (Eds.) (1993). *Automating Instructional Design: Concepts and Issues*. Englewood Cliffs, NJ: Educational Technology Publications.

Tennyson, R.D. (1994a). The Big Wrench vs. Integrated Approaches: The Great Media Debate. *Journal of Educational Technology, Research & Development*, 42(3), 15-28.

Tennyson, R.D. (1994b). Analyzing instructional information: Content analysis and contextual module analysis. *Journal of Structural Learning*, 12(2), 113-127.

Tennyson, R.D. (Ed.) (1994c). *Automating Instructional Design, Development and Delivery*. Berlin: Springer.

Tennyson, R.D., F. Schott, N.M. Seel & S. Dijkstra (Eds.) (1997). *Instructional Design: International perspectives*, Vol. 1, Part III: Models of Instructional design. Mahwah, NJ: Erlbaum.

Tennyson, R.D. & M. Rasch (1988). Linking cognitive learning theory to instructional prescriptions. *Instructional Science*, 17, 369-385.

Tessmer, M. & R.C. Richey (1997). The Role of Context in Learning and Instructional Design. *Journal of Educational Technology, Research & Development,* 45(2), 85-115.

van den Akker, J., R.M. Branch, K. Gustafson, N. Nieveen & T. Plomp (Eds.) (1999), *Design Approaches and Tools in Education and Training, Part II: Computer-Based Tools for Educational Design and Development*. Dordrecht: Kluwer.

van den Akker, J. (1999). Principles and Methods of Development Research. In J. van den Akker, R.M. Branch, K. Gustafson, N. Nieveen & T. Plomp (Eds.), *Design Approaches and Tools in Education and Training*. Dordrecht: Kluwer.

Weber, L.E. (1999). Survey of the Main Challenges Facing Higher Education at the Millenium. In W.Z. Hirsch & L.E. Weber (Eds.), *Challenges Facing Higher Education at the Millenium*. Phoenix: Oryx.

Wessels, A., S. Fries & H. Horz (2002). Interactive Lecture: Teaching and Learning in Wireless Networks. Paper Presented at the Workshop *Instructional Design for Multimedia Learning* of the EARLI Special Interest Group 6, June, 27-29, Erfurt, Germany.

8 Reusable Learning Objects for Medical Education: Evolving a Multi-institutional Collaboration

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Abstract

In early 2002 a number of UK HE institutions founded a collaborative project to produce a bank of high quality e-learning resources to support and enhance teaching in the traditionally difficult area of statistics, epidemiology and research skills. Creation of these resources is very costly; typically amounting to more than one institution can afford to fund. Yet many of these resources are generic and can be used, re-used and shared between institutions. So the collaboration was proposed to produce and share these resources in a cost-effective manner.

Reusable learning objects offer a number of educational advantages compared with more traditional course-based approaches. Because they are stand-alone resources that encompass a single "chunk" of learning, they can be used in many different ways and across disciplines. Entire courses may not be appropriate for re-use in different institutions (the "not invented here" syndrome) but individual learning objects can be selected and re-used as components of a much wider course. Resources may be presented in different formats within customisable virtual learning environments to suit individual learning styles and address disability issues and technological constraints. Material can be kept up to date more readily: it's much easier to update a single resource than an entire course. Web-based materials can be indexed and stored in a fully searchable database and can thus be retrieved and downloaded directly to the user's desktop.

This paper outlines the approaches adopted during the first phase of the collaboration to develop e-learning resources to support teaching and enhance learning. Some of the problems faced by the collaborators in the early stages are described along with the decisions and strategies for effective progress.

Keywords: reusable, learning objects, collaboration

1. Background

The Universities' Collaboration in E-Learning (UCEL) was founded in April 2002 by four collaborating institutions: the UK universities of Cambridge, Nottingham, Manchester and East Anglia. Schools of medicine, nursing, midwifery, health visiting and health and behavioural sciences were all represented.

The collaboration was borne out of a common need to produce and share high quality e-learning resources to enhance teaching and learning in what were perceived to be broadly 'difficult' subject areas; epidemiology, statistics, research skills, communication skills, ethics and the sociology of medicine. (These also comprise the more marginalized subject areas of the medical curriculum and whilst they are both vital and compulsory, they are often neglected due to other curricular pressures). The high cost associated with these resources, which are very labour intensive to produce, puts them beyond the reach of individual departmental budgets. Yet students and teachers alike clearly value these resources and would welcome their increased availability.

An obvious strategy to produce and share these resources in a cost-effective manner was to work collaboratively. In addition, if the resources could be reused across different disciplines this would offer added value. However, a multi-institutional, inter-disciplinary collaboration is neither easy to initiate nor is it a trivial task to achieve consensus and thus keep it productive, on target and moving forward. But invention is the daughter of necessity and the early stages of the project had the benefit of a focused, enthusiastic and committed group of collaborators with high expectations for the project.

The model proposed and adopted was a self-funding one with each institution committing a proportion of the project funding and individual collaborators pledging a modicum of their time (typically a few days per year) to work their subject matter into e-learning resources. The bulk of the annual fee paid for time buy-out for a developer to create the resources. This was of the order of £10,000 (€13,500) for the first year, which meant that although this was by no means an insignificant contribution it was eminently affordable. Despite this, there were still budgetary problems to be overcome however, as institutions had no automatic provision for a project of this nature and funds had to be negotiated or

grants applied for. Fortunately for the project, these problems were temporary and were overcome.

The collaboration is overseen by a steering group which meets bi-monthly and is composed of representatives from each of the collaborating institutions. Which resources are to be developed are decided by the steering group and collaborators offer their areas of expertise to create content which is then developed into digital resources by an e-learning developer. The strategies for achieving this are outlined in section 4 below.

2. E-learning strategies

The temptation when considering the implementation of any new teaching method is to adopt an "all-or-nothing" policy. A common inference is that if e-learning is introduced in a wholesale fashion then all teaching will subsequently be conducted remotely; indeed, the sheer expense of it may make this appear a desirable outcome. Yet the history of media teaches us that new forms tend to add to rather than displace: cinema has not been replaced by video or DVD; television never replaced radio; the internet has not replaced books, as was commonly feared. The sheer hype generated by a new medium can also result in fairly wild claims which cannot be achieved in reality. Consequently, as each new hope is dashed, the bubble bursts (as happened with the nineties dot.com start-ups which rapidly came to be seen as up-starts in the cold light of the new century) and early proponents quickly lose faith in something they perhaps should not have accepted so credulously in the first place.

Clearly, there are many forms of teaching and learning activities. Equally, it is apparent that there is no technological solution. "Teaching and learning are not problems that require solutions – they are processes", argues Gilbert and if a single solution is sought it will inevitably fail. Successful education involves multiple forms of teaching and learning in order to engage, stimulate and extend the learner. The UCEL project called for a balanced and appropriate approach, where there is no single answer, rather a whole raft of them. E-learning resources have the power, if developed and deployed appropriately, to significantly enhance the learning experience but one message is clear; teachers will always be needed.

Therefore UCEL adopted the pragmatic view that resources should be created to support teaching and learning rather than replace them; that they should be used, reused and shared to maximise cost-effectiveness; and to these ends they should be as generic and as reusable as possible across the broad medical and health professional educational landscape. In order to achieve this last aim, emergent metadata and interoperability issues had to be addressed.

Reusable learning objects (RLOs) present a number of educational advantages compared with more traditional course-based approaches. Because they are stand-alone resources that encompass a single "chunk" of learning, they can be used in many different ways and across disciplines. Entire courses may not be appropriate for re-use in different institutions (the "not invented here" syndrome) but individual learning objects can be selected and re-used as components of a much wider course. Resources may be presented in different formats within customisable virtual learning environments to suit individual learning styles and address disability issues and technological constraints. Material can be kept up to date more readily: it's much easier to update a single resource than an entire course. Web-based materials can be indexed and stored in a fully searchable database and can thus be retrieved and downloaded directly to the user's desktop. Their use can also be monitored. And, importantly, by engaging a focused and enthusiastic group of collaborators in the production of these resources, a sense of ownership is engendered which also makes uptake and reuse much more likely.

3. Metadata and interoperability

"There is a need within any community which expects to share resources to agree a common practice." (Duncan et al, 2002).

A consistent pattern that emerges from a scan of the current literature on reusable learning objects is that no consensus on standards yet exists. Whilst no-one disputes the power of metadata schema to enhance retrieveability, and thus enable reuse, there is considerable disagreement as to how exactly this can or should be achieved. There are a number of nascent schema:

- ADL/SCORM – Advanced Distributed Learning Network/ Sharable Content Object Reference Model (US federal government)
- ARIADNE - Association of remote Instructional Authoring and Distribution Networks for Europe (EC framework 3 programme)
- BSI IST/43 – British Standards Institute
- CEN/ISSS – Centre de European Normalisation / Information Society Standardisation System
- DCMI - Dublin Core Metadata Initiative
- IEEE LTSC – Learning Technology Standards Committee
- IMS Global Learning Consortium
- ISO – International Standards Organisation

Increasingly, these various bodies are not all working in isolation, although as they all have slightly different aims there is some way to go before universal agreement on metadata standards can be reached. In the meantime, how should development proceed, given that the first collection of resources is required in time for the new academic year? To wait until standards emerge is merely to postpone the problem; there will be further and unforeseen interoperability

issues down the road which will require further spells of waiting until they in turn are resolved. And so on.

4. Collaborative development benefits

The collaborative development of learning objects requires consideration of a range of issues which warrant individual analysis. Plewes and Issroff (2002), Hammond et al (1992) and Bennett (2001) describe the low level of use of networked learning resources within teaching programmes; the reasons for this can be ascribed to three general themes i) lack of funding ii) lack of technical knowledge iii) development time. Issroff et al (1997) identifies the need to link resources to assessment in order for them to be fully utilised. Daniel (1998), reflecting on his experience at the OU, highlights evidence that team approaches to course development are more effective than individual efforts. Weil (1996) explores the influence of changing practices in education on the lowering of barriers that demarcate content. Couple this with the employment of a pedagogy that encourages the use of an object-oriented approach, and the concept of reusability becomes a reality.

The project attempts to address these areas and in particular create an environment where collaborative working becomes the norm. Detailed consideration given to reshaping the educational structure of courses creates additional benefits. We have found that commonalties between modules can be explored and developed at School, Faculty and cross institutional level. Similar content within different courses can allow joint development in the form of RLOs. The use of a VLE can allow the reuse of these objects and the creation of an object in one subject area may open routes into other specialist areas and provide a thematic approach to cross module learning.

5. RLO development strategies

Wiley (2000) defines a learning object as 'any digital resource that can be reused to support learning'. Whilst this is a broad and useful definition, the UCEL project found it necessary to define a RLO more precisely for it's own particular purposes.

A powerful aspect of the project is it's ability to collaboratively draw out individual expertise in order to re-deploy it for the common good. Lecturers commit a certain amount of time to work on an outline specification for the RLO to be created. Whilst the actual development of the RLO is carried out by a multimedia developer; the lecturer is required to organise their material in such a way that this development process is simplified. This requirement has led to the evolution of a "Reusable Learning Object Specification", a template document with a number of fields into which the lecturer can slot their material. The specification has accompanying support notes which begin by defining a learning object (specifically for the purposes of this project):

Definition: "A reusable learning object (RLO) is based on a single learning objective, comprising a stand-alone collection of three components:

1. Content: a description of the concept, fact, process, principle or procedure to be understood by the learner in order to support the learning objective

2. Interaction: something the learner must do to engage with the content in order to better understand it

3. Assessment: a way in which the learner can apply their understanding and test their mastery of the content".

It is fully expected that this definition, will evolve and change with use and over time yet it was clearly felt at the outset of the project that some form of helpful definition and template were required; there are few things less conducive to the creative process than a blank sheet of paper, and lecturers were keen to accept help and guidance to introduce them to these new working practices.

It soon became apparent that a significant amount of 'hand-holding' was also going to be required to kick-start the RLO creation process. A decision was taken about a third of the way into the project, for the lead e-learning developer to spend some time (typically a day or two) with each of the collaborators in their workplace, to focus intensively on a pre-selected portion of content and work this material into a RLO 'on site'.

6. Evaluation strategies

As with all innovative and thus unproven teaching and learning projects, evaluation is key in ensuring improved 'product development' and also the viability and durability of the entire project.

Donabedian (1966) defines three classic principles in the evaluation of medical programmes: structure, process and outcome. Outcome is the most important because it enables assessment of the overall effectiveness of the project and its component parts. In the context of the UCEL project, the desired outcomes would be improved understanding and enhanced skills, resulting ultimately in better healthcare. Yet since RLOs will be used in many combinations and alongside other forms of teaching and learning, it may prove difficult to quantify a single RLO's contribution. Individual qualitative responses to RLO use can be collected and analysed and quantitative evaluation can be achieved by comparing formal exam results 'pre' and 'post' RLO implementation.

Structure should be easier to evaluate; at its simplest it will be a description of the content (as detailed in the RLO specification document., How closely content maps to curriculum can then be assessed. The structure of content may also change over time through the iterative development lifecycle.

Evaluation of process requires observation of how RLOs are actually used and this will be informative. It may be assumed

that effective RLOs will be used more than others and this enables a evolutionary approach where the success of an individual object can be reinforced by regular updating of its content, structure and interactivity. Fit objects are thus identified and made fitter. Further insight may also be gained from an examination of how RLOs are used in sequence (as a collection), and how they are combined with other resources.

Leeder & Davies (2001) describe three main components of e-learning evaluation: content, human-computer interaction and learning preferences. They highlight the importance of evaluating each separate area in its own context to avoid confusion of disparate issues. For instance, if the content is set at an inappropriate educational level then the quality of HCI makes little or no difference. Conversely, if the e-learning resource is impossible to navigate then the level of content is irrelevant. The third issue of individual user preferences is important in understanding how users engage with both technology and content and also informs iterative future development.

7. Conclusion

"…because content counts" is UCEL's motto. But it is no trivial task to drive forward a project with upwards of a dozen individuals in almost as many departments across four geographically, culturally and politically separate institutions. This requires persistent and consistent project management with regular communication by email, post and phone as well as face-to-face. This essential activity requires a considerable investment of time which should not be underestimated.

The very nature of RLOs lends them to ubiquitous use. Increasingly they will come to be seen as central resources to support and enhance teaching and learning across a wide variety of subject areas. Similarly, the nature of collaboration is that it tends to spawn further collaborations. The UCEL project and its collection of RLOs will grow over time as more collaborators join and the project may become a model to encourage collaborations in other disciplines.

Creative product development together with effective evaluation are central to the project's success. But the great strength of the project is in its focussed, enthusiastic and committed core of members and it must never be overlooked that institutional collaborations succeed not because institutions collaborate, but because people do.

References

Bennett, R. (2001) Lecturers' Attitudes Towards New Teaching Methods. *The International Journal of Management Education* (LTSN Business, Management and Accountancy Centre),2,1,42-58

Daniel, J. S. (1998) *Mega Universities and Knowledge Media,* Kogan Page, London

Donabedian, A. (1968) *The evaluation of medical programs* Bull. N-Y-Acad-med: 44(2), pp. 117-24

Duncan, C., Campbell, L., J. Slater & G. Graham (2002). *Using Metadata in Packaged e-Learning Content: Common Practice in the UK*. Presented to UK-MEG, 18 April 2002

Gilbert, S. W. (2000) *A New Vision Worth Working Toward – Connected Education and Collaborative Change* [WWW document]. URL http://www.tltgroup.org/gilbert/NewVwwt2000--2-14-00.htm (visited 2002 Jul 02)

Hammond N. *et al* (1992) *Blocks to the Effective Use of IT in Higher Education*. Computers and Education, 18,2,155-162.

Issroff, K. *et al* (1997) From Cadaver to Computer: Incorporating Computers into the Topographical Anatomy Laboratory. ALT-J, 5,1, 55-59

Leeder, D. & T. Davies (2001). *Delivering a web-based course for Cambridge medics: evaluation, issues and outcomes*. Presented to TET2001 conference, Prague, May 2001. [WWW document]. URL http://www.medgraphics.cam.ac.uk/medsoc/evaluation.pdf (visited 2002 Jul 02)

Plewes, L. & K. Issroff, (2002). *Academic Staff Attitudes Towards the Use and Production of Networked Learning Resources*. Presented to Networked Learning 2002, 26th March 2002

Weil, S. & I. McGill,, (1996) *Making Sense of Experiential Learning* OU, Bristol

Wiley, D. A. (2000). *Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy*. In D. A. Wiley (Ed.), The Instructional Use of Learning Objects: [WWW document]. URL http://reusability.org/read/chapters/wiley.doc (visited 2002 Feb 20)

9 A Web-based Teaching and Training Network in Neurosurgery

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Abstract

The era we are living in is often referred to as the "information age" because new information and communication technology (ICT) has had an enormous influence and a revolutionary impact to change the way we do business, live and learn. New educational concepts, technologies and course contents will be required with consideration of topics, e.g.

- Teaching/learning strategies,
- E-learning environments,
- Development and production of learning modules,
- Web-based learning resources/tools,
- Virtual learning labs/classrooms in conventional universities,
- Collaborative learning in small groups,
- Policies, ethics, worldwide (EU) standards.

These new ICT systems open up new forms and ways of learning.

In the German Federal Ministry of Education and Research (BMBF) granted project "Teaching and Training Network in Neurosurgery" (TT-Net), modern multimedia and information technology is used in the hospital in order to leverage it for the training of students and physicians. The aim is to compose web-based course modules for a virtual education system for neurological diseases. The TT-Net is being realized in a very well equipped and highly competent learning environment in the Hannover Medical School campus network (see figure 1).

Keywords: life long learning, volume visualization, virtual education system.

1. Introduction

Because web browsers are becoming the universal front-end for multimedia applications, learning is not limited by geography and does not cause pressure of time by the user. The development of such multimedia information and communication systems demands cooperative working teams of authors, who are able to master several areas of medical knowledge as well as the presentation of these using different multimedia facilities. A very important part of communication design in the context of multimedia applications is the creation of screen design, both of icons and buttons, and interactive use of images and video-clips. The growth and complexity of medical knowledge as well as the need for continuous, fast, and economically feasible maintenance impose requirements on the media used for medical education and training. An efficient content creation and production of web-based courseware is necessary. It is an innovative education resource for medical students and professionals.

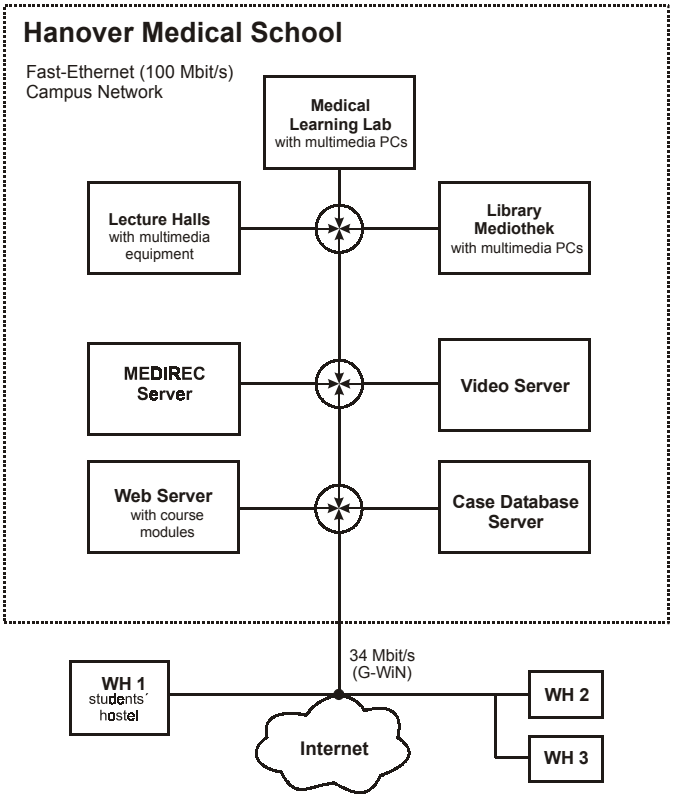

Figure 1: TT-Net Sever in the Campus Network

2. Using web technologies for education

The theory and practice of education are undergoing dramatic changes. Lifelong learning and adaptation of medical practice to new knowledge and new techniques will be even more important. The focus will move on from conventional teacher based lectures to virtual learning centers. How do we support successful lifelong learners and help them to competently

respond to the rapidly changing opportunities in the 21st century? In addition to and in combination with classroom courses, the development of internet-based multimedia courseware is significant (Matthies, 2000).

Web technologies support smarter learning, make it possible to better manage changes, continually improve learning, and offer an efficient representation of contents. Instructions provided through Web-based learning environments should incorporate active learning models to make it possible for students and physicians to take an active role in their learning. Information skills are needed for problem solving. Related information skills should be developed within the context of real need and the overall information problem solving process. Learning means understanding. In addition to passively receiving information in the classroom, learners are invited to actively explore the medical knowledge in a virtual learning environment designed with flexible jumping (buttons) to virtual learning rooms.

3. The virtual learning room concept for the TT-Net at the Hannover Medical School

Our virtual learning room concept (see figure 2) to use web-based learning environments has been realized with consideration of both systematic learning and problem-based learning.

Figure 2: Buttons for virtual learning rooms of the TT-Net

For example, the “Orientation”-button (see figure 3) always gives information about the current virtual learning room.

Every learner may select different learning levels and has also the possibility to test his knowledge using multiple choice questions (see figure 4) as they would be given in real examinations. The SQL database system responds with “Your answer is correct” (see figure 5) or “Sorry, your answer is incorrect”. Incorrect answers will be color labelled.

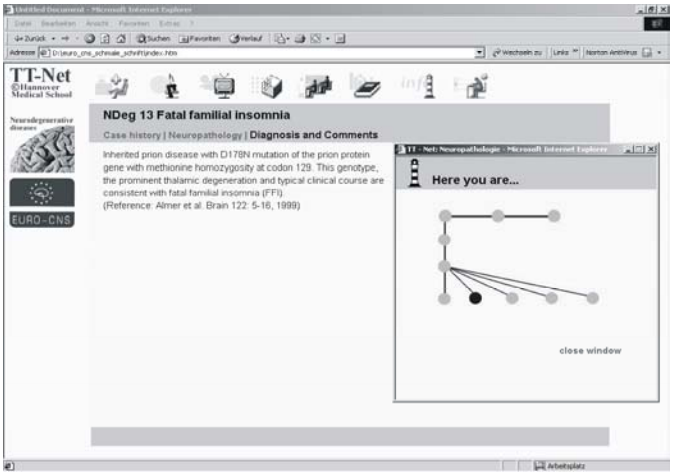

Figure 3: Orientation-Button

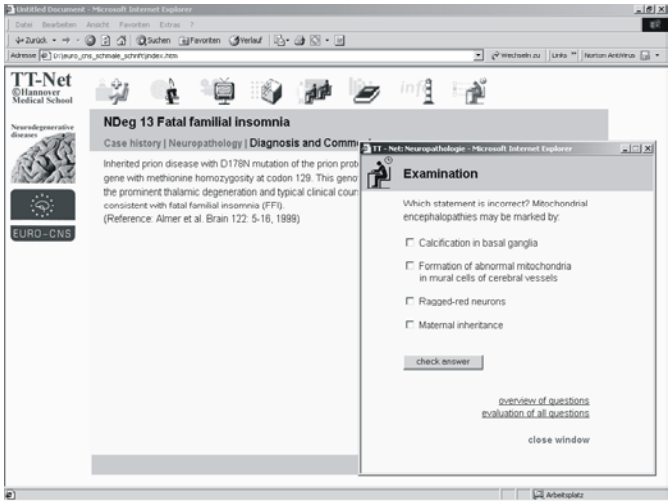

Figure 4: Test using multiple choice questions

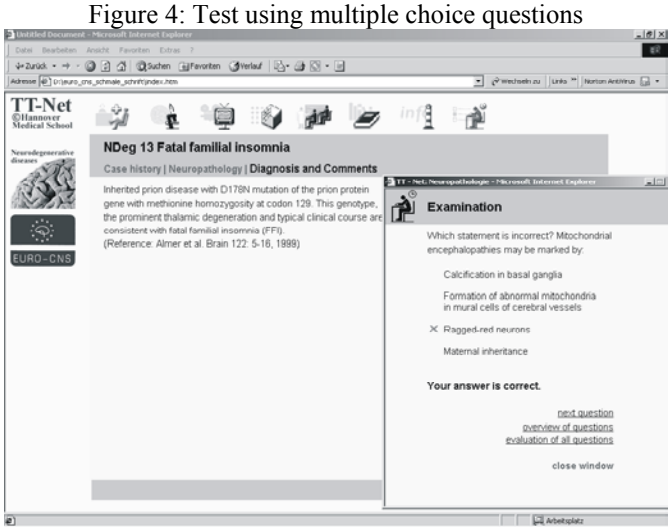

Figure 5: Test results

4. Content of TT-Net

The aim is to build a web based textbook for teaching basic knowledge in neurosurgery. This textbook contains text,

hyperlinks, video-clips (see figure 7), animations and virtual reality scenes as well as digital radiographs (DICOM). The teaching of surgical skills by means of multimedia based materials, i.e. "learning by viewing" will minimize "learning by doing" for surgical training. Through the use of three-dimensional (3D) models and volume visualizations of real patient data (e.g. CT or MR), the student's spatial orientation in the datasets is greatly facilitated, which is an important aspect for learning how to plan and perform surgical procedures. Contrary to what can be shown by conventional drawings, 3D models and volume visualizations show the anatomy in a quantitative way and make it possible to interactively view the scene from every imaginable and desired perspective.

4.1. The learning module "Basic procedures in Neurosurgery"

The first step is to compose a multimedia learning module "Basic procedures in Neurosurgery" (see figure 6), containing text, hyperlinks, video-clips, animation, VR environments (Virtual Reality) and digital radiograms (DICOM).

Figure 6: Screenshot of the content page of the learning module "Basic procedures in Neurosurgery"

The web-based textbook contents are diagnosis oriented, and based on the subject catalogue (GK) of the disciplines Neurosurgery, Neuropathology and related fields. The textbook material is generated from a collection of case examples acquired from the involved clinical institutes containing electronic data of neurosurgical procedures and case reports as well as digital patient records.

German cooperation partners of the Hannover Medical School are the Clinics of Neurosurgery of the Humboldt University (Charite) in Berlin and of the University Erlangen, the Institute of Neuropathology of the Saarland University in Homburg/ Saar and the International Neuroscience Institute Hannover.

The learning modules for "Neuropathology" in the TT-Net are developed for students' level. They are the base for the development of a virtual education system within of the framework of the continuing training courses of the Confederation of Neuropathological Societies (EURO-CNS).

Figure 7: Video-clip of a neurosurgical procedure

4.2. EURO-CNS Virtual Education System

This system is based on the software for the TT-Net modules for neuropathological Images and Cases (see figure 8) developed by the Institute of Neuropathology and by the Institute of Medical Informatics of the Hannover Medical School. A special adaptation for the needs of EURO-CNS, including a refinement of the software in cooperation with specialists for communication design and media pedagogics, is foreseen.

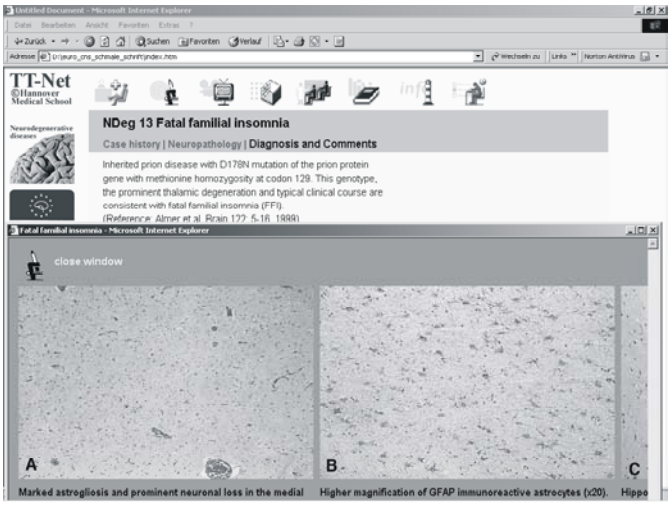

Figure 8: Case report with histological images

The scientific contents will be decided and controlled by the educational board of EURO-CNS. The language will be English, but in principle the system is adaptable to all languages and script types, e.g. Greek or Cyrillic.

The development and maintaining costs are borne by the institutes from Hannover Medical School, financed from available research grants.

The System will be accessible over the Internet websites of EURO-CNS and of Hannover Medical School. The access can be limited by password to members of EURO-CNS societies, if wanted.

This System should/could contain

- the cases presented at the training courses, including prototypic images and case reports, for self-instruction and repetition;
- summaries and reviews of the topics of the training courses, provided by invited lecturers;
- the original questions of the European Board Examination organised by EURO-CNS during the European Congress of Neuropathology in Paris, in 1996, including multiple choice text and slide questions, for self testing; this is accompanied by an automatic evaluation and correction of the given answers;
- forthcoming EURO-CNS Board Examinations including automatic evaluation and correction;
- additional features decided by the educational board of EURO-CNS, such as enclosure of video-clips and/or audio-clips;
- links to well selected websites, e.g. the websites of EURO-CNS member societies can be established.

4.3. Volume visualization

The development of medical imaging over the past 30 years has been truly revolutionary. Three-dimensional volumetric visualization of CT and MR data of the spine, internal organs and the brain has become standard of routine patient diagnostic care. Volume data are 3D entities that may have information inside them, may not consist of surfaces and edges, or may be too voluminous to be represented geometrically. Volume visualization is a method of extracting meaningful information from volumetric data using interactive graphics and imaging (Kaufmann, 2000).

Volume rendering conveys more information than surface rendered images, but at the cost of increased algorithm complexity, and consequently increased rendering times. To improve interactivity in volume rendering, many optimization methods as well as several special-purpose volume rendering machines have been developed.

Commercial solutions for medical 3D visualization frequently use manufacturer-dependent and expensive hard- and software, which can not always be adapted to the needs in educational environments. Therefore, an efficient visualization tool with support for hard- and software based volume rendering according to our requirements was developed for use in student education (see figure 9). This tool is based on the open source software library VTK (visualization toolkit, version 4.0).

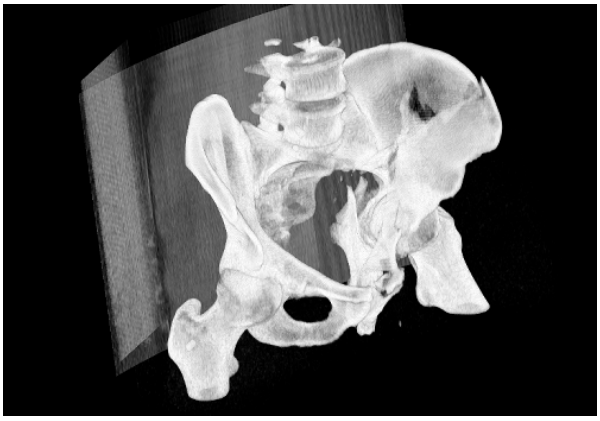

Figure 9: 3D view of a complex fracture of the pelvis

4.4. Quantitative 3D models of neurosurgical procedures

In addition, a new method is used to generate quantitative three-dimensional models of neurosurgical procedures (Köster, 2002). A computer assisted surgery (CAS) device (MKM of Zeiss, Germany) is used to scan optically discrete points of the outlines of surgically relevant structures in order to obtain 3D co-ordinates of the surgical scene. These data are applied to a computer aided design (CAD) software (AutoCAD LT 2000i, Autodesk), which allows quantitative 3D modelling. Using these data we obtained a CAD model of the surgical scene, which represents not only the intraoperative anatomy, but in addition information from the preoperative imaging. This new method of modelling neurosurgical procedures (Koester, 2002) enables a documentation of surgery with quantitative properties and is therefore unique compared to conventional film and photo documentation. The resulting model can be used to simulate different perspective views and to perform measurements within the model like exact localization and size of a craniotomy, spatula position and optical axis of the microscope at different stages of a surgery. Thus, this new method of modelling neurosurgical procedures allows accurate 3D documentation of intraoperative anatomy and surgical manipulation. It therefore provides basis data necessary for 3D modelling and simulation of neurosurgical procedures.

4.5. 3D rendering

3D rendering is recognized as an efficient educational tool to present human anatomy and included pathologies. In The Visible Human Project it is in use as an interactive 3D atlas. For 3D visualization, all anatomic structures of the body were precisely segmented, which is a very time and cost consuming task and is not feasible for larger databases, as detailed segmentation of each individual case is unreasonable. In a clinic, the high computing cost of direct volume rendering makes it difficult for sequential implementations and general-purpose PCs or workstations to deliver the targeted level of performance. This situation is aggravated by

the continuing trend toward higher and higher resolution datasets. Therefore we started a project using a direct volume rendering technique to build a large-scale 3D database of pathological cases intended as an interactive learning tool for medical students (Shin, 2002).

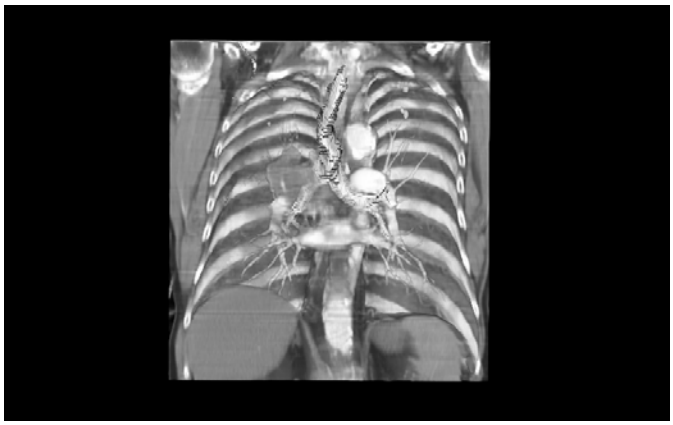

Figure 10: Visualization of a centrally located bronchial carcinoma. The segmented tracheobronchial tree is embedded in the 3D volume.

Without radiological training, medical students were able to work with the case-based 3D presentations (see figures 10 and 11). With basic anatomic knowledge, they could interact with the different 3D data sets to gain a deeper understanding of the underlying pathology. All pathologies of the CT-angiography cases could be visualized using volume rendering techniques without time-consuming segmentation.

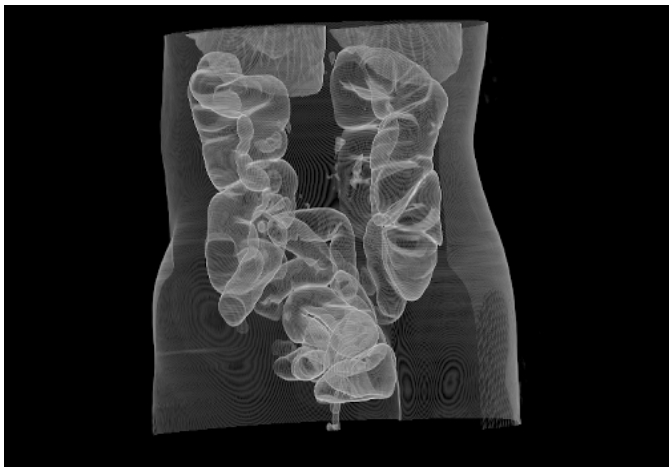

Figure 11: Visualization of the air filled colon

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Prof. C. Strauss, Neurosurgical Clinic, Univ. Erlangen/Nuernberg, Germany;

Prof. G.F. Walter, Inst. of Neuropathology, Hannover Medical School, Germany;

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References

van Bemmel, J.H. & M.A. Musen (1997). *Handbook of Medical Informatics*. Springer Verlag Heidelberg, and URL http://www.mieur.nl/mihandbook/r_3_3/handbook/home.htm

von Jan, U., H. Shin, H.M. Overhoff & H.K. Matthies (2002). Interactive PC-based volume rendering of CT datasets, *Biomedizinische Technik*, (vol.: 36. Jahrestagung der Dt. Gesellschaft für Biomedizinische Technik), i.p.

Kaufmann, A.E. (2000). *Volume visualization in Medicine*. In: Brinkman, I.N. *Handbook of Medical Imaging*. Academic Press San Diego - San Francisco - New York-Boston-London-Sydney-Tokyo, pp. 713-730.

Koester, I., A. Samii, T. Brinker & H.K. Matthies (2002). *A new method for 3D modeling of neurosurgical procedures*. In: Lemke H.U. et al. *Computer Assisted Radiology and Surgery*. Proceedings of CARS 2002, Springer-Verlag Berlin-Heidelberg-New York, pp. 1071.

Matthies, H.K., U. v. Jan, A.J. Porth, M. Tatagiba, A.C. Stan, G.F. Walter (2000). *Multimedia-based courseware on the virtual learning center at the Hannover Medical School*. In : Studies in Health Technology and Informatics, vol. 77: Hasman, A. et al. (Eds.): *Medical Infobahn for Europe*. IOS Press Amsterdam, Berlin, Oxford, Tokyo, Washington DC, pp. 541-545.

Shin, H., U. v. Jan, M. Galanski & H.K. Matthies (2002). *Interactive tutorials: development of a large scale 3D database of pathological cases using interactive volume*

rendering technique. In: Lemke H.U. et al. *Computer Assisted Radiology and Surgery*. Proceedings of CARS 2002, Springer-Verlag Berlin-Heidelberg-New York, pp. 473-476.

10 Information Problem Solving: Analysis of a Complex Cognitive Skill

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Abstract

In (higher) education students are often faced with information problems: tasks or assignments which require the student to identify information needs, locate corresponding information sources, extract and organize relevant information from each source, and synthesize information from a variety of sources. It is often assumed that students master this complex cognitive skill all by themselves. In our point of view, however, explicit and intensive education is required. In order to design education that fosters the information problem solving skill, a skill decomposition is required. In this research the complex cognitive skill of information problem solving is analysed. Experts and novices were observed while solving an information problem. Preliminary results reveal that experts spend more time on the sub-skills 'defining the problem', 'processing the information' and 'presenting the information'. They also regulate their process more often.

Keywords: Information problem solving, regulation, expert-novice analysis.

1. Introduction

Our current society is transforming into an information society. Both social and technological developments have contributed to a situation where information plays a key role (see Boekhorst, 2000). According to Marchionini (1999) the proliferation of electronic information technologies for computation and communication has speeded up the transformation process.

New technologies provide promising opportunities for accessing, storing, and distributing expanding amounts of information. However, these new technologies do indirectly create some problems. More than ever before people in our society are required to manage information overload, multi-tasking stresses, privacy and security issues, disorientation, distraction and addiction. Being able to adequately deal with information and to handle problems like techno stress and datasmog means being information literate. Marchionini (1999, p. 18) defines information literacy as "the skills, concepts, attitudes, and experiences related to information access, understanding, evaluation, communication, application, creation and value". An important component of information literacy is the ability to solve information problems, that is: to identify information needs, to locate corresponding information sources, to extract and organise relevant information from each source, and to synthesize information from a variety of sources into cogent, productive uses (Moore, 1995). In our study these activities are conceived as parts of one complex cognitive skill. This skill, which we refer to as information problem solving (see Eisenberg & Berkowitz, 1990, 1992; Moore, 1995), is complex, because it takes considerable time to achieve an adequate level of competence (cf. van Merriënboer, 1997). In contemporary higher education –due to a shift towards a learning-focused paradigm in instructional theory (see Reigeluth, 1999)- new curricula emerge that often appeal to information problem-solving skills. Examples are environments for resource-based learning (Hill & Hannafin, 2001; Macdonald, Heap & Mason, 2001), problem-based learning (Savery & Duffy, 1995), project-based learning (Land & Greene, 2000), and competence-based learning (Kirschner, Valcke & Van Vilsteren, 1997).

Since the skill of information problem solving is important in education and the skill requires substantial training, attention should be paid to the design of effective instruction. Before instruction can be designed, we need to analyse the skill. For a skills analysis, various methods can be used. The present study has chosen a comparison between novices and advanced information problem solvers. By choosing this approach two results were attained: (1) a decomposition and further analysis of the complex cognitive skill, and (2) an insight into the critical (sub) skills that distinguish advanced problem solvers from novices. Based on these results instruction can be designed.

Prior to the study, based on a review of literature, a preliminary model or framework of the information problem-solving skill was set up. The framework was derived from different studies. In the last decades the process of solving an information problem has been extensively studied and this has resulted in a variety of models (see for instance Spitzer, Eisenberg & Lowe, 1998, Wilson, 1999). According to Boekhorst (2000) most of these models can be characterized as information process models, which describe the steps one should undertake to fulfil an information need. Unfortunately higher-order thinking, like real problem solving and metacognitive activities, is underexposed in these process

models (Boekhorst, 2000, McKenzie, 1994). Therefore, this first attempt to describe the process of information problem solving has explicitly paid attention to metacognition by distinguishing regulation as an important component of a new model. The preliminary model or framework, taken as the study's starting point, consisted of the following components:

Problem definition. During the first phase of the process of information problem solving the need for information is formulated and the required types and amounts of information are considered. The final goal of this phase is to get a clear idea of the problem and the information required for solving it.

Select sources. Once the information problem is formulated, the sources for solving it must be considered. In this phase sources are to be selected and prioritised, resulting in the formulation of a search strategy.

Search and find. During this phase the search strategy developed is actually followed. This strategy facilitates the search for the required information. The sources selected earlier are to be looked for and, once found, the information within has to be located. After scanning the information, the resulting requirement for additional information can be established. Boekhorst (2000) emphasizes that, in order to be successful in this phase, knowledge about information and communication technology is essential.

Processing. Once the required information has been located, the phase of information processing starts. During this phase it is important to examine the relevance of the information in relation to the problem. The information has to be studied and new ideas and concepts have to be integrated into prior knowledge. Activating prior knowledge during information processing may result in a deeper understanding (Dochy, 1993). Other activities that can be undertaken during this phase are: analysing, selecting, relating, and structuring information and critical thinking.

Organization and presentation. Once all the information required for solving the information problem is present, the information has to be organized and presented in such a way that the questions formulated in the first phase are addressed. Usually, a product has to be completed, for instance an essay or a presentation.

Evaluation. During this phase the product and the process are evaluated to ensure that the product is in line with the original question or task and that the problem-solving process is efficient. This is a kind of self-evaluation. It is important to retrace what went wrong and what turned out to be a good way of working, so that the approach and strategy used can be improved and fine-tuned according to one's own requirements and preferences.

Regulation. Regulation is not a phase. The regulation activities, which can be performed while solving the information problem, coordinate the entire process. Regulation activities can be described as: planning, diagnosing, monitoring and steering (Vermunt, 1995). The learner must be able to make a plan and check during the process if the plan should be adjusted, because of inefficiency and ineffectiveness. Good regulation is also a characteristic of a 'goal-directed approach" (Land & Greene, 2000). The interaction with the information is related to a preconceived plan. When using a 'data-driven approach' broad subject areas are identified, searches are conducted and information is read in order to formulate the goals, hypothesis or questions. So, there is not really a preconceived plan.

Research of Hill (1999), Hill and Hannafin (1997), Land and Greene (2000) and Marchionini (1995) has revealed that the quality of regulation is related to the effectiveness and efficiency of the information problem solving process. There is also evidence that the use of metacognitive knowledge and skills during the process can compensate for a lack of subject matter knowledge (Moore, 1995; Land & Greene, 2000).

In different kinds of education students get more and more tasks and assignments, which can be characterised as information problems. Because solving information problems can be seen as a complex cognitive skill, it is necessary to train students in this skill. In order to design education that fosters information problem solving, it is necessary to make a skill decomposition (Van Merriënboer, 1997). In this research the complex cognitive skill of information problem solving is analysed. Experts and novices have been observed while solving an information problem.

The aim of this study has been to come to a decomposition of the complex cognitive skill 'solving information problems'. Another goal of this study has been the comparison between experts and novices. To what extent does the information problem solving process of the experts differ from the process of the novices on 1) time investment in the main component skills, 2) use of regulation activities and 3) search patterns.

Guidelines for the development of education fostering the skill of information problem solving can be generated from the characteristics of and the differences between the experts and the novices.

2. Method

Participants

Five experts and five novices voluntarily participated in the study. The experts were PhD-students from the Open University of the Netherlands in their final years (two female, three male). The five novices were freshmen from a Dutch university studying Psychology.

Materials

Task. The participants were asked to solve an information problem while thinking aloud. The task description was: 'How must we deal with the perishability of food? Can we consume food that is out of date? Or must we rely on our senses? Write (in Microsoft Word) an argument of about 400 words, which is meant for a consumers' magazine. You can use information from the Internet to build up your argumentation.' The topic perishability was chosen because we expected that the prior knowledge on this would not differ too much between the participants.

Instrument to analyse the thinking aloud protocols. An inductive – deductive method was used to develop the coding system for analysing the thinking aloud protocols. The coding system was based on the framework described in the introduction and the protocols, and was tested and re-adjusted in a few iterations. Three kind of codes were used: descriptive, interpretative, and patterns (Miles and Huberman, 1994). Descriptive codes entail little interpretation and can be attributed to segments of the text in a straightforward way. Interpretative codes require more interpretation by the rater. Pattern codes are even more inferential and explanatory. They signal themes that account ".. for a lot of other data, make them intelligible, and function like a statistical 'factor', grouping disparate pieces into a more inclusive and meaningful whole" (Miles & Huberman, 1994, pg. 58). Furthermore, the system consisted of three types of categories, organised in three columns that were scored simultaneously. In the first column, the six main skills (or phases) of information problem solving were scored in an exclusive and exhaustive way. The six categories were: define the problem, search for information, scan for information, process the information, organize and present the information and evaluate the process and product. In the second column the categories representing the sub-skills were scored. Each main skill (or phase) was refined by several sub-skills that could only be scored during the main phase. For instance: the category 'defining the problem' consisted of: reading the task, explaining the problem, activating prior knowledge, determining the prerequisites, making notes. In the third column categories on the following topics were scored: regulation of the process, regulation of emotions, interventions and remarks of the session leader, and several pre-defined pattern codes. These categories could be scored independently of the scoring in both other columns. Regulation included: monitoring and steering of one's working process, orientation on the process, and testing of the results during the process. The first two pattern codes were related to the moment of deciding that the information was sufficient for completing the task. The first pattern indicated that a participant searched a lot of information first and decided *later on* that sufficient information had been found. The second pattern indicated that *after a short period* of searching, the student decided that sufficient information had been found. The next three pattern codes concerned the way people search the Internet. There were three possibilities: (a) *meandering:* starting from a list with results and surfing from site to site using hyperlinks; (b) *browsing subject categories/databases*: starting a search from a structured site and finding the information needed through refining; (c) *list link*: going to a site by a result overview of a content based search (search engine), returning to that overview and going to a new site, etc. The next three pattern codes were related to the search strategy used. Again there were three possibilities: (a) a *goal-oriented approach:* participants seek information in the context of a goal, hypothesis or question; (b) a *data-oriented approach:* participants identify broad subject areas, conduct a search and read information on a topic and formulate the goals, hypothesis or questions from the resources; (c) a *chaotic approach*, participants are lost and do not know where to search.

Design and Procedure

The participants were asked to come to the Multi-Media-Laboratory of the Open University of the Netherlands. At the beginning of each individual session the participant was instructed on the purpose and procedure of the session, and on what thinking aloud involved. They also read the task and could ask questions on the task (10 minutes). Once the session leader had left the room the participant had one and a half hours to complete the task. During this time the participant could use Internet to search for information and Microsoft Word to present the information. During the session the computer actions and the thinking aloud expressions of the participant were recorded on digital video. All Internet actions were logged on the computer. The session leader watched the participant through a one-way screen and could communicate with the participant by microphone. He or she mainly encouraged the participant to keep on thinking aloud and answered questions if there were any. All tapes were typed-out into protocols.

Data-analyses

Two trained raters scored the protocols and the video-registrations by using the coding system. In the first round four of the ten protocols were scored. The interrater reliability was calculated for these four protocols and the raters reached consensus on the statements they disagreed on. Next, the raters scored another two protocols in the second round. Again interrater reliability was calculated and consensus was reached. Only one rater scored the remaining four protocols. Table 1 gives an overview of the interrater reliability on the main skills and the regulation variables. Sub-skills variables have not been included, as these have not yet been analysed.

	Main skills		Regulation	
	P_a	Kappa	P_a	Kappa
First round	.72	.67	.35	.13
Second round	.76	.72	.54	.39

Pa = Percentage of agreement

Table 1. Interrater reliability on the main skills and on regulation

3 Results

The first question concerned the decomposition of the information problem solving skill. During the development of the coding-system and while analysing the protocols the (sub)skills emerged. Figure 1 gives an overview of the important (sub)skills.

	Analysis				Synthesis	
	define problem	**search information**	**scan information**	**process information**	**present information** (write)	**evaluate**
	concretize problem	internet skills - search strategies			formulate problem	process-evaluation
	activate prior knowledge	derive search terms	scan site (skimming)	read	outline product	product-evaluation
	prerequisites product	judge search results	judge scanned information	deep process of information	structure the product	
			think about the content	judge processed information	formulate text	
					think about content	
remaining	Regulation (monitoring / steering, orientation on task and time, test on content, etc.)					

Figure 1: Skill decomposition of the information problem solving skill

The next question concerned the extent to which novices and experts differed while using the (sub)skills. Figure 2 shows the time investment in the main component skills by the novices and the experts. The time investment in this figure is calculated as the time spent on the main component skills divided by the total time spent on the task.

The novices and the experts differed in the main skills: defining the problem, processing the information and presenting the information (writing the text). The data revealed that none of the participants evaluated the process or the product after completion of the task.

Another difference between the experts and the novices was the time they spent on completing the task. The average time spent by the experts was 91,7 minutes (*SD*=6,46). The average time spent by the novices was 71,6 minutes (*SD*=20,06).

Because the experts were expected to show more self-control in their information problem solving processes, the differences between the two groups on the regulation variables were calculated. The frequencies of all regulation variables were calculated and divided by the time on task.

Table 2 gives the frequencies of the regulation variables and the frequencies divided by the time of task per participant. Figure 3 shows the mean differences on regulation between the experts and the novices.

Finally the differences between the experts and the novices on search patterns were analysed. Figure 4, 5 and 6 give an overview of these.

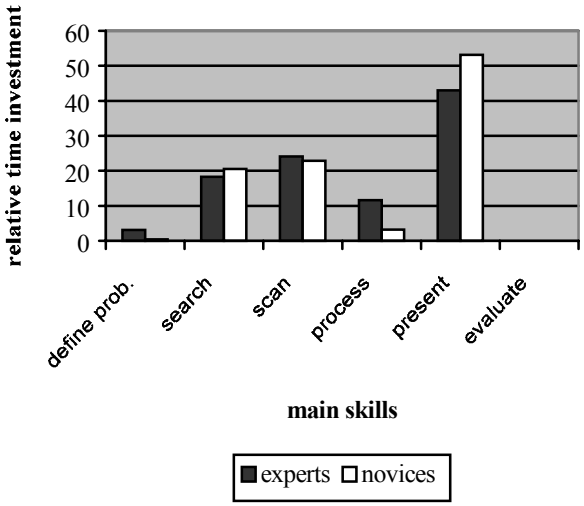

Figure 2. Differences in main skills between expert and novices in percentage of time

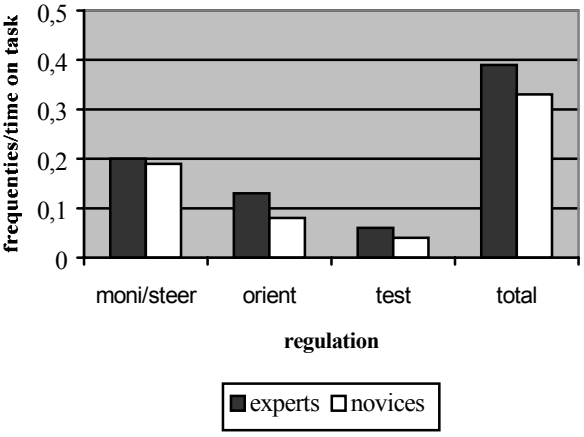

Figure 3. Differences between novices and expert on regulation

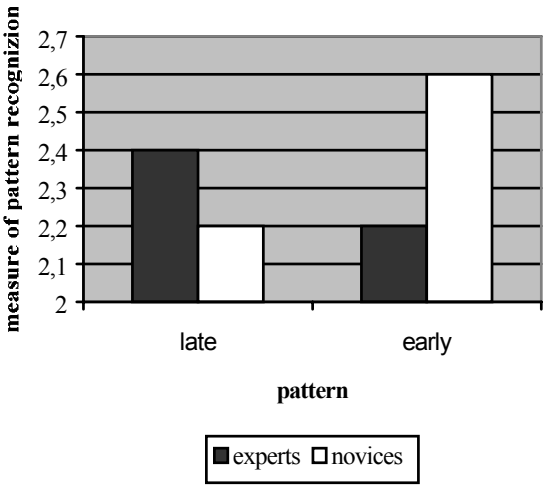

Figure 4. Moment of decision if information is sufficient

	Time on task	10.1.1.1	Frequencies Regulation		
	minutes	**moni-steer**	**orien**	**test**	**total**
Expert 1	95,5	12	9	2	23
Expert 2	91	27	13	7	47
Expert 3	83	15	6	8	29
Expert 4	89	12	9	5	26
Expert 5	100	26	21	6	53
Total Exp.	458,5	92	58	28	178
Novice 1	88	17	10	9	36
Novice 2	40	1	4	2	7
Novice 3	70	5	4	0	9
Novice 4	70	20	3	1	24
Novice 5	90	24	8	4	36
Total Nov.	358	67	29	16	112

	Time on task	**10.1.1.1.1**	**Frequencies Time on Task**		**Regulatio**
	minutes	**moni-steer**	**orient**	**test**	**total**
Expert 1	95,5	0,13	0,09	0,02	0,24
Expert 2	91	0,30	0,14	0,08	0,52
Expert 3	83	0,18	0,07	0,10	0,35
Expert 4	89	0,14	0,10	0,06	0,29
Expert 5	100	0,26	0,21	0,06	0,53
Total Exp.	458,5	M. 0,20	M. 0,13	M. 0,06	M. 0,39
Novice 1	88	0,19	0,11	0,01	0,41
Novice 2	40	0,03	0,01	0,05	0,18
Novice 3	70	0,07	0,06	0,00	0,13
Novice 4	70	0,29	0,04	0,01	0,34
Novice 5	90	0,27	0,09	0,04	0,40
Total Nov.	358	M. 0,19	M. 0,08	M. 0,04	M. 0,31

Table 2. The frequencies of the regulation variables and the frequencies divided by the time of task per participant

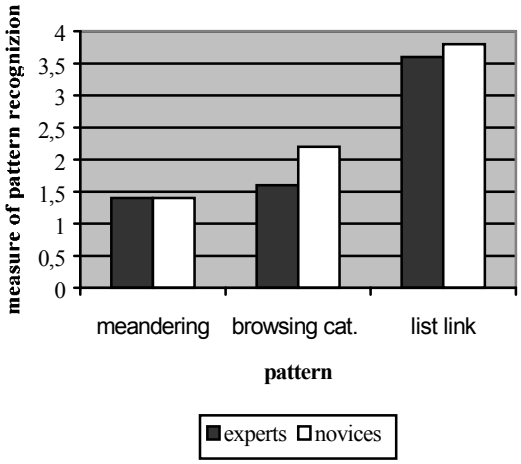

Figure 5. Way of searching the Internet

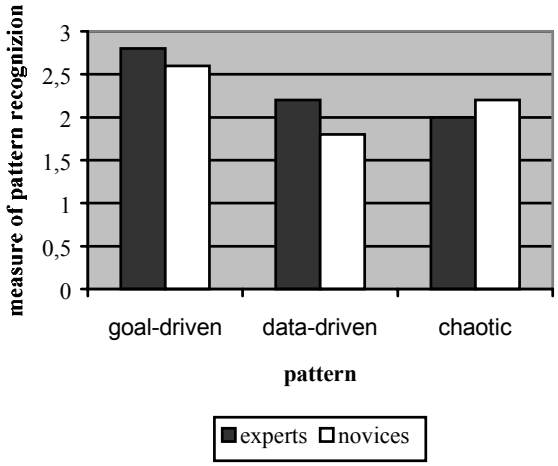

Figure 6. Used search strategy

Figure 3 shows that in general the experts regulated there process more often. It appears that the experts in general decided at a later stage which information was useful for completing the task (Figure 4), while the novices decided earlier on in the process which information would be used, and, consequently, started their writing-process earlier. The way experts and novices searched the Internet hardly differed: both groups mainly searched by using the list-link approach (Figure 5). Nor was there a marked difference in the search strategies used: as both mainly used the goal-driven approach. It is, however, striking how often the 'chaotic' strategy occurred.

4. Conclusion and discussion

The aim of this study was to come to a decomposition of the complex cognitive skill information problem solving by observing experts and novices while completing an information problem solving task. Another goal of this study was the comparison of experts to novices. Differences with respect to 1) time investment in the main component skills, 2) use of regulation activities and 3) the patterns concerning the moment of deciding if information is sufficient, the way the Internet is searched and the search strategies used.

From the theory and the data a skill decomposition was constructed which was largely compatible with the framework presented in the introduction. The categories 'select sources' and 'search and find' in the framework and the skills 'searching for information' and 'scanning information' differed, however. Searching for information included in our view the decision on which search-strategy was to be used, the process of searching itself, up to the judgement of the sources found. The stage of scanning the information started when a person skimmed the information in a source. In the original framework those stages were more interwoven.

The comparison between the experts and the novices has revealed that there are some differences between the two groups. Novices spend less time on defining the problem in the beginning of the process. Experts probably asked themselves more often: 'which information do I need to accomplish the task? What do I already know and what kind of information must I search for? The retrospective interviews, which were held after the participants accomplished the task – but which have not been analysed as yet – may provide more information on this.

In general the participants did not spend much time on processing the found information in depth. However, the experts took more time to study and process the information in a deeper way.

In general the participants invested a lot of time in organizing and presenting the information, c.q. in writing the argumentation. According to the skill decomposition this part of the process is the synthesis. Compared to the experts the novices spent more time on writing. This result is in line with the results on the patterns, which showed that novices generated less information and decided at an early stage whether the information was sufficient.

Neither the experts nor the novices evaluated the process and the product after completing the task. The fact that the participants skipped this part of the process may be due to the characteristics of the task. The task was not very complex, therefore, the participants may well have been able to form a clear picture of the quality of their product during completion of the task.

Experts regulated their information problem solving process more often than the novices. They showed more expression of monitoring and steering activities during the task performance, they oriented themselves more often on for example the task and tested the results more frequently during the process. It will be investigated in the near future whether this also resulted in better products. If this is indeed the case, this result will be in line with research of Hill (1999); Hill & Hannafin (1997), Land and Greene (2000), and Marchionini (1995). They found that students who regulated their information problem solving process more often were more effective and efficient in their way of working.

As shown by the results on the pattern codes, a difference was found with respect to the moment of deciding whether the information was sufficient. The experts decided at a later stage which information was sufficient for accomplishing the task while the novices decided this earlier on in the process. It is assumed that experts do have another conception of a task and probably set higher demands, which may well lead to a longer period of searching, because they are not satisfied until they have reached their goals. This may also be an explanation for the fact that the experts spent more time on completing the task.

The way experts and novices searched the Internet was the same. They all used the list-link approach most of the time. Neither did they differ in their use of the goal-driven, data-driven or chaotic approach. However, we did notice that on the whole the chaotic approach occurred more often than expected. The fact that no differences were found between the data- and goal-driven approaches may again be due to the characteristics of the task, which was quite open. For example, there were no restrictions on the content of the argument. Therefore, a combination of the data- and goal driven approach could be considered to be an appropriate approach for completing the task. While searching the Internet participants came up with interesting information and decided to use this information in their argumentation. This is in line with the data-driven approach. But participants also often used the information found for adjusting their preconceived plan.

The study described in this paper is part of a larger research. The following research questions will be addressed in the near feature. What do the information problem solving processes look like in depth? Once the analyses of the sub-categories of the main skills have been finalised we hope to gain a better insight into the use of the sub-skills. Another question is the relation between the way participants solved information problems and the quality of the arguments written. Are the expert argumentations of a better quality? Finally we will discuss the heuristic knowledge of the participants. This will be done by another close examination of to the protocols and particularly the retrospective interviews, which were conducted following completion of the tasks. Again the differences between the experts and the novices will be analysed.

After finalisation of the entire research guidelines for implementing instruction on information problem solving will be generated.

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References

Boekhorst, A.K. (2000). Informatievaardig worden in het onderwijs, een informatiewetenschappelijk perspectief: Een vergelijkende gevallenstudie in Nederland en Zuid-Afrika [Becoming information literate in education, an information science perspective: A comparative case study in The Netherlands and South Africa]. Unpublished dissertation. Retrieved January, 23, 2002, from http://www.hum.uva.nl/~albert/public/prom-akb-tot.PDF.

Dochy, F.J.R.C. (1993). De invloed van voorkennis op leerresultaten en het leerproces [The effect of prior knowledge on learning]. In W. Tomic & P. Span (Eds.), Onderwijspsychologie: Beïnvloeding, verloop en resultaten van leerprocessen (pp. 97-119). Utrecht, The Netherlands: Lemma.

Eisenberg, M.B. & R.E. Berkowitz (1990). Information problem-solving: The Big Skills approach to library and information skills instruction. Noorwood, NJ: Ablex.

Eisenberg, M.B. & R.E. Berkowitz (1992). Information problem-solving: The big six skills approach. School Library Media Activities Monthly, 8 (5), 27-29, 37, 42.

Hill, J.R. (1999). A conceptual framework for understanding information seeking in open-ended information services. Educational Technology Research & Development, 47(1), 5-27.

Hill, J.R. & M.J. Hannafin (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. Educational Technology Research and Development, 49(3), 37-52.

Kirschner, P., M.M.A. Valcke & P. Van Vilsteren (1997). Business game learning environment: Design and development of a competency-based distance educational business curriculum at the Open Universiteit. Distance Education, 18(1), 153-177.

Land, S.M. & B.A. Greene (2000). Project-based learning with the World Wide Web: A qualitative study of resource integration. Educational Technology Research & Development, 48(1), 45-68.

Macdonald, J., N. Heap & N. Mason (2001). "Have I learnt it?": Evaluating skills for resource-based study using electronic resources. British Journal of Educational Technology, 32, 419-433.

Marchionini, G. (1995). Information-seeking in electronic environments. New York: Cambridge University.

Marchionini, G. (1999). Educating responsible citizens in the information society. Educational Technology, 39(2), 17-26.

McKenzie, J. (1994). Grazing the net: Raising a generation of free range students – part one. From Now On, The Educational Technology Journal. Retrieved July 3, 2002, from http://www.fno.org/grazing1.html.

Miles, M.B. & A.M. Huberman (1994). Qualitative data analyses: An expanded sourcebook (2nd ed.). Thousend Oaks, CA: Sage.

Moore, P. (1995). Information problem solving : a wider view of library skills. Contemporary Educational Psychology, 20, 1-31.

Reigeluth, C. M. (1999). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.), Instructional-design theories and models (Vol. 2): A new paradigm of instructional theory (pp. 5-29). Mahwah, NJ: Lawrence Erlbaum Associates.

Savery, J.R. & T..M. Duffy (1995). Problem based learning: An instructional model and its constructivist framework. Educational Technology, 35(5), 31-38.

Spitzer, K.L., M. Eisenberg, & C.A. Lowe (1998). Information literacy: Essential skills for the information age. Syracuse, NY: ERIC Clearinghouse on Information and Technology.

Van Merriënboer, J.J.G. (1997). Training complex cognitive skills. Englewood Cliffs, NJ.: Educational Technology.

Vermunt, J.D. (1995). Process-oriented instruction in learning and thinking strategies. European Journal of Psychology of Education, 10, 325-349.

Wilson, T.D. (1999). Models in information behaviour research. Journal of Documentation, 55(3), 249-270.

11 Motivating Students towards Online Learning: Institutional Strategies and Imperatives

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Abstract

This paper examines the issue of motivation as it applies to online learning. It argues that whilst institutions are currently focussing much effort on the integration and embedding of virtual learning environments, the student perspective is receiving very little attention. Institutional strategies include adopting training and support for academic staff in developing online learning, support for institutional structures to enable the integration of systems and the sharing of good practice and expertise. However, there is very little evidence that institutions are giving enough consideration to the student perspective and in particular the issues of motivation and engagement. The paper begins by examining the characteristics of good motivation and learning approaches that can be characterised as 'open' and 'closed' approaches to learning. It then examines Keller's (1983) instructional design model for student motivation and his four components that contribute to motivation: arousing interest, creating relevance, developing an expectancy of success, and providing extrinsic/intrinsic rewards. The paper then provides key findings from the evaluation studies to illustrate specific instances of how the nature of the learning environment affected motivation either beneficially or detrimentally. The paper concludes with a set of suggested strategies for optimising levels of student motivation towards virtual or online learning in order to ensure that the organisational investment in new approaches to learning will be repaid through high levels of student participation and effective learning. These conclude that virtual learning needs to provide opportunities not available elsewhere; that tangible extrinsic motivators need to built in; that learners must have clear expectations in a virtual environment; specific guidance is needed to exploit opportunities and the level of threat must be managed through support and peer group induction. The paper ends by outlining future work to be undertaken in this area to exploit the ideas further.

Keywords: Virtual Learning Motivation

1. Introduction

The potential of virtual and managed learning environments (VLEs, MLEs) to support new ways of learning and increasingly diverse students is widely recognised and anticipated. The explosive uptake of VLEs at UK higher education institutions over the past few years reflects the drive from governments and institutions to exploit the full potential of these new technologies. A recent UCISA survey (Armitage et al, 2001) reported a 13% uptake of VLEs in 1997 compared to an 81% uptake by 2001. Another more recent survey (Stiles, 2002) of 127 HE/FE institutions found that the vast majority of institutions have selected VLEs for one reason above all others: *'ease of use by staff'*. The UCISA survey substantiates this finding 'the focus of the impact of VLEs on institutions is on *staff* rather than *students*' and concludes that 'VLEs are widely recognised as an important component of an institutional strategy yet is poorly matched by delivery' and 'mature support mechanisms have (…) yet to be comprehensively developed across the sector'.

Clearly, institutions in the UK and throughout Europe are focussed on the key question "How can we make virtual learning work?" Institutional strategies already include training and support for academic staff in developing online learning, support for institutional structures to enable the integration of systems and the sharing of good practice and expertise. However, there is very little evidence that institutions are giving enough consideration to the student perspective. Online learning offers more flexibility and choice to students including the ability to opt out as well as opt in. We therefore need to consider what will make students want to engage with this new form of learning. There appears to be an assumption at present that students will automatically be motivated or alternatively that coercion is a satisfactory. means of ensuring engagement and therefore effective learning.

In this paper we examine the issue of motivation and the highlight the critical factors which emerge for those in institutions who are implementing and designing virtual learning to ensure that students will engage and become effective learners. We begin by considering some theories of motivation in learning in order to understand how motivation might affect the learner. In particular we examine the work of John Keller in developing a model of motivation specifically for instructional design. Findings from two evaluation studies previously undertaken by the authors will be presented to demonstrate some motivational issues students have encountered. We then consider some of the unique characteristics of online learning in order to apply these theories and develop our own understanding of the motivational context for online learning. Finally we present some strategies resulting from this work which can be

adopted by both educational designers and those involved in implementing online learning across their institutions.

2. Theories of motivation in learning

2.1. 'Open' and 'closed' learning

In this section, we consider some theories of motivation in learning which resonate with the concerns and approaches that are particular to online learning. Achievement Goal Theory is a recent development of the goal theory tradition (Ames 1992, Dweck 1986, Urdan 1997, Urdan & Maehr 1995, cited in Covington, 2000). Two kinds of goals are identified – learning goals and performance goals. Learning goals aim to increase competency, understanding and appreciation for what is being learned. Performance goals involve outperforming others as a means to increase status.

The hypothesis put forward by the achievement goal theorists is that learning goals support deep level, strategic-processing of information, whereas performance goals encourage superficial rote level processing which has a stultifying influence on achievement. Covington (2000) also states that learning goal oriented students exhibit "cognitive self regulation", that is being actively engaged in one's own learning. This active engagement in one's own learning has been shown to assist students in monitoring their understanding of what is being learned (Meece & Holt 1993; Middleton & Midgley 1997, Archer 1994, cited in Covington, 2000).

Viewing the same distinction from a psychoanalytic point of view, Bion (cited in Waddell, 1998) describes two possible orientations towards learning originating in the individual's infantile experience of how uncertainty and anxiety was managed for the child and mediated by the carer(s). "K linked" learners are motivated by curiosity about their environment, and derive satisfaction from learning about it, able to manage anxiety about errors and the unknown, to apply learning creatively and to integrate it into the whole personality. In contrast, "-K linked" learners learn about the environment in order to control it and thus reduce the level of unmanageable anxiety. Learning is defensive, treats knowledge as a commodity to be possessed, and tends to be narrowly intellectual.

Although there are differences in perspective and emphasis, these theories all seem to have at their heart the same basic distinction, between learning that has either an "open" or a "closed" orientation, as shown in Table 1.

Covington (1992) in his self-worth theory suggests that the perception of an individual's own ability dominates his/her willingness to learn. As a result he advocates non-competitive learning structures, such as mastery learning, co-operative learning and contract learning (e.g. individual goal setting) in addition to rewards.

A premise of this paper is that in designing online learning, we should aim to engage the learner in an "open" learning orientation in order to encourage personally driven motivation.

Orientation	
"Open"	"Closed"
Learning goal	Performance goal
K learning	-K learning
High self-worth	Low self-worth
Characteristics	
Exploratory	Controlling
Collaborative	Competitive
Motivated by curiosity	Motivated by anxiety
Embraces failure	Defends against failure
Creative	Mechanical
Fluid	Rigid
Self-motivated	Externally motivated
Whole person involved	Mind alone involved

Table 1: Orientation and characteristics of learners

2.2. Motivation and instructional design

Keller (1979) argues that motivation is the "neglected heart" of our understanding of instructional design. Historically this has always drawn upon how people learn but not why.

As part of his theoretical work on motivation, performance and instructional influence which examines cognitive and environmental variables and how they relate to effort, performance and consequences, Keller developed a macro model to demonstrate the different influences that learning designers need to understand and control. Keller's related model (1983) demonstrates the different motivational strategies that can be employed within instructional design: interest, relevance, expectancy of success and developing satisfaction (see Figure 2).

Keller maintains that by arousing and sustaining interest, we can ensure that the learner is engaged. However, this must not be too risky. Keller (1978) has shown that people need to feel comfortable about the consequences of taking risks before they will exercise curiosity.

By creating relevance, Keller suggests that the learning must "connect to important needs and motives" and that unless the learner perceives that these personal needs can be met, they will not be sufficiently motivated. These include the need to develop trust and affiliation and opportunities for no-risk, co-operative interaction. Salmon (2000) also emphasises this need to minimise risk when beginning to work online and her

5 stage model for online tutoring provides opportunities for "safe" interaction.

Developing an expectancy of success is described by Keller as one of the most difficult strategies to implement although in fact this is probably one of the best developed categories within online learning environments. Keller describes strategies to increase experience of success, ensure the requirements for success are understood, personal control is available and expectancy of success is increased by providing feedback and other devices to connect success to personal effort.

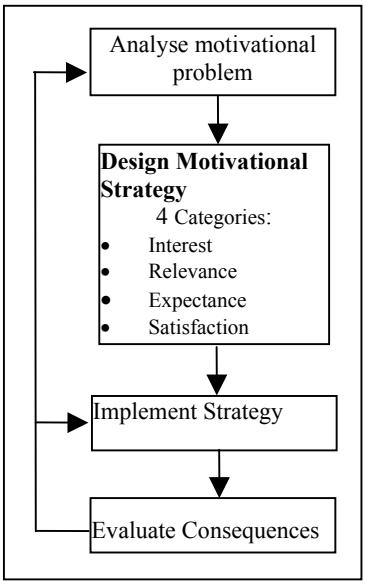

Figure2: A model of designing motivation instruction

Satisfaction, the final category in Keller's model concerns strategies that increase both intrinsic and extrinsic rewards. Keller describes the difficulties of balancing these two, the danger that one may outweigh the other and the need to manage them carefully.

Keller provides some useful guidance in thinking about motivation in the design of learning, however, he focuses on the instructional material rather than the context in which the learning takes place. When working online, the context is much less controlled than in face to face situations and is likely to be a more critical factor. We will return to this later in this paper when considering motivational strategies for online learning.

3. Evaluation findings

In order to investigate the relevance of Keller's model and the 'open and closed' orientations, two evaluation studies, previously undertaken by the authors, were re-examined to look more closely at the motivational aspects of the findings. The two studies represent the two main ways of implementing online learning, namely for campus-based students and distance learning students. The studies were a TLTP funded project for the Pharmacy Consortium for Computer Aided Learning (PCCAL) and Repromed, an NHS funded evaluation of an Internet based course in Reproductive Medicine. Each of these studies will be briefly introduced, relevant findings will be presented and where appropriate, link these to motivational strategies and theories discussed earlier.

3.1. PCCAL study

The evaluation (Timmis et al, 1998) consisted of 11 separate case studies involving whole year groups of undergraduate pharmacy students at five UK universities and a total of 854 participants. It investigated the effectiveness of courseware modules produced by the consortium and their impact on student learning. There was also a strong emphasis on evaluating different methods of implementing and embedding the material. An illuminative and integrative methodology (Parlett & Hamilton, 1977, Draper et al, 1995) was adopted, using a range of methods including pre and post-tests, classroom observation, questionnaires and focus groups.

The evaluation found that students frequently lacked appropriate learning strategies to help them get the most out of a task. In almost all the studies, it was found that students suffered from a lack of guidance and many of them worked through material sequentially even when they were already familiar with it or undertaking revision. Often they did not progress to the material that was of most use, as these quotes show:

"*Today I started at the beginning and worked my way through but (...) it would have been the third section that would have benefited me the most but I didn't get round to it*"

"We should be told which bits we're concentrating on"

These students' remarks display a measure of anxiety and caution over how to approach their learning and needed more encouragement to adopt a more exploratory, "open" orientation.

Similarly, in observing students in the classroom, it was found that note-taking was influenced by both the tutor's input and by group behaviour. Students appeared to be highly suggestible and either everyone took notes or little or none was observed throughout a session. Furthermore, collaboration and discussion between students was only observed where this had been organised and directed by the tutor, despite the fact that student views supported this approach:

"I think that's helpful (...) working with someone else, sometimes you can understand it better. Whereas in a lecture you can't do that 'cause you can't talk"

Keller suggests increasing the expectancy of success by using instructional-design strategies that indicate the requirements for success and by using techniques that offer personal control over success. We would argue that if these students had been given more guidance on explorative learning

strategies and working co-operatively, their motivation and personal success would have been enhanced.

In one case study, students were asked to study in their own time. This was found to have a direct effect on their willingness to learn and overall success. Students were given four weeks to study the package for revision purposes, shortly before exams. The findings were very striking as large numbers of students did not study the package at all. Those that did (only 28 out of 110) spent little time studying and felt very strongly that it had not been scheduled at an appropriate time and the material was too easy.

"We're very pressed for time and it wasn't a difficult area to understand"

"Anything relevant was very easy"

Keller recommends that "to arouse or maintain curiosity, give people the opportunity to learn things they already know about (…) but also give them moderate doses of the unfamiliar and unexpected".

Furthermore, the same students also felt that the task offered little extrinsic motivation.

"If it was part of the syllabus, I think we'd feel more otivated(…) So I didn't really feel like spending much time on it."

As already mentioned Keller is concerned that extrinsic reinforcement will decrease intrinsic motivation and that this may encourage a more closed approach to learning. However, these students could not connect the task to personal needs and motives so both kinds of motivation were absent.

3.2. ReproMED

This evaluation (Jenkins et al, 2001) was of a course in Reproductive Medicine delivered over the Internet to 18 specialist registrars in Obstetrics and Gynaecology. It consisted of 5 monthly case studies, each illustrating a major aspect of the subject. The text of the case study was presented along with questions to which the participants were expected to respond electronically. Evaluation was by interview, questionnaire and logs of server activity.

The evaluation found that active participation was very low - only 5 of the 18 registrars posted responses with any regularity. A key reason for this may be that participants were wary of losing face in front of their peers and superiors, exacerbated by the public, written and therefore fixed nature of online text communication. As one participant commented:

"You think, my God, they're going to find out I don't know anything".

In Covington's terms, participants clearly experienced a threat to their sense of self-worth. According to Keller's model, the course did not seem "to satisfy the need for affiliation, establish trust and provide opportunities for no-risk, co-operative interaction".

Not only were the postings few in number, but their style was very formalised, comprehensive and careful. Very few answers were tentative, exploratory or polemical, and this seemed to discourage follow-up comments and discussion. Some participants expressed disappointment with these "exam-type" answers, and the tutors commented that they'd hoped for more discussion. It may be that the unfamiliar format and medium meant that participants did not know what kind of responses were expected and so fell back on what they knew and assumed would be acceptable. The format seemed to engage Bion's -K learning, participants seemed to adopt a defensive approach rather than a more exploratory one. Participants appeared to interpret the task in performance goal terms and felt they were expected to produce a perfect finished product. Keller suggests that educators should "increase expectancy for success by using instructional design strategies that indicate the requirements for success". Perhaps participants felt demotivated and discouraged from participating creatively because they were unsure of what these requirements were. A third relevant finding was that participants who took the most active part were generally those who a) had an intrinsic interest in the subject and crucially b) did not have that interest satisfied by another means. One participant was planning to specialise in Reproductive Medicine, but felt no need to take an active part in the course because he was in regular face-to-face contact with the course tutors. His intrinsic interest in the subject did not translate into intrinsic motivation to follow an online course, whereas another participant who was very active was located over 100 miles away.

Some participants commented that an extrinsic motivator, such a certificate for following the course, might have been effective. However Keller comments that external inducements can have a detrimental affect on intrinsic motivation, which "decreases as the perceived locus of control shifts from internal to external". Nevertheless much learning in higher education is driven by extrinsic factors, largely assessments and examinations, even though these all seem to encourage a performance goal orientation and to discourage exploratory, risk-taking learning.

Both of the evaluation studies provided examples of where the instructional design or management failed to enhance, or even had a detrimental effect upon learner motivation. Keller's model of motivational design, as well as Goal theory, self-worth theory and K/-K theory can contribute to our understanding of how and why this may have happened.

4. Characteristics of online learning

We will now consider some of the characteristics of online learning in order to help clarify the role of motivation and the motivational context for this new form of learning.

Goodyear (in Steeples and Jones, 2002) suggests that one of the unique aspects of networked or online learning is that it is inherently social. "Part of the point of encouraging online communications within a learning group (or 'learning

community') is to capitalise on some of the social aspects of learning" (page 51). However, Goodyear also makes the point that we cannot expect learners to be totally compliant no matter how good the pedagogy and educational design. Building a learning community needs commitment from participants, as it is they who will create the community.

A second area to consider is the tasks and activities students are asked to undertake. Spector (in Steeples and Jones, 2002) talks of networked learning as "blurring the distinction between learning and working" (page xvi). This idea is similar to that developed by Goodyear, (in Steeples and Jones, 2002). He uses the term 'working knowledge' to represent active and dynamic knowledge, implying that the learner exercises a degree of improvisation and acts at the edge of their knowledge. This suggests that online learners construct and co-construct knowledge in a proactive, explorative way, resonant of the "open" orientation to learning we introduced earlier in this paper. This kind of learning requires different levels of support and implies a new role for tutors, already well documented by Salmon (2000) with her five stage model for "e-moderating" online.

A third characteristic of online learning is its flexibility of time and place. The fact that students and tutors do not need to meet together in order to communicate has frequently been highlighted as one of the positive aspects of this form of learning. Certainly it features heavily in literature provided by commercial suppliers: " …a personal information source with the most recent and relevant information 24 hours a day." (Blackboard, 2001) Nevertheless, this "open all hours" approach brings its own challenges. Richardson & Turner (2000) and Jones (2000) both highlight the need for effective time management in relation to students' successful use of virtual or networked learning. Furthermore, the flexibility provided by the "any time, any place" medium also means that there is little control over what the student actually does. As Jones (2000) observes in a study of student experiences with networked learning: "The students made selective use of the network technology provided, moved outside its framework and used a variety of other means to achieve their objectives."

5. Motivational strategies for online learning

The following motivational strategies draw together our conclusions. They address the specific needs of online learning and are designed to complement Keller's strategies for motivational design of learning.

Virtual learning needs to provide learning opportunities that are not available elsewhere

Whilst there is plenty of evidence to show that students are strongly supportive of learning technologies (e.g. Laurillard, 1994) and virtual learning environments (e.g. Richardson & Turner, 2000), the Repromed study suggests that virtual learning can be perceived by learners as inferior compared with face to face contact except when learning at a distance. Richardson & Turner (2000) also found a similar response amongst campus-based students who saw virtual learning environments as supporting rather than replacing direct contact and who wanted to feel part of a physical group. It should therefore not be assumed for example that in an on-campus setting, learners will be automatically motivated to hold peer to peer discussions online. This does not necessarily mean however that learners will only be motivated to use virtual learning in a distance learning context. Virtual learning does offer its own unique learning opportunities, but these need to be carefully designed to ensure all students have a need to engage.

Tangible extrinsic motivators should be built in to virtual learning

Ideally instructional design should aim to maximise learners' intrinsic motivation, as this is believed to be more powerful than extrinsic motivation, and leads to deeper and longer lasting learning. Moreover, as Keller states, working towards extrinsic goals can shift the perceived locus of control from internal to external, and remove much of the inherent pleasure in learning. However, the current reality is that higher education is largely exam driven and learners are motivated to study what will help them achieve their immediate extrinsic goals.

It must be clear to learners what is expected of them in the virtual learning environment

Learners will be motivated to make use of virtual learning opportunities if they have a relatively high expectation of being able to use them successfully. This will come in part from previous experience of success. In order to maximise their success; learners need to be given strategies that will give them confidence that they can use the environment appropriately. In terms of online communication, this can be done by training learners to use online communications tools in a gradual, structured way progressing from simple factual communication to more sophisticated discussion (Salmon 2000). In terms of using resources such as CAL simulations and tutorials, learners need to be given strategies that will enable them to approach the materials knowing what they want to get out of it and how.

Learners need guidance in how to make the most of the online environment within specific learning contexts

There is a danger that virtual learning will be used as an add-on resource or support or alternatively a universal approach may be adopted with a "one size fits all" philosophy. Laurillard (1994) emphasises that the learning context is critical to whether learning technologies are successful. Our studies indicate that the way in which materials and learning episodes are introduced can have a far-reaching impact on the motivation of the learners and subsequently the success of the learning undertaken. They show that without clear guidance, students will not automatically collaborate with each other, approach the material selectively or even take notes. A similar view is suggested by McConnell (2000, p 72) when

talking about developing online learning communities he states that "working with others in online environments is so unusual that we may have to approach it as if it is a completely new experience. Relying on well born strategies, and working from common assumptions about how groups work in face to face environments, is not always the best orientation to take". Virtual learning needs more, not less introductory and contextual guidance, together with ongoing support and active tutor involvement.

The level of threat must be managed through support, gradual induction and peer group working

McConnell (2000) states that co-operative learning involves learning in public and that not everyone is able to deal with this challenge. According to Keller, instructional design needs to take into account people's need for affiliation with and influence over others, and should therefore offer a no-risk environment where this is possible. It might be argued that the relative anonymity and lack of status signals available with virtual learning helps to reduce risk. However it also offers the learner far less feedback than a face to face situation about how his/her contributions are being received. Strategies such as having people meeting face to face or even by videoconferencing before interacting online can help to overcome this. Working in small groups in separate areas away from the evaluative purview of the tutor may also help.

6. Conclusions

In this paper, we have explored the way in which motivation in online learning can be understood and optimised. We have identified some specific strategies for designers and tutors to build upon to ensure that motivation is not assumed but planned for and that the "neglected heart" that Keller refers to will become an essential element in the design of online curricular. Future work in this area will focus on developing a model of the motivational aspects of virtual learning by further exploring what is unique about this new form of learning and how this will impact on motivation. Observing and talking to students about their experiences will also help to inform and develop this new area of understanding and allow us to develop practical as well as theoretical tools to support this.

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References

Armitage, S, Brown, T, Jenkins, M: (2001) Management and implementation of Virtual Learning Environments: A UCISA funded survey, available at http://www.ucisa.ac.uk/TLIG/vle/welcome.htm

Blackboard Inc. (2001) Brochure on Blackboard 5. http://www.blackboard.com

Covington, M.V. (2000). Goal theory, motivation, and school achievement: an integrative review. *Annual Review. Psychology*. 51: pp.171–200

Covington, M.V. (1992). *Making the Grade: A Self-Worth Perspective on Motivation and School Reform*. New York: Cambridge Univ. Press

Draper, S.W., Henderson,F.P., Brown,M.I., & McAteer,E. (1996) 'Integrative evaluation: an emerging role for classroom studies of CAL' *Computers and Education* 26 (1-3): pp. 17-32

Jenkins, J.M., Cook, J., Edwards, J., Draycott, T., Cahill, D.J. (2001) Medical education with the Internet: a pilot training programme in reproductive medicine. *British Journal of Obstetrics and Gynaecology*, 108: pp.114-116

Jones, C.R. (2000) Understanding students' experiences of collaborative networked learning. In Asensio, M., Foster, J, Hodgson, V. & McConnell, D. (Eds) Networked learning 2000: innovative approaches to lifelong learning and higher education through the internet. Proceedings of the Second International Conference. Sheffield: http://collaborate.shef.ac.uk/nlpapers/C.R.Jones1.htm

Keller, J.M (1983). *'Motivational design of instruction'*. In Reigeluth, C (ed.), Instructional Design Theories and Models. Hillsdale, NJ: Erlbaum.

Keller, J.M (1978) 'Motivation and Instructional Design. A theoretical perspective.' *Journal of Instructional Development*, 2(4): pp.26-34

Laurillard, D. (1994) 'How Can Learning Technologies Improve Learning?' *Law Technology Journal*, Vol 3, No 2. http://www.warwick.ac.uk/ltj/3-2j.html

McConnell, D.(2000*) 'Implementing Computer Supported Co-operative Learning'* , London Kogan Page

Parlett, M & Hamilton,D (1977) *'Evaluation as Illumination'* in Parlett, M & Dearden, G. (eds) Introduction to Illuminative Evaluation: Studies in Higher Education Pacific Soundings

Richardson, J.A. & Turner, A. (2000) 'A large scale 'local' evaluation of student' learning experiences using virtual learning environments.' *Educational Technology &Society* 3 (4)

Salmon, G (2000) *'E-Moderating: The Key to Teaching and Learning Online.'* London Kogan Page,

Steeples, C. Jones, C.(eds) (2002) *'Networked Learning: perspectives and issues.'* London Springer-Verlag,

Stiles, M. (2002) Staying on track: why are we using technology in teaching? *JISC Inform*, Spring 2002.

Timmis, S., Brown, K.N., Gilbert, M.J., Gifford, L., John, D.N., Lloyd, A., Moss, S.H., Mottram, D.R., Redfern, P., Rostron, C., Stevens R.G. (1998) *'Student Learning Using CAL. Case studies in the evaluation of the PCCAL consortium'*, Bath, Commercial and Academic Services (CoAcs) - http://www.coacs.com/PCCAL/

Waddell, M (1998) *'Inside Lives: Psychoanalysis and the Growth of the Personality.'* London Duckworth

12 The Conflict between Constructivist and Prescriptive Learning in a Virtual Learn-Work Environment

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Abstract

The endeavour of the Virtual Business learning concept of OTO developed at the Open University of the Netherlands, is the implementation of a new type of open learning arrangements, meeting the learning needs of today's bachelor students at the School of Informatics. OTO is the virtual learn-work environment for a course 'Design Project'. The constructivist and prescriptive learning elements in OTO lead to conflict situations, which in our opinion are fruitful for competence based education (CBE).

OTO is the acronym for "Ontwerp Transfer Open Universiteit Nederland" (www.ou.nl/open/otonet).

Keywords: collaborative learning, constructivism, critical transformative room, virtual business learning.

1. Introduction

The Open University of the Netherlands (OUNL) is an independent government-funded institution for higher distance education. Its primary objective is to develop open academic education accessible to anyone with necessary attitudes and interests, regardless of formal qualifications. The OUNL explicitly strives to encourage innovation in higher education. Innovation addresses all dimensions from instructional design to implementation: curricula, teaching methods, electronic mediation, etc. Distinctive for the OUNL's education is guided competency based self-study and teamwork, curricula with minimal pacing and time constraints, plus an orientation towards more cost effective forms of higher education.

At the School of Informatics 70% BA or MA students, already have other degrees and are in paid employment. They want to acquire additional know-how or retrain for a different occupation. Hence they appreciate the freedom of choice, time and place and the possibility to proceed at their own pace. A lot of courses at the School of Informatics are still based on distance self-study. The didactical means are mostly printed course material, CDs, books and readers, supplemented with tutor meetings in the study centres. The course testing is an automated assessment or an open-end assessment at the study centres. Each course is represented in the Study Net. Some courses have there an electronic course book, newsgroup and discussion group. Although, the web is mostly used as a source for study relevant information, the use of the potential of the web for interaction between students and staff is growing. The web is a good alternative for overcoming the geographical distances between students and tutors and creates an awareness of an interaction world of study. The OUNL has moved towards a more demand-oriented approach to education. Students ask for more personalisation; a request, which is expected to grow with the tendency towards life long learning and the resulting heterogeneity of future student population. On the other hand the ICT-industries and enterprises call for more team oriented competencies. The need for organizational competence will increase, too. They are looking for 'social-able' employees, with up-to-date domain expertise, proficient communicators, creative problem solvers and above all flexible team workers. Individuals working in teams, within or across companies will have to acquire versatile abilities, a combination of hard and soft skills to participate in a working life based on 'knowledge productivity'. A concept in which Kessels relates the required broad professional skills (competencies) of professionals, to generic learning abilities. Kessels defines knowledge productivity as the ability to signal relevant

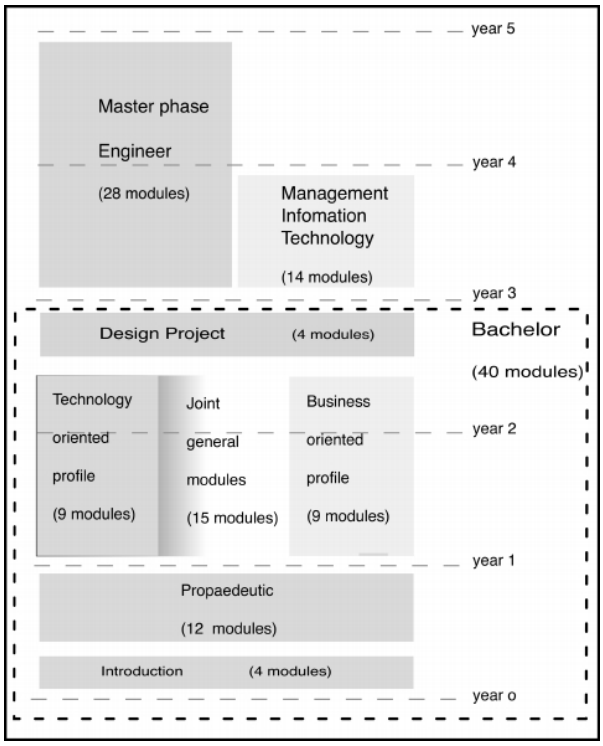

Figure 1: Curriculum of the School of Informatics

information, create new knowledge and apply this knowledge to step by step improvement and radical innovation of working processes, products and services (Kessels 1998, 2001). Knowledge construction in organizations is crucial for the continuous improvement of existing products and services and the development of new ones. Ongoing transformations in our society require from professionals to add value to their enterprise through creative use of available expertise. At the same time a pro-active learning attitude integrating new experiences for the person's knowledge productivity, is expected (Kessels 2001). Software systems have to satisfy the requirements of professional communities whose cultures of practices differ. Simultaneously integration with existing and future systems and components is required. 'Knowledge-ability', and versatile social-ability are crucial to today's competent professional behaviour. As an ICT-professional you need to learn focussing on users, consumers, clients as co-developers of an ICT-product: "(...) *Different relevant social groups have their specific kinds of expertise – we are all experts in specific ways. (...) more is involved in designing large projects (...) than is described in the engineers' handbooks. And for those other aspects, others are experts and need to be involved. (...) The interactions within and among relevant social groups can give different meanings to the same (technical artefacts*)." (Bijker 1996)

However students in distance education have the feeling that their wish to study with individual pace and the team oriented study approach are in conflict. They think that communication, coordination and cooperation tasks are just time consuming and not effective for the individual learning process. As 'knowledge-ability', the power to learn to create new solutions and situated competent behaviour become thriving forces in our economies, the educational debate intensifies on how to meet future professionals learning needs adequately (Drucker 1993, Castells 1998, Bolhuis 1999, Brown 2000). Issues as the transfer of students' learning experiences in academia to subsequent professional practice are crucial. The same holds for the debate regarding instructional guidance for competency growth on-the-job on multiple dimensions. Traditional training approaches strong in predefined transfer of domain expertise and skills in well-defined and prestructured instructional settings will not suffice.

How can distance education adequately prepare students for professional practice? How do we facilitate learning at work and a more team-oriented approach? (Tobias 2000). Education has to provide concurrent domain specific competency growth, supportive social competencies applicable to ill-defined problems in rapidly changing contexts. For professional life the facilitation of competency growth including today's key-competence: the learning ability will become predominant over the traditional learning processes embodied in traditional formal training structures. Responding to these demands a transformation of the content and the learning dimension of the Informatics curriculum is necessary. Therefore the School of Informatics is in the process of restructuring its education offers towards a competence based curriculum. A first innovation step was to position a course of 400 hours of study 'Design Project' at the end of the bachelor degree, imbedded in a Virtual Business learn-work environment OTO builds on notions of social constructivism, critical transformative interactions, situated and experienced based learning (Bolhuis 1999, Crutzen 2000a, Feltovich 1997, Kirschner 2001, Westera 2000). Within this context the web can facilitate 'interaction' and 'presence' between students and tutors. Since a major objective of the CBE curriculum is an ameliorated fit of academic education and the labour market: by preventing or reducing qualitative discrepancies. Hence learning by doing through immersion in the authentic setting of future professional practice might prove to be a successful answer.

2. Interaction, intertwining use and design

2.1. Interaction and competency

Interaction is an exchange of representations between actors; an ongoing process of mutual actions from several actors in series of situations. All acting of an actor is a representation of itself in a world of other actors and at the same time an interpretation of that world. Human actors are 'travellers' gathering many experiences, and connecting these to the ongoing interactions. Wherever there is interaction there is also continuity, a continuity of experiences, which function as representations of interactions in the past. Sloterdijk calls this travelling 'horizontal movements' and sees it orthogonal to the 'vertical movement' of thrownness[1]. Thrownness is the necessity of acting in situations without the time or ability to grasp the full consequences of actions or plans in advance (Mallery 1987, Heidegger's Ontological Hermeneutics). Designing[2] a future out of the actor's thrownness in the world of the actual interaction are fusions of experiences, expectations and fantasy. Through these fusions, actors give meaning to the actual exchange of representations. Making use of experiences is giving a situated and actual meaning to these representations in the current interaction. To develop the capacity to intertwine use and design in the actual situation is learning and growing in competency. It is the ability to operate effectively in ill-defined and ever changing environments where participants apply knowledge, skills and attitudes adequately to the task situation at hand.

2.2. Interaction worlds, habits and routines, change and doubt

Repeated presentations and interpretations of actions create interaction worlds, spheres of discourses. In such worlds of interaction the potential of all meaning constructing processes that may emerge, depends on the participating actors and the exchanged and ready-made representations. This potential will determine the learning possibilities of the individual actors. Through learning in interaction worlds actors develop habits and routines. In the way actors and the world encounter each other they reveal themselves. According to

Dewey acquiring habits out of experiences is the power to develop dispositions, to cope with difficulties of a later situation to represent an acquaintance with the world of actors, materials and equipment to which action is applied. Routines however are repeated and established acting; frozen habits, which are executed without thinking. Most routine acting can be qualified as obvious and therefore invisible for all actors in their world of interaction: *"Routine habits (...) put an end to plasticity. They mark the close of power to vary."* In interaction worlds with only routine acting there is no room for learning. Dewey thinks that most people need to act out of a combination of routine and habits but *"(...) change is always with us as a part of our being and demands the constant remaking of old habits and old ways of thinking, desiring and acting (...) but the effective ratio between the old and the stabilizing is very different at different times*" (Dewey 1916, Chapter 4: Education as Growth, Ratner 1938 p.451). Although through the continuity of developing habits the potential of changed behaviour and sensitivity to situations will remain. For change of meaning and acting, according to Pierce and Dewey, doubting as critical thinking is necessary[3]*:"But everything which is assumed without question, which is taken for granted in our intercourse with one another and nature is what, at the given time, is called knowledge. Thinking on the contrary, starts, (...), from doubt or uncertainty. It marks an inquiring, hunting, searching attitude, instead of one of mastery and possession. Through its critical process true knowledge is revised and extended, and our convictions as to the state of things reorganized."* "*Our beliefs guide our desires and shape our actions. (...) Belief does not make us act at once, but puts us into such a condition that we shall behave in some certain way, when the occasion arises. Doubt has not the least such active effect, but stimulates us to inquiry until it is destroyed."* (Dewey 1916, Chapter 22, The Individual and the World, Peirce 1877).

Doubt is always situated in the interaction and occurs not only by the visible in the interaction but also by the invisible. The activity of doubt is a method starting the process of dialog between differences, connecting and disconnecting experiences, it is a movement between construction and deconstruction between use and design: *"(...) embracing the skilful task of reconstructing the boundaries of daily life, in partial connection with others, in communication with all of our parts. (...) It means both building and destroying machines, identities, categories, relationships, space stories. Though both are bound in the spiral dance, (...)"* (Haraway 1991, p.181).

2.3. CBE and critical thinking

Competence based education (CBE) aims to provide enough possibilities for unfreezing routines, making them visible, testing and growing in experienced habits and acquire new habits. It demands from students and student teams an autonomous and critical attitude. In CBE the acts of doubting and questioning are crucial. They are bridges between obvious acting and a possible change of habitual acting. Without these habits change is a routine and does not create doubt. Every (inter)action causes changes but not all activities of actors are present in interaction worlds. If changes caused by interaction are comparable and compatible with previous changes then they will be perceived as obvious. They are taken for granted. This kind of interaction will not cause any doubt; they are not present. Actors and representations are only present if they are willing and have a potential of creating doubt and if they can create a disrupting moment in the interaction. According to Heidegger (re)presentations are 'ready-to-hand' and/or 'present-at-hand'. In an exclusive readiness-to-hand, actors are unaware of their presence and they are in a position of 'thrownness', being immersed in a situation. In present-at-hand situations actors are aware of the representation. (Heidegger1926, §15, §16). Acts of doubting and questioning create situations in which a ready-to-hand (re)presentation can be simultaneously present-to-hand; the (re)presentation can be encountered in an intertwined use-design relation. Learn-work environments for CBE are ready-made environments. The question is how they can be open enough so that the prescriptive elements for acting in this environment can be present and that prescriptivism can be experienced as useful and doubtful simultaneously. However in learn-work environments the act of doubt should not become a routine because a continuity of ongoing doubt will lead to despair and not to design; it will create a frozenness of not acting anymore. Creating and supporting such critical transformative learn-work environments is balancing in the actual interaction between the frozenness of the established acting and the frozenness which occur by to much insecurity. A room for such a mutual actability is based on a concept of work and study support of stimulus and impulses which provides that the process of use and design get out of balance. Such support is situated and cannot be planned completely in advance. On the contrary a generalisation of a planned support system makes the negotiation room for the learners very small, fenced in between forced and frozen routine and despair[4].

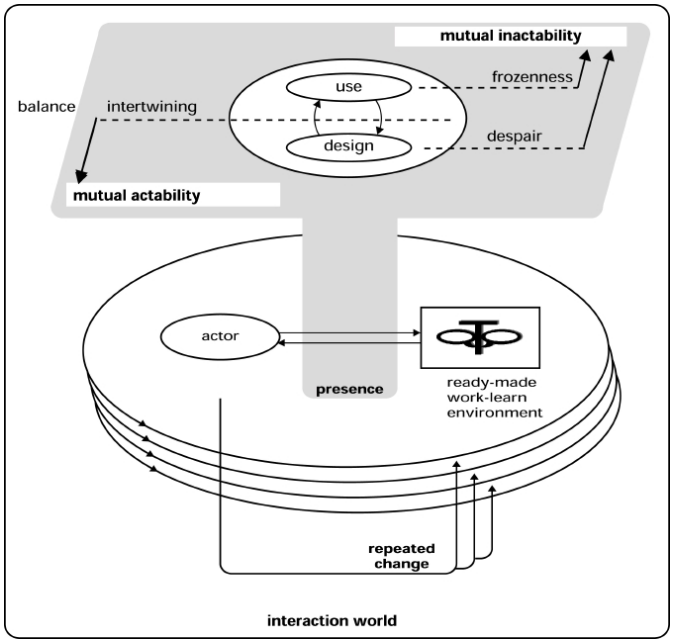

Figure 2: Use-design balance in interaction worlds

2.4. The world of Informatics

What actors know and understand is grounded in perceived experiences from their interaction in the worlds they live in (Jonassen 1991 p.10; 1994 p.34-35). The experiences of students at the School of Informatics are situated in the interaction world of their study and their professional job. In these worlds they have developed routines and habits. A learn-work environment should give students the opportunity for doubting their obvious acting, questioning the behaviour of others and transforming their habits developed through participating in the interaction worlds of Informatics. The 'preferred reading' of experiences from the past: representations in the form of hardware, software, methods and theories are negotiable if differences, different meaning construction processes, variety and ambiguity are respected. Differences from the dominant meaning and acting are not errors or failures. Actors questioning dominant discourse in Informatics are not dissidents. However changing 'routine-acting' is always very difficult. Routine does not have much presence in each world of interaction and a lot of people especially computer scientist whose focus is security and non-ambiguity, see doubt as a feeling of insecurity and creating doubt as an unpleasant activity and not as a necessary prerequisite for change (Crutzen 2000a, b). In every interaction world, there are mutually accepted or enforced habits and routines: *"'Reality', or the way we see reality through the prism of our own culture's means of assigning meaning to the various elements of our world, (...) is a phenomenon which will inevitably be defined differently according to the dictates and needs of different cultures. (...) The meaning of 'reality', therefore, will depend very much on the way a particular society defines it. All elements of that society's history, the totality of its development, including its present economic, cultural, racial, class and political balance, will make it unlikely that any two societies, no matter how similar, will look at one issue in exactly the same way." (Dellinger 1995).* So it is likely that the culture of Informatics discipline differs from the culture of the worlds in which their products will be used. The invisibility of 'routine-acting' is precisely the problem of computer scientist designing ICT-representations for actors in other interaction worlds. The obvious acting in both worlds, the world of computer scientist and world of users, is hidden. They should experience that the meanings of ICT-products are always socially negotiated. Modifications in the culture of consumers cannot be imposed by ICT-products. Consumers should have the opportunity to develop their own use-design interactivity.

2.5. Learn-work environments: critical and transformative

In the course 'Design Project' the word 'design' has the meaning of projective acting into the future. So design implies the possibility of changing and changed acting in the Informatics domain and in the domain of learning and working. Learn-work environments can be characterized as critical transformative rooms (Crutzen 1999, 2000a, 2001) within the discipline Informatics if they are critical and transformative on several levels where use-design relations are at stake:

2.5.1. The study environment

The constructivist learning process (Vygostky 1978, Brown 1989, Duffy 1993) of integrated learning and working in an virtual business setting, is a rich and authentic context in which the interactivity of use and design can be realised by confronting the student with an ill-structured domain in which alternative solutions for problems are possible because of the participation of and cooperation in a group of human actors coming from different worlds. The collaborative construction of knowledge happens in two ways: through internal negotiation and through social negotiation. The success of collaboration and therefore the success of collaborative knowledge construction and the sharing of constructed realities depend highly on successful social negotiation of meanings. With respect to this particular point Hiltz points out *that "The social process of developing shared understanding through interaction is the 'natural' way for people to learn"* (Hiltz, 1994, p. 22). However it is crucial that the social negotiation in the critical transformative room should not focus on coming to a shared equal understanding as soon as possible, but only to a mutual actability in which differences and multiple representations of reality are respected, and in a sense of change also appreciated. Learning in OTO is learning while performing in a team. It is active and self-regulated.

2.5.2. The methods, theory and practices of Informatics

By deconstructing the 'use-design' opposition in the Informatics discipline and domain the vanishing of the critical 'subject-position' and the vanishing of design as a changing activity focused on an openness of the future can be 'disclosed'. Doubting and questioning is necessary in working and learning interaction for changing the concept of 'interaction' itself in the Informatics domain; a concept that usually is conceptualised as a transmission between a dominant sender and adaptive receiver in which feedback is seen as necessity for convergence to the intention of the sender. (Crutzen 1997) Interaction is based on the planned cooperation between software and hardware. Necessary is a displacement of the binary opposition 'use–design' and a change in the Informatics discipline to a view that the relations of use and design are basically interactive. Design in Informatics is seen as making a product for a remote world, whose interaction can be modelled from a distance and without being experienced. In the process of making ICT-representations those models of interaction are frozen into the behaviour of computer scientist and into the ICT-representations, which they them self use and which they apply and force back onto the informatics domain. ICT-professionals are mostly not designing but using established methods and theories. They focus on security, non-ambiguity and are afraid of the complex and the unpredictable (Crutzen 2000a, b, 2001). As Hirschheim a. o. claims "*The research literature by and large continues to promote one paradigm: functionalism in ISD (comment: information systems development) and objectivism in data modeling. (…) the textbooks on data modeling and IS development which form the basis of university teaching, they are virtually entirely functionalist in orientation (...) So the academic community perpetuates, consciously or unconsciously, functionalism. We teach it to our students (...) The students (...) apply it in practice. However in applying it to practice, it is likely that the shortcomings of functionalist approaches surface*." (Hirschheim 1995 p.237). A learn-work environment in which the working process is based on practices of Participatory Design in a real business setting can discover that ambiguity and doubt creates a changed vision on design.

2.5.3. The relation of consumers with ICT products and their involvement in the development of an ICT product.

The usage practices of professionals are reflected in the ICT-products ready-made for consumers. Users are not given enough opportunities to intertwine use and design. Meaning construction processes have disappeared in processes of doubtless syntactical translation. The dominance of ICT ready-made products closes off and mostly prevents the act of discovery of the users by the designer and acts of discovery on the part of the users. Design is focused on generalised and classified users. Users are turned into resources, which can be used by designers in the process of making ICT-products. Users do not have room any more for starting their own designing processes. Those who do not fit in pregiven classes are seen as dissidents. Use and design cannot be treated as activities in different worlds; a world of senders (informatics professionals) and a world of receivers (consumers), while the IT-products are seen as the exclusive links between these worlds. A reconstructed meaning of 'use' is: Using ICT-representations means always designing and redesigning a flexible world of interactions between human and non-human actors. For human actors involved in these worlds it should be possible connecting and disconnecting the interaction between themselves and the non-human actors (Crutzen 2000a)[5]. ICT-representations should always have a presence of leavability; a user should be allowed to use the ICT-representations as a routine but also give the users the opportunity of learning in which situations the ICT-representations are adequate and in which situations they should be abandoned (Crutzen2001)[6]. A closed readiness is an ideal, which is not feasible because in an interaction situation the acting itself is ad-hoc and, therefore unpredictable. The ready-made behaviour and the content of ICT-representations should be differentiated and changeable to enable users to make ICT-representations ready and reliable for their own use. The means of interaction with ICT-representations should be as diverse as possible and the presentation of the ICT-representations' behaviour must not determine the acting of users. Translations and replacements of ICT-representations must not fit smoothly without conflict into the world they are made ready for but the range between desperation and obvious acting should be leavable, useful and reliable.

This use and design concept is realised in the implementation of OTO since as students they are consumers of a ready-made implementation, too.

3. The implementation of OTO

3.1. The Company OTO

For the 'Design Project' course a virtual company OTO is started by the School of Informatics based on and developed out of a generic learning concept: the Virtual Company developed by the OUNL as an organization-for-learning and a learning organization (Westera 2000). The demands of the professional workplace for communicative employees able to deal with non-routine working processes operating in teams embedded in a turbulent business environment lie at the basis of OTO. Students are temporary employees in OTO during the project and work collaboratively in teams of 5 to 10 members. The staff roles in the company are director, human resource manager (hrm), coach, knowledge coordinator, help desk and expert. The parts are taken by employees of the OUNL. If necessary students can consult experts from outside the OUNL. The director in cooperation with the hrm is responsible for the contacts with external organisations. They make the initial contacts and acquire project proposals from which the student teams can choose. The external business goal of the company OTO is to offer to other organisations a cooperative and participative redesign process (analysing,

modelling, implementing, evaluating) of the relation between their business processes and their information system. OTO offers its clients a participatory design process. OTO-employees (the students) intentionally and continuously involve employees of the external organization in the interaction redesign process of the external domain. External organizations must make a commitment that they are willing to give participation time in the project. The team refines the chosen initial proposal together with the representatives of the external organization to a project draft and first product idea and later on to an external project planning script. This script contains the basic agreements of the formal contract that the external organization and OTO sign. This contract symbolises the end of the A(cquisition)-phase of the working process and the beginning of the P(roject)-phase. The internal business goal of OTO is competence development of each employee, of each team and OTO itself by means of knowledge and human resource management and by evaluation of the business processes of OTO strengthening the changing potential of OTO; all employees, staff and project teams, to design the process of learning together.

3.2. The learn-work environment OTO

Conventional instructional scripts do not fit the learn-work community in OTO. The main processes in OTO, working and learning cannot be completely planned in advance. Therefore they are only minimally prescribed. However OTO is not supposed to be a work environment in which learning results depend on learning occurring by chance. On the contrary OTO is purposefully designed to facilitate critical transformative learning. OTO offers the students a set of well defined competencies they can develop. The broad range of professional skills defined in the 'Workplace Big Five' (Pi Media) and Kessels' professional core competencies[7] are regarded as key objectives for learning on the job, and are essential for preparation of students for professional practice. The basic OTO competencies are cooperation, integrity, client orientation, result orientation and self development.Students can couple these with an individual choice of competencies, related to the tasks and roles they can take in the team, such as flexible behaviour, initiative, problem analysis, power of reasoning and judgement, organisation sensitivity, quality oriented, adaptivity. Beside to the competency definitions there are descriptions of ICT jobs and tasks in which specific competencies are needed. The definitions are accompanied with coaching and performance tips.

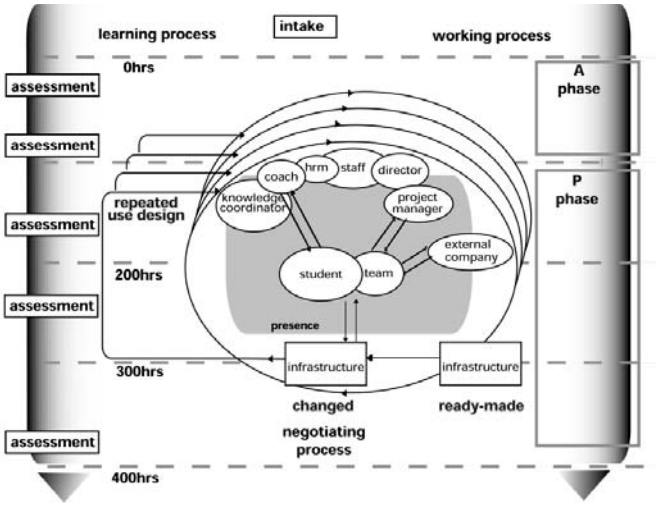

Figure 3: The infrastructure of OTO

The personal growth objectives for each OTO professional are laid down in a personal development contract in the intake. The contract will be renewed constantly through peer-, coach- and self-assessment. In OTO there are a lot of instruments available for assessment. Each assessment is followed by a coach-student consultation. Together with the external planning script each team composes at the end of the A-phase an internal planning script in which the tasks and the roles of each team member are mentioned. These tasks and roles should be linked to the competencies they want to explore. It is the responsibility of the student team to combine the working and learning process in the internal planning script. The internal and external planning scripts are the starting documents for the P-phase. During the P-phase these planning scripts are continuously adjusted to the circumstances in the project interaction.

A project manager from the OTO staff supports the working process in each team. This role is a supporting role for the working process. In the role description of the project manager there is a set of impulses available. Besides that a personal coach supports the learning process of each student employee. Project manager and coaches are not leading in the A- en P-phase of project. The project manager and coach give impulses only in situations when a student or a whole team is blocked, and processes are frozen, and the balance between use and design is lost.

A very useful instrument is the personal reflection template in the electronic student portfolio in which coach, project manager and student comment the ongoing activities in relation to the chosen competencies. By commenting the ongoing learning and working processes the student can reflect on her/his performance and relate activities in the working process to the objectives of the learning process. Besides the support by staff members and the competence structure, OTO provides in its infrastructure a variety of tools, templates, skeleton contracts and a library with relevant articles on methods and theories.

OTO has a lot of tools to support the communication, coordination and planning processes needed for collaborative work in a networked environment, for assessment and coaching, for (knowledge) management and especially for the working process and the interaction with the external organizations. In the electronic study material a global description of the working and learning processes and of the competencies student employees can acquire, are provided.

The infrastructure is offered to students mainly as an open structure with only minimal prescriptive elements. For instance in OTO there are some strict rules regarding privacy and responsibilities for the learning process of oneself and the colleague team members. The teams can decide autonomously which tools, methods and theories they want to use for making the product, only with the constraint of the client's close involvement. Using this structure, students and the student teams can negotiate a tailored, personal growth in the team. By the critical use of the infrastructure through student teams and staff, OTO is growing into a virtual environment of differences in acting. It is the task of the human resource manager and the knowledge coordinator to keep the balance between an overwhelming offer of differences in coaching approaches. In the role of examiner of the Design Project it is the task of the OTO director, in spite of all these necessary differences, to guarantee a fair and just final assessment.

4. Learning in OTO: first student experiences

The design and availability of the educational facilities provided in OTO enable the student employees to acquire as many competencies as possible, acquire domain-expertise as well as self-propelling learning attitude for sustained life-long learning in work practice. How do students experience learning in OTO designed on such different foundations as the more prescriptive learning arrangement they encountered earlier in their study? Since OTO has become operational we can present the impressions of the first student teams, the 'OTOWEG' and 'Omega' teams. In both teams the students live geographically distributed in the Netherlands and in Belgium.

First of all students highly valuated the possibility to be able to focus on their own competency growth while working in a real work setting. Even when they were already working in an ICT job the possibility to explore their own potential in a safe setting, where doubt and insecurity are allowed, were of great importance to them. However in the future the competency definitions including the performance and coaching tips needed a more appropriate formulation according to the teleworking situation.

Since the work takes place in a virtual setting: distributed, computer mediated and predominantly a-synchronous, the students noticed that the process of getting acquainted to each other is differed from their earlier experiences: working face-to-face in teams with people one already knew somehow. Communication and coordination processes in a virtual e-room differ especially in the beginning, when you are not yet familiar with your team member's contexts and qualities. The processes of getting acquainted with the abilities and ambitions of each other takes time. Decision-making in the first phase therefore is a somewhat difficult and a more time-consuming process since it intermingles with the complex processes of becoming a team. In a virtual room team oriented interactions such as communication, coordination and planning lose their routine status. The technology of a virtual room reveals the richness of human behaviour not mediated by technology and it discovers that technology supports especially structured communication, planning and coordination. In the beginning of the A-phase some necessary impulses of the project manager prevented the new employees from a too high level of frustration. However the students' discovery that some of the work was done twice or superfluous lead to their conclusion that a team leader was no luxury. On the other hand in both teams the experience of their own autonomy was fruitful for becoming acquainted with the freedom of a non-restrictive way of use and design. The OTO environment was experienced as an environment in which students see themselves confronted with a multitude of new elements: a task different to earlier assignments, a new work environment, new expectations and new learning possibilities in a variety of dimensions. For most students working so intense in a team was new, too. The richness of the OTO learn environment however offered each student the possibility to choose for learning objectives matching her or his ambition.

The asynchrony of the OTO learn environment fits very well to incorporate the OTO work into the student's daily (job and private) obligations. Most of the students work in OTO during evenings and weekends. However the asynchronism places a burden on the rapidity with which processes take place: it takes some time before you receive feedback on a message or proposal to your coach, project manager or teammates. In this sense it burdens a smooth and rapid workflow and decision-making. In a future experiment with synchronous electronic work facilities we want to experience how and when synchrony can support coordination and cooperation. At the moment the students do a lot of telephone conferencing and net meeting. Incidentally they meet face to face, especially for client contacts.

Students experienced that it was difficult to concurrently cope with the ongoing performance in learning- and group-processes. Problems and postponing decisions led to stress in order to meet deadlines with the client. So the reflection template was introduced as an instrument for the second team and it proved to be adequate for connecting the working and learning processes. What worked very well was the attention to the chosen competencies. As a student expressed: "It enlarged your awareness on your attitude, behaviour and it forced you to explore tasks which in other circumstances you would ignore out of escapism." Another student observed that in the P-phase the attention to competency development was

overlooked by the stress getting the project done. The student experienced that as something what is typical for an ICT job.

Virtual communication and asynchronous working requires a lot of time. Especially participation of persons of external organizations was time consuming. Students have discovered that "you need to start this process as early as possible" (one of the many guidelines the first team advised to the second team).

As staff we have learned that giving only the necessary impulses does not mean not giving stimulating and positive feedback.

Making OTO a more realistic company, we plan to make the staff team's work more visible for the student teams and we have to do efforts to support the knowledge management of the students more, because students are not experienced enough to do this all by themselves. We need to develop stimulations to encourage students to read articles from the OTO library to enhance their knowledge, especially on Participatory Design. We also have to enhance the means of transporting knowledge and expertise between teams.

We believe the OTO concept fulfils the requirements of a constructivistic learn environment. In line with the claim stated by the constructivists that knowledge and skills are best acquired in the context of a real life experience our design of 'employee teams' uses a 'natural' setting, thereby preserving the complexities and uncertainties of real life. Task and role performance within the teams connects knowledge and skill construction to the real life working problems of the business context of a real company.

We have seen that the application of an electronic telecommunication network enables group members to be connected and allow having interpersonal conversations in which meanings and individual and team behaviour are socially negotiated, using the ready-made infrastructure intensively and differentiated. There is good balance between the prescriptive elements and the variety of free choices. It stimulates students to discover the qualities of their team members and becoming good colleges.

Is there a conflict between the demand of students for prescriptive learning instructions and the situated self-directive learning of the students in authentic collaborative action of participatory design? There are conflicts because we have chosen for an approach in which the 'travelling' of the student teams is not smoothly. Roundabout ways enable unexpected experiences. We only give impulses if they loose their orientation towards the product: to design their own competency growth, and towards the client's needs for the product. However we have learned that travellers should receive a 'warm bath' regularly to refresh their use-design energy.

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References

Bolhuis, S. M. & Simons, P. R-J, (1999). *Leren en werken. Opleiden en leren.* Deventer: Kluwer.

Brown, J. S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Research,* 18, 32 – 42.

Brown, J. S. & Duguid, P. (2000). *The Social Life of Information.* Boston: Harvard Business School Press.

Bijker, W. E. (1996). Democratization of Technology, Who are the Experts? http://www.desk.nl/~acsi/WS/speakers/bijker2.htm

Castells, M. (1998). *End of millennium: The information age – Economy, society and culture*, vol. 3. Oxford, Blackwell.

Crutzen, C. K. M. (1997). "Giving Room to Femininity in Informatics Education". In: Grundy, A. F., a.o. (eds.) *"Women, Work and Computerization: Spinning a Web from Past to Future".* Berlin: Springer-Verlag, 177-187.

Crutzen, C. K. M. & Vosseberg, K. (1999). Die Interaktion zwischen objektorientiertem Denken und feministischer Kritik - eine dynamische Verbindung. In: Dreher, B., a.o. (eds.) *"Software Engineering im Unterricht der Hoch-schulen"* (SEUH '99). Stuttgart, Teubner Verlag, 149-165.

Crutzen, C. K. M. (2000). *Interactie, een wereld van verschillen. Een visie op informatica vanuit genderstudies*. Dissertatie, Open Universiteit Nederland, Heerlen.

Crutzen, C. K. M. & Gerrissen, J. F. (2000). Doubting the OBJECT World. In: Balka, Ellen, & Smith, Richard (eds) *Women, Work and Computerization: Charting a Course to the Future*. Boston, Kluwer Academic Press, 127-136.

Crutzen, C. K. M. (2001). Dekonstruktion, Konstruktion und Inspiration. In*: FifF, Kommunikation*, 3/2001, 47-52.

Crutzen, C. K. M. & Hein, H.-W. (2001). Die bedenkliche Dienlichkeit und Sicherheit von Softwaresystemen und die erlebte Verläßlichkeit. In: Bauknecht, K., Brauer, W. & Mück, Th. *Informatik 2001. Wirtschaft und Wissenschaft in der Network Economy - Visionen und Wirklichkeit, Band II*. Wien, Österreichische Computer Gesellschaft, 782-787.

Dellinger, B. (1995). *Critical Discourse Analysis*, http://www.utu.fi/~bredelli/cda.html.

Dewey, John (1916). Democracy and Education. The Macmillan Company. Used edition: ILT Digital Classics (1994), http://www.ilt.columbia.edu/academic/texts/dewey/d_e/contents.html

Dewey, John (1917). Essays in Experimental Logic. The University of Chicago Press, Used edition: Ratner 1939

Dourish, P. (2001). *"Where the Action is"*, Cambridge, The MIT Press.

Drucker P. F. (1993). *Post-capitalist society*. Oxford: Butterworth. Heinemann.

Duffy, T. M. & Jonassen, D. H. (1993). *Designing environments for constructivist learning*. Berlin: Springer Verlag.

Feltovich, P., Ford, K.M., Hoffmann R.R,(1997). *Expertise in context: human and machine*, Menlo Park, Calif: AAAI Pr.

Haraway, D. J. (1991). *Simians, Cyborgs, and Women. The Reinvention of Nature*.London: Free Association Books.

Heidegger, M. (1926). *Sein und Zeit*. Used ed.: Heidegger, M. (1993). Sein und Zeit, 17. Auflage. Tübingen: Max Niemeyer Verlag.

Heidegger, M. (1936). *Der Ursprung des Kunstwerkes*. Used ed.: (1960). Stuttgart: Philipp Reclam jun.

Hiltz, Starr R. (1994). The Virtual Classroom: Learning without limits via computer networks. Norwood, NJ USA: Ablex Publishing Corporation.

Hirschheim, R., Klein, H. K., & Lyytinen, K. (1995). Information Systems Development and Data Modeling. Conceptual and Philosophical Foundations. Cambridge: Cambridge University Press.

Jonassen, D. H. (1991). Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm? Education Technology Research & Development, 39(3), 5 – 14.

Jonassen, D. H. (April 1994). Toward a Constructivists design model. Educational Technology, 34(4), 34 – 37.

Kessels, J. W. M., van Lakerveld, J., Van den Berg, J. (1998). Knowledge productivity and the corporate curriculum. Proceedings AERA. San Diego, CA,.

Kessels, J. W. M. (2001). Learning in Organisations: A Corporate Curriculum for the Knowledge Economy In: *Futures 33*, 497-506 Elsevier Science.

Kirschner, P. A. (2000). *The inevitable duality of education. Cooperative higher education - Inaugural address*:, June 23, 2000 http://www.ou.nl/otecresearch/index.htm.

Levinas, E. (1996). Martin Heidegger and Ontology. *Diacritics 26.1* (1996), 11-32

Mallery, J. C.,Hurwitz, R. & Duffy, G. (1987). Hermeneutics: From Textual Explication to Computer Understanding? In: Shapiro, S. C. (ed.) (1987). *The Encyclopedia of Artificial Intelligence*. New York: John Wiley & Sons, 362-376. Revised version (1994): http://www.ai.mit.edu/people/jcma/papers/1986-ai-memo-871/memo.html.

Peirce, C. S. (1877). The Fixation of Belief. *Popular Science Monthly 12* (November 1877), 1-15, http://nothing.com/peirce/writings/p107.html

Ratner, J. (ed.) (1939). *Intelligence in the modern world, John Dewey's Philosophy, with an introduction by Joseph Ratner*. New york: Random House.

Sloterdijk, P. (2001). *Nicht gerettet, Versuche nach Heidegger*. Frankfurt am Main: Suhrkamp.

Tobias, S. & Fletcher, J. D. (2000). *Training and Retraining A handbook for business, industry government and the military*. New York: Macmillan Reference.

Vygotsky, L. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

Westera, W., Sloep, P. B. & Gerrissen, J. (2000). The design of the virtual company: Synergism of learning and working in a networked environment. Innovations in *Education and Training International*, 37, 24-33.

Notes

[1.] Sloterdijk 2001, Absturz und Kehre, Rede über Heideggers Denken in der Bewegung, p.41-45

[2.] (Heidegger 1926, §31, p.145-148) Heidegger uses the word 'Entwurf' (project-in-draft): *"The German terminology shows us clearly the opposition that there is in Heidegger's thought between dereliction and the project-in-draft – between Geworfenheit (comment: thrownness) and Entwurf. (comment: Design) (...) 'Entwurf": "does not mean, ..., to contemplate this beyond as an object, to choose between possibilities as we choose between two paths that intersect at a crossroads. This would be to deprive possibility of its character of possibility by transforming it into a plan established beforehand. Possibility must be seized in its very possibility – as such it is inaccessible to contemplation but positively characterizes the way of the being of Dasein. This way of being thrown forward toward one's own possibilities, of adumbrating them throughout one's very existence, is a crucial moment of understanding."* (Levinas 1996).

[3.] Dewey gives several meanings to the function of doubt in a variety of modes of thinking; the thinking necessary for change (Ratner 1939, p.837-850) (Dewey 1917, p.183-216).

[4.] Despair in the meaning of continuous doubting. Dewey calls this kind of doubt an intruder, a not welcome guest (Ratner 1939, p.838) (Dewey 1917).

[5.] Dourish calls this use-design relation to ICT-technology 'coupling': *"(...) coupling is (...) how to assemble the range of computati-onal components available to me into a grouping through which I can achieve whatever effect I need."* (Dourish 2001, p.140-142).

[6.] Heidegger calls this "Verläßlichkeit". He used it in two meanings: leavable and trustworthy (reliable) (Heidegger 1936, p.28-29).

[7.] Kessels seven key competencies for the professional: technical-occupational competence; methodological; organisational; social-cooperative; cultural-normative; strategic; learning competence.

The assessment instruments and competency definitions of OTO were developed in cooperation with PiMedia (Big Five competencies see: www.pimedia.nl).

13 Development of an ICT Open Learning Environment for Teaching Multimedia

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Abstract

The paper presents a multimedia open learning environment in a local area network. The environment is composed by a teaching method, a multimedia application; a number of Internet based learning modules and an ICT assessment. Each module includes an interactive glossary, Internet resources database, a comprehensive bibliography, homework, applications and examples, computer-based self-assessments, interactive communication via e-mail and discussion forum. The method and the development process are new in Romania and have been adapted to the abilities of the Romanian students. The designed environment has proved his efficiency and it is used constantly in the "Politehnica" University of Timisoara for students at the Audio-Video and Multimedia Technologies specialization.

Keywords: ICT environment, Teaching multimedia, Romania

1. Introduction

During the last years, the field of education is more and more subject to economy measures all over the world. It has to be able to renew itself, both structurally and pedagogically. The role of networks in a learning environment is becoming more and more important. Educational technology is expected to bring in new solutions for both distance and traditional teaching. This concept is generally known as Open and Flexible Learning and use different teaching methods for the entire learning process.

Learning environment for individual students is most often the basis for development of new open learning environments. The ability to use information technology, interaction and teamwork skills, and interaction between small groups is the starting points for projects in the context of an information society.

2. Goal of the work

The goal of the present work was to develop a multimedia open learning environment on a local area network. The production costs, as well as of the hardware and software support, should be kept at the minimum and use the existing equipment in the Multimedia laboratory (mainly achieved through EU PHARE TEMPUS Programs). The addressed application is teaching course of Development of Multimedia Applications and TV Journalism for individuals or groups of students at the Audio-Video and Multimedia Technologies specialization. A good efficiency could be obtained if students would be able to assist interactive courses over the Internet. The course producer or lecturers are able to update the content of the courses and should have a kind of control over the presence and the activity of the student to that course.

The final product is formed by a multimedia application; a number of Internet based learning modules and an ICT assessment accessible over the Internet or on a local network.

3. Educational and technological goals

The primary purpose for building the ICT environment was to improve the experience of the students and teachers and to use intensively the learning time for better results.

At the beginning an analysis of the current classes for students at the Audio-Video and Multimedia Technologies specialization runned in the old academic way has been done.

The main questions raised were: what are the factors that waste time on the learning process, lessen the effectiveness of learning, make it more difficult to for the students to learn, increase the cost of offering the class, which are the advantages of the subjects taught (McCormack 1998). The results were mainly: the learning time allocated to the courses

are too short for the demand of acquired know ledges, constant feedback with bibliographical texts from teachers or library was more and more difficult (due to economical reasons just one piece of each book was available in the specialization library), the information available on the Internet expands and change yearly and students find it more difficult to access it all. The conclusion was that some of the subjects are practical oriented and can be adapted for the ICT environment.

A deep knowledge of computer network programming is required to develop a remote laboratory from scratch with major initial constraints both for the students and the teacher, and with a limit of the development of a number of practical examples. To overcome these problems it was proposed computer architecture based on the existing local area network, a flexible communication protocol between client and servers computers, and a set of programs and libraries. The friendly, interactive programs and the libraries were intended to help teachers to develop continuously the course and environment, and also to help other teachers in the university to develop further classes. The Intranet network has direct access to Internet through the RoEduNet academic Romanian network and some of the modules are available on the Internet.

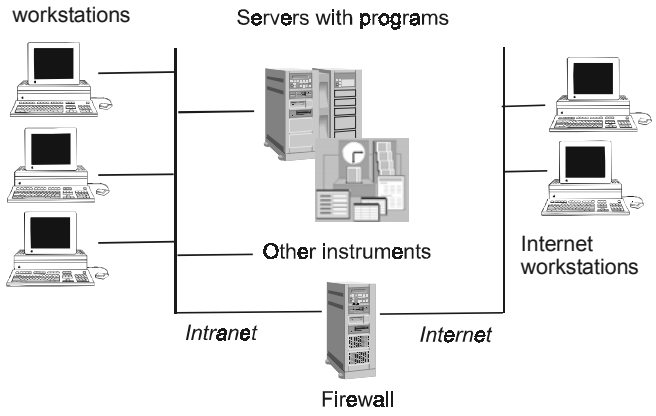

Figure 1. Architecture of the multimedia laboratory

Several advantages are obtained by using this configuration. First of all valuable and expensive instrumentation can be shared between many users. Different programs may be available to the students, depending on the actual need of the course. The network topology supports a high flexibility and access if more students decide to use the same programs and test in the same time, the server programs grant the access in timesharing fashion with suitable priority policies.

4. Scenario of the ICT environment

The environment is composed by a teaching method, a multimedia application; a number of Internet based learning modules and an ICT assessment. Each module includes an interactive glossary, Internet resources database, a comprehensive bibliography, homework, applications and examples, computer-based self-assessments, interactive communication via e-mail and discussion forum. The addressed application is teaching the course of Development of Multimedia Applications and TV Journalism for individuals or groups of students at the Audio-Video and Multimedia Technologies specialization, short-term higher education (college) degree. The same application has been adapted for the students in the new degree in Multimedia through Distance Education. The method and the development process are new in Romania and have been adapted to the abilities of the Romanian students.

The application implements a new student-centred learning method based on Information and Computer Technologies. It uses audio and video applications, interactive computer methods, Internet based learning software and the World Wide Web as a resource tool. The method is a result of several years of experience in teaching these courses and experience in developing multimedia applications. The course producer or lecturers are able to update the content of the courses and have a kind of control over the presence and the activity of the student to that course. The final product is formed by some course modules accessible over the Internet or on a local network and different other resources, with track on their activities.

5 Development of the ICT environment

The ICT environment has been developed by using different software and also the extended experience in developing web-based and multimedia materials of the authors. A team has been established and also some students were involved din tools developments.

5.1. TV journalism multimedia application

The multimedia application has been developed by using mainly Macromedia Director with extensive scripts in Lingo and it is mainly for the TV journalism course. It is based on 13 teaching chapters, 68 activities and examples (mainly videos or photos), self-assessment exercises, an extensive glossary with direct links to the hot words in the course notes. The application is personalized to each student who needs to enter his name at the start and his activities on the application are tracked and supervised by the teacher. The application is installed on the faculty intranet and it is also given to students on CD-ROM.

The Internet based learning modules have been developed in 2 stages. They are available on the Internet and the student's access suing their username and passwords. This allows also the teacher to track each student activity in order to better assess his knowledge, to help and support him during semester.

5.2. The TV Journalism on-line course

The course of TV Journalism was developed on HTML using all the characteristics of web-based training: easy and quick access to information, search tool, structured information with constant references to glossary, library, schematic drawings, on-line support (Driscoll 1998).

It has 10 chapters and several photos, plus a library with links to interesting websites.

Figure 2. TV Journalism course on CD – content page – personalized

Figure 3. TV Journalism course on CD – one of the inside pages – with link to glossary

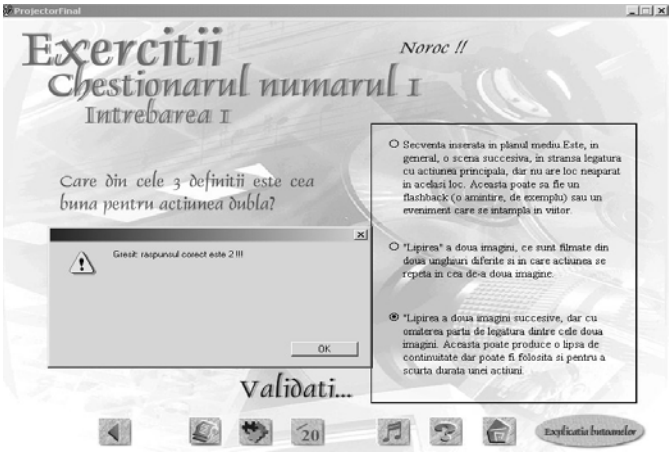

Figure 4. TV Journalism course on CD – one of the self-assessment pages – multiple-choice test with the answer

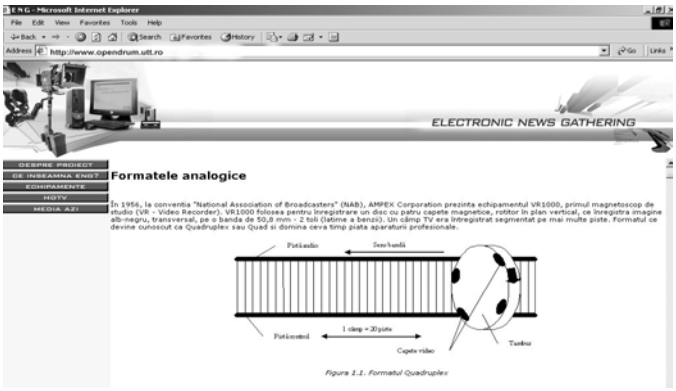

Figure 5. TV Journalism on-line (Electronic News Gathering)

Figure 6. TV Journalism HTML Source

5.3. The Development of Multimedia Applications on-line course

The other Internet tool developed was the course of Development of Multimedia Applications (course notes, activities, glossary, library, assessments, etc). The authors choose to implement it using WebCT environment, which after that has been extensively used for implementing also other courses. The WebCT offers different facilities: password protection, different level of student' access,

students' activity track, assessments checks) which are fully used on this course.

Figure 7. The WebCT interface on www.opendrum.utt.ro

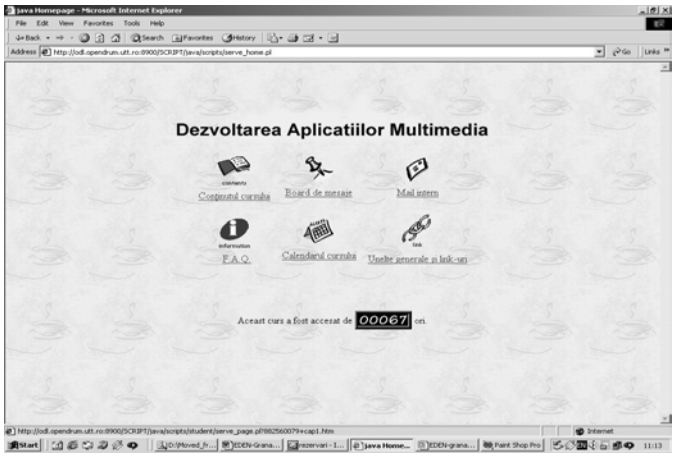

Figure 8. The main page of the course

Figure 9. One of the inside pages of the course

So, the system allows the teacher to track the student progress during the academic period. Moreover, the system provides some statistical tools to determine the global progress of a group of students and to compare the theoretical and experimental difficulty level of the tests.

5.4. The self-assessment tool

All the 3 tools are used in parallel by the students in the second, third and fourth year of study. They are registered students and all the access to all the applications is with username and password. This increase the security, allow the student to see exactly what knowledge he has achieved and allow the student activity track by the teacher.

On all the applications there are different exercises for the self-assessment. It is worthy to consider that students have no obligation to do all the exercises although depending on the grade they obtained in the self-assessment history; the course final grade can be increased. The final grade of an exercise is the average grade of all the attempts.

In each year the teachers realized that an increased number of students are doing the exercises on self-assessment and their final results are better than those who don't pass all the exercises.

6. Evaluation

It has been tested for 2 years and assessed using different methods. The quality of the application is assured by using standard higher education quality methods and the expertise of the external auditors. The evaluation process started earlier, during the progress of the environment development. The evaluation comprises different performance indicators concerning also the process of teaching/learning and the environment products. The process aspects data that was quantitative and qualitative evaluate were: enrolments, numbers using all the facilities, learners' workload, problems experienced by the learners/teachers, etc.

The students have also done an assessment by questionnaires and conversations with the staff. The evaluation goal was to assess the ICT environment and to collect information and suggestions in order to achieve an improved version in the future. At the end of each term and module of the courses students were asked by e-mail to fill in the on-line questionnaire about the tools utility, course structure and assessment tools. The questionnaire was organized in two parts: a set of closed questions (with multiple-choice answers) and a set of open questions.

It proved mainly the effectiveness of the environment with a passing percent increased with 25%, a larger number use the facilities, they access a larger amount of information and data, their knowledge and skills have been certainly improved.

The use of ICT tools in higher education should also be considered from the economical point of view. It is proved and has been verified by our experience that the initial development of such tools is quite expensive. This is why the initial costs per student are higher compared to the traditional

teaching. As far as the number of students is increasing, the costs tend to become comparable to the traditional ones. On the other hand, once the system is tested and becomes stable, the administration costs are lower than the traditional ones. This assertion generally applies to the use of ICT tools, but becomes stronger when we address technical education, that involves anyway high costs related to the use of equipment. This is why, our experience allows us to consider the use of ICT tools of great benefit not only from the point of view of the interactivity involved and the pedagogical one, but even from the economical point of view.

7. Conclusion

The ICT environment developed by the multimedia staff has been in full use since 2000. Several attempts of partly developed tools existed before in the multimedia lab. The designed environment has been proved his efficiency and it is used constantly in the "Politehnica" University of Timisoara. Constant update, both on the course content and of the resources are possible and done continuously.

With adequate content the ICT environment can be implemented for any subject (partly the process started for other courses at the Audio-Video and Multimedia Technologies specialization) to be taught.

For more information or to see the courses demo please visit the URL http://www.opendrum.utt.ro/online.

References

Margaret Driscoll (1998). *Web-based Training*. USA: Jossey-Bass Pfeiffer Publisher

Colin McCormack, David Jones (1998). *Building a Web-based Education System*. USA: Wiley Computer Publishing.

Adam Warren, others (1999). *Technology in Teaching and Learning*. UK; Kogan Page

A. Gracia-Beltran, R. Martinez (2002). The Role of Self-Assessment in Aulaweb E-learning System. *EDEN Annual conference proceedings*, pp 302-307.

14 Web-based Model of Engineering Studies Developed by Warsaw University of Technology

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Abstract

The article gives a review of reasons for developing and adopting a new web-based model of studies by Warsaw University of Technology. That is followed by a description of the Internet and multimedia-based educational model, known as SPRINT. The article presents also a structure of the four-year engineering studies offered by Electrical Faculty, Faculty of Electronics and Information Technology and Faculty of Mechatronics for given specializations. Then follows a description of the structure and tools of the electronic books. Finally, the article discusses briefly ways of further development.

Keywords: Distance learning, open education, asynchronous learning

1. Introduction

In the 1970's and 80's Distance Learning was perceived as a model of entirely different nature than the traditional one. That approach led to establishment of separate university units whose task was to conduct 'distance' studies. As a result, several Open Universities were established in Europe, e.g.: Open University in Great Britain (1972), FernUniversität in Germany (1974), Universidad Nacional de Educacion a Distancia in Spain, a federation of universities – Federation Interuniversitaire de l'Enseeigment a Distance – FIED in France, or NETTUNO, a network of Italian universities, established in 1990. However, the emerging new technologies, particularly the invention and spread of Internet, forced many European universities to follow American universities in the process of introducing new technology in the university learning. The adoption of a new form of learning, Continuing Education and Distance Learning, co-existing with the traditional form of education resulted in establishment of a new model of university.

Traditional model of education is based on a direct face-to-face contact between student and teacher, in which textbooks play a role of additional self-learning tools. New technological developments, such as computer-based technology, telecommunication, multimedia, Internet and television, have enriched a traditional classroom with new tools, improved learning quality in both residential universities and geographically-dispersed learning groups. Of all the technical innovations, the Internet has become an indispensable tool in introduction of the new technology to education, and its growing impact on the future of the educational model is inevitable.

In the 1990's, Warsaw University of Technology initiated a series of actions whose objectives were to reform and modernize available forms of education. The WUT introduced a three-degree model of studying (B.Sc., M.Sc., Ph.D.), extended the Continuing Education system by adding new post-diploma courses dealing with information and communication technology, and contributed to the improvement of multimedia literacy needed in the production of new didactic materials.

Two years ago, the university authorities agreed it was high-time the WUT developed and introduced a new model of studies. The Internet and multimedia have become the basic tools of a new model of education – known as SPRINT (in Polish: **S**tudia **PRez INT**ernet).

The present paper offers a short description of the new model of education adapted by WUT.

2. Facts about SPRINT.

A variety of asynchronous technologies are used in the contemporary model of studies (Minoli 1996, Taylor 1999, Farrel 2001). Thus, to the basic tools used by student in a Distance Learning belong: computer and Internet. These tools enable e.g.:

- access to Internet,
- e-mail correspondence/communication,
- work with didactic materials stored on CD-R,
- solve tasks and problems,
- write reports and projects, etc.,
- online meetings with lecturers and other students.

Although direct, face-to-face contacts between student and teacher are very rare in the SPRINT model, they are considered as important and essential elements of education. Thus, every year students have an opportunity to meet with tutors during one-week laboratory and research meetings. During that time students are instructed how to use measuring apparatus, conduct scientific research (computation and simulation) with the use of advanced software. The final examinations, preceded by a series of meetings with professors, are also conducted in the university.

The four-year studies lead to a degree in engineering (B.Sc.) of a chosen faculty and specialization. The academic year is divided into four half-semesters: autumn, winter, spring and summer, a system practiced in the FernUniversität Hagen. Each semester lasts 8 weeks and finishes with two-week examination sessions. Fig.1 shows the structure of the four-year studies.

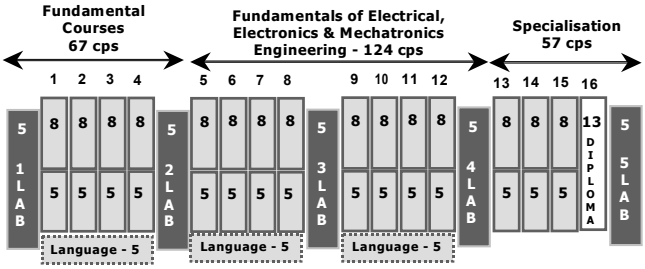

Fig.1 The structure of the four year studies

The division of the academic year into four and not two parts, enables students to study no more than two subjects at the same time.

The SPRINT model offers three types of subjects:

- **Major** subject, worth 8 cps, which ends up with an exam;
- **Minor** subject, 5 cps, which also ends with an exam;
- **Laboratory session** (one week long), 5 cps.

The problem of foreign language teaching will be discussed in a separate publication.

The grading of the subjects is based on the credit points system (cps), established by and used in the university teaching system in the majority of European countries. The credit system gives students the opportunity to gain credit points (credits). The total number of credits for the subjects is 248.

There is a three-level system of study:

- **Fundamental courses**, 1 year, whose program is fairly universal and basic; within the course student is required to credit 4 Major courses, 4 Minor courses and 2 Laboratory sessions, which gives minimum 67 cps.
- **Faculty courses**, 2 years, whose program is dependent on the faculty chosen; student is required to credit 8 Major courses, 8 Minor courses, 2 Laboratory sessions, and finish language course, which gives 124 cps.
- **Specialization courses**, 1 year, one faculty can offer more than one specialization; student is required to credit 3 Major courses, 3 Minor courses and finish a diploma thesis, which gives 57 cps.

According to the requirements of the program of studies every student should credit at least one Major and one Minor course per half-semester, and during summer semester gain credit for the laboratory session.

The model of the studies is entirely open. It means, one can become a 'regular' student of the Warsaw University of Technology and credit all the courses required to get a diploma in engineering, one can also study chosen courses, or group of courses as a 'short-term' student.

In the SPRINT model the process of expelling students is avoided. At least once in a year, progress of 'regular' students is verified. In order to be admitted to the registration for the next year student should have at least half of the required points for a given year.

Thus the pace of individual learning and gaining credits is student dependent. However, to keep the status of a 'regular' student one should not have less than 50 % of required points.

If the student is not registered for the next year, he still has a chance to continue his education. He keeps all his credits and has the opportunity to gain further credits and short before the last year of studies the student is enrolled once again.

3. Faculties and specializations

The introduction of an entirely new model of studies by the WUT, a university with 30 thousand students enrolled in 18 faculties, had to be accompanied by the establishment of a new university unit – Centre of Open and Distance Education CODE (in Polish: Ośrodek Kształcenia na Odległość OKNO).

As a principle, CODE does not have full time academic teachers. The lecturers of the particular faculties are responsible for the production of didactic materials, student supervision, and conducting examinations.

The three faculties of the WUT, Electrical Faculty, Faculty of Electronics and Information Technology and Faculty of Mechatronics, offer courses in the following specializations:

- Industrial Informatics (Electrical Faculty),
- Computer Engineering (Faculty of Electronics and Information Technology),
- Multimedia (Faculty of Electronics and Information and Faculty of Mechatronics),
- Mechatronics (Faculty of Mechatronics).

The Fig.2 presents the structure of the studies program offered by particular faculties.

The Fundamental Courses, offered during the first year of studies (Mathematics, Physics, Fundamentals of Informatics), are universal courses that can be adopted by every faculty of the WUT.

Fundamentals of Electrical, Electronics and Mechanical Engineering offer a set of courses for the second and third year of studies. The number of common courses for each specialization is relatively big. As a result, students have the opportunity to attend the majority of the offered courses.

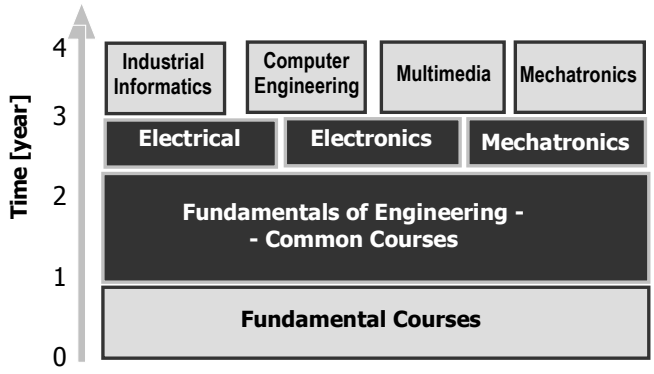

Fig.2. Program of studies structure.

During the fourth year of studies students attend only courses of their specialization and work on their final thesis that leads to a diploma.

Every year students have the choice between several courses, whose number increases with the progress of introduction of new didactic materials.

4. Electronic Books

The didactic materials of the particular courses are prepared by professors and experienced tutors in the form of electronic books stored on CD-R. The material is also available via Internet. The electronic books have the advantage of presenting the whole material of a single subject on one CD-R, and the cost of copying the material is relatively low (Kaskine 1999, Michau 2001).

For the production of the material the DynamicHTML technology was used, including: HTML, Cascading Style Sheets, Java Script and FrontPage tools. Thus the navigation system is based on HTML and dynamic Web page processing by Java Script.

The material of an electronic book is divided into two main parts:

Introductory part,

A. Learning Units and Exam requirements.

B. The introductory part includes:

- **Authors' note**, which describes course objectives. The authors explain what level of knowledge and what skills are expected from students after examining all the materials presented in the book.

- **Requirements for computer** – includes description of requirements for computer.

- **How to use an electronic book** – it is a clear, step-by-step instruction of how to use the material stored on the CD-R. Although it may seem to be obvious for the most of the students, it may turn out to be a real help for others.

- **What to know to understand?** – the authors explain conditions for understanding the didactic materials: minimal level of knowledge enabling student to understand the material presented.

- **Examination requirements**, this element is included only if the given course ends with an examination.

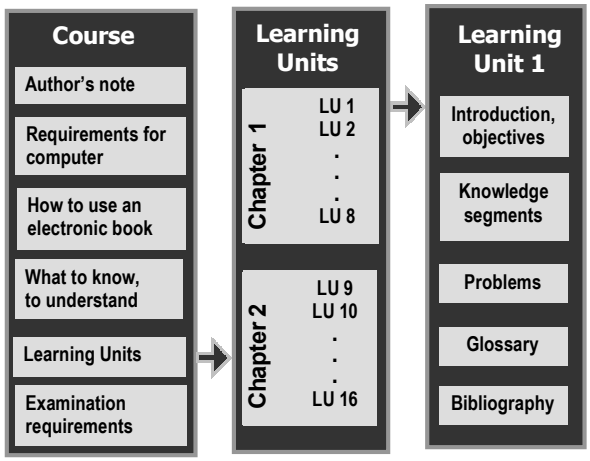

Fig.3. Structure of the electronic book

The Learning Unit part includes a series of basic didactic units that should be learnt in a suggested order. Every learning unit is composed of several basic elements:

- **Introduction**, objectives, which presents the aim of the particular Learning Unit.

- **Knowledge segments**, which includes basic didactic material required from the students. Some parts of the material contain additional information for further reading.

- **Problems**, this part includes examples of partly solved problems and tasks to be finished by the student himself. Also, it enables students to revise their understanding and command of the material required during examinations.

- **Glossary** – includes new terms and definitions.

- **Bibliography** – a list of important publications for further reading.

The electronic books have an advantage over traditional textbooks by presenting the material in different ways: written form, audio-video, simulations and animation etc. These tools enable easy and fast understanding of the course materials.

5. Plans for the future development.

The new web-based model of undergraduate engineering studies, SPRINT, adapted by the WUT is still in a forefront of really important developments.

More technical innovations create new possibilities. Thus, one of the objectives of the WUT is to develop and enrich the model with a set of new multimedia tools e.g. production of DVD, designing new simulation tools etc.

As for research, convenient conditions for conducting experiments and laboratory analyses "in a distance" need to be created. Such laboratories would enable students better understanding of studied subjects. Our knowledge concerning processes resulting from experiments, ability to control these processes and a set of tools needed for digital recording and transmission are enough to introduce a new model of laboratory research – 'distance research'. The introduction of the model is a forthcoming development of WUT.

The WUT considers also installing an advanced software that would improve the quality of projects and computer-aided simulations created by students.

Another objective for the future is the establishment of a network of universities offering distance education. This would lead to creation of a new model of distance education based on the NETTUNO model.

6. Conclusions

As soon as the new model and program of studies was approved by the university authorities – May 2000, a group of specialists and tutors started production of new electronic books.

A group of computer scientists, with the help of IBM Lotus-LearningSpace software platform, prepared an educational portal.

In October 2001, two hundred students enrolled and started education in a new web-based model of undergraduate engineering studies.

References

Minoli D. (1996), "Distance Learning. Technology and Applications", *Teleport Communications Group*. Stevens Institute of Technology. Artech House, Inc.

Taylor J.C. (1999), "Distance Education: the Fifth Generation", *Proceedings of 19th ICDE World Conference on Open Learning and Distance Education*, Vienna-Austria, June 20-24.

Kaskine T. et al. (1999), *The great Paella Cookbook for online learning,* Universidad Politecnica de Valencia & Helsinki University of Technology.

Michau F., S. Gentil & M. Barrault (2001), "Expected benefits of web-based learning for engineering education: examples in control engineering", *European Journal of Engineering Education,* vol. 26, pp. 151-168.

Farrel G. M. (2001), *The Changing Faces of Virtual Education,* Vancouver, Canada, The Commonwealth of Learning.

15 The Knowledge Economy Iceberg Meets the Good Ship Education

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Abstract

This paper reports on an institutional response to the findings of two international Delphi investigations. Although a local response, the principles and the software can be applicable to a variety of institutions at all levels of the educative process.

ICT offers enormous potential for education. However, many of its applications focus on the more straightforward area of resource provision. By 2002, there is no shortage of content, either educationally or commercially generated.

One of the more valuable applications of ICT though, and one that is largely overlooked, is that of managing the learning which is to take place or taking place. Content can be linked to a management system but is often more economically provide by a third party. For educational institutions at all levels perhaps the more crucial operation is to flexibly manage the learning that takes place. Moving digital emphasis from content to management is not yet a common consideration.

Eltham College has developed a prototype for a truly integrated learning management approach. It is presently based on formal schooling years (in our instance, from age 3 to 18) but offers solutions to a far wider set of conditions.

The Eltham model offers parents in their homes an online "Knowledge Community" that provides them with complete course/learning programs, selected assessment processes, rationale for that assessment and reporting on their students progress on a daily basis or on the basis of their students progress. The student has similar access, though more detailed in terms of the actual learning process. At all stages, both students and parents have direct access to the teachers involved. The system that results is one in which all parties to the learning process are clear on the intentions and activities as well as actively and interactively involved.

Eltham has firmly based their learning model on the community concept in which all participants of the learning process are involved and all processes are readily transparent.

In the post compulsory model, beyond state compulsory schooling requirements, the involvement of parents as a key layer group is not necessarily relevant. There is a growing school of thought, in Australia at least, that parent involvement at tertiary level has distinct advantage, though much less easy to involve both in legal and practical terms.

The net result of the digital community established is a greater flexibility of educational opportunities combined with a more transparently managed learning process. Students are aware of their learning progress, able to choose more widely how they wish to learn, when and where. Learning has become for them more supportive because they are a part of a learning community, with clear links and clear support mechanisms.

Keywords: learning, knowledge economy, knowledge community, transparent education

1. Introduction

In 1912 the captain of SS Titanic, either chose to ignore the larger part of the iceberg that confronted him, or refused to accept it was a problem for him. Either way, the results are history. His ship was one of the largest in its time, one of the most modern, hi-tech devices of its type. It represented a huge investment of time, skill and development. It sank all the same.

Education in the twenty-first century faces a number of issues – not all of them positive. In a climate of uncertain economic futures educational institutions at all levels face escalating costs, increasing competition for students and for funding. Many tertiary institutions, especially those operating within a "western" culture context, have become highly commercialised. This tends to be reflected by increasingly vocational targets for courses and stronger competition for available research and corporate funding. While the move from a "general" education to a specific one is not necessarily bad, there are potential threats. One of those already being faced by some is the growing number of courses that require constant review and frequently, constant capital outlay. The range of IT courses are possibly the best examples of these. Do we teach to Windows 98, 2000, XP or what? Are the more specific directions of courses producing the necessary "global" citizen of the next generation?

These and similar challenges are presented to educational administrators and educators generally, within the context of rising costs, especially those relating to the technology. Hardware is expensive but necessary. It is constantly in need of upgrading as the software changes even faster than hardware. Further, while the equipment is constantly changing, one of its major uses is to provide ever-faster access to ever increasing quantities of data and information. This, in turn requires constantly growing bandwidth so that the access is possible. And so the cycle continues.

Resolving at least a part of this dilemma requires some new or perhaps revised management strategies. Taking what might be a micro view for a moment, libraries of the nineteen fifties,

whether educational or public, were generally viewed in terms of "storehouses" (Dowler 1997, p.158-9). Systems were in place, constructed on the basis that users could enter the four walls if the library, locate the resources they needed there and then, massage those resources to suit their needs and emerge into the sunlight complete with their new knowledge and ready to tackle their next project.

Today, libraries rarely admit to holding all the necessary resources. Their managements accept that there exist new sources and resources beyond the physical buildings. Development of the intranet as a public tool forced those considerations on them from the early eighties. The modern library is more of a gateway to information (Dowler 1997, p.159, Prytherch 1998, p.5), a place where communication tools and trained search staff meet with the information seeker to begin a magic carpet ride to a "whole new world". This change in library nature has brought with it a drastic rethink of the way libraries operate, their physical construction and the skills required by their staff.

Similarly, it is necessary for educational establishments and administrators to review, continuously, their management strategies. These strategies are essential to avoid the good ship Education being wrecked on the Knowledge Economy iceberg. No longer can any particular institution be seen as sufficient to itself. We work in a highly interactive world. Our learners already operate in a far more connected way than most of their instructor generation and will move on from us to live on a "stage" largely unfamiliar to us.

2. A new learning Paradigm

The context of learning at the present time is different. One only has to pick up any of the current books on lists of popular children's literature to find that times have changed. Words and concepts are regularly available to children today that were not acceptable even a generation ago, in readily available material. Mass media content too reflects a new "morality". The context of growing up, is different.

Running alongside the literature and mass media is the development of technology that has dramatically changed the way even very young children communicate. For almost a generation, young people wrote few letters. Telephones were readily available and voice communication saw letter-writing skill almost die out. More recently, children of all ages have rediscovered writing in the form of email and text messaging. At the same time they have reinvented phone communications in a mobile context (one of the largest selling Christmas gifts for under 12s in the UK last Christmas).

There are many other examples. We do work as educators with a different student to that of the eighties, and maybe even the nineties as well.

Post compulsory schooling, the tertiary years in particular, face all the same issues. Electronic information is expected, with many of our learners far more proficient in processing data (and misappropriating it) than we are. The use of libraries is one clear example of this. Online resources are expected and used, sometimes exclusively. Library managements have had to face increasing pressure to offer their materials on line and where some have been better at this; they have frequently become a focus for users in many geographically different areas, perhaps to the determent of local institutions.

Internet resources and their extent has seen dramatic change with whole libraries of full text materials now available on a wide variety of topics. To these can be added an even greater number of partial providers or extract and indexing services.

In the teaching/learning field, most establishments now operate some form of "online" learning program.

Clearly, where our students are coming from and the way we are being "pressured" to deal with them, is creating a whole new learning paradigm. Once upon a time it was "good" teaching practice to stand at the front of a group of students, take 50 minutes of their time lecturing them and then retire quietly to an office safe in the knowledge that they would have gained considerable information if not knowledge. Highly motivated persons might add a few flourishes on a chalkboard to that formula – they were the radicals of the 1960s.

In the present age, PowerPoint's, interactive whiteboards and other assorted technologies tend to be common. Not necessarily because, we have discovered they are better, or because we can do it (though these might play their part) but because, we are more or less expected to be "modern".

Providing the technology, managing it, and managing student learning in and around it, has created a new dimension for the management of learning. Both the teacher and the administrator have needed to become more creative in terms of financing an increasing technology and in terms of providing learning that fits a different paradigm.

3. New Management Strategies

Two very important considerations face the educators of the new millennium. One, perhaps the first to be dealt with, is the "how" of learning - the mechanics of accessing information, of processing it and assimilating it. The second, and very much related one, is the "who" of learning - who is involved and where they can be located.

Information overload is virtually unavoidable in the present century. Growth of IT in all its aspects has opened the floodgates. As educators we need to stay mindful of this. It is a problem all our learners need to cope with, especially the younger ones, but equally the not so young. What help can we offer? There are three issues here. The first is one of access - How much? How little? or simply, How? We need to budget for bandwidth. One consultant recently wrote:

Until this point in time the vast majority of schools have been dabbling with Internet links and indeed their whole telecommunications. Most are using 56K, or 64K or 128K

ISDN connections. In relative terms those connections are but garden lanes to the networked world. You should be planning to move in the very near future to broadband – 400 K plus – connections, the now clichéd 'information highway', with its facility to carry multiple services. WA has opted in general terms for a10 Meg – or 10,000K - standard for its government schools. (Lee 2002)

His allowances for schools need to be multiplied many, many times for tertiary institutions. And that is only the beginning. It is no longer a question of "will we" but one of "how much", and that question seems to have no accurate answer. Tied to the issue of bandwidth is the one of understanding the material access thereby. Learners need the comprehension tools for this understanding. Many establishments, including some governments, are already emphasising information literacy. It has been around in some form for many years. But what does it mean in the context of our current information overload and what will it mean in the future. Has the development of IL concepts over the past twenty years or so helped us prevent overload?

Clearly, one aspect of information literacy is more vital now than ever – that of evaluation. The Internet has certainly increased the amount of information available to each one of us, but are we any more discerning? Technical improvements that take advantage of greater bandwidth have usually worked well to deliver more information. Is it better information? How can we tell? Larger servers do not provide us with any assurance of valuable information. Improvements in software do not seem to have moved us far in this direction either.

In 1996, the Online Meeting in London featured a stream of discussion as to the importance of human intermediaries, people skilled at evaluating material and teaching evaluating skills to users. That meeting also featured considerable debate on issues surrounding quality and evaluation (Raitt and Jeapes 1996, et.al). Four years later, the importance of evaluation and quality were still being debated (Kerr 2000, et.al). Meanwhile the amount of information to be evaluated had obviously kept growing. If the issue presents difficulties at a theoretical level, have can learning facilitators cope with it at a practical level and on a daily basis?

The transition from information to knowledge, the essential product of "learning", needs to take place within this sort of difficult ecology. The raw material, information, needs to be complemented with the tools to unpack it, understanding, evaluation, etc. Only once they have the tools can the learner be successful in converting the information to knowledge.

This matter raises the second important management consideration – that of the "who" in learning. If tools are needed to unpack all of the information available, to select from it and make sense of it, where do these tools come from? One weakness in early ICT applications was the "unguided" nature of those initial approaches. Five or six years ago, in the full heat of the internet excitement, it was sometimes considered enough to simply provide a linked computer on the employee or learners desk and they would find the required information and become instantly knowledge rich. It was not long before the early, free access situations began to display some unwanted products. Intermediaries have come to be recognised as entirely necessary if real learning is to take place efficiently and effectively. Learners need not only the resources but also the skills to learn. These skills are acquired by transferral from already skilled people. Specialist training in access, evaluation and the other information literacy skills is required. Those skills are provided by specialists and the combination of learner and learning facilitator allows progress with learning.

So – navigating education through a Knowledge Economy requires a map, compass and crew. There are many dangers and the ocean of information is huge.

4. Traditional Online Learning

In the past ten years or more a number of educational establishments have moved into the field of "Online Learning". There are many reasons for this, not the least of which is capturing an entirely new "at home/work" market. Increasing multimedia interactivity has provided further encouragement to the online moves. In some instances, especially medical and scientific areas, it is far safer and more cost effective to learn by simulation than it is by practice – at least in early stages.

Online developments at the University of North London illustrate the value of interactive resources as a stimulant to learning engagement (French 2001). Combining technologies can further enhance the type of material that can be presented only in an online form (Farrimond 2001). For a variety of reasons then online learning is common, and growing. It brings with it considerable cost in terms of research and development. These costs can far exceed the financial resources of the establishments who wish to use them and so we have a potential for a great knowledge rich/knowledge poor divide.

A common factor with current online developments is the resources direction. Another is the concentration on web-based technologies.

4.1. Resources Online

Resource webs were a natural first step in the move to online learning. These were (are?) generally still built around libraries – both institutional and public.

In the past information management was to a large extent fixed and predictable. Glasgow (2000, p.300), in an article dealing with the origins of the Library Association (UK), noted that libraries in the early part of the twentieth century could be characterised by their staff who were "learned, distant and affable". Collections were directed by a policy of "not what they want, but what is good for them". Emphasis was on "good" cataloguing, extensive bibliographies and comprehensive classification systems (Glasgow 2000, p.300-

301). Academic libraries were formal though informed. Users were expected to select from what was available, limited as they were by the extent of the particular collection they were eligible to use.

Perhaps Glasgow best sums up the traditional library in his comment on the public libraries of Bootle, U.K., as a system with "many books, borrowers and readers" (Glasgow 1998, p.237). The description of a successful library in terms of its numbers of books and users ("real" not virtual) seems to typify the library information industry of the post-war period. Success or worth of libraries during this period seems often to be summed up, even by contemporary writers, in terms of the amount of material – the extent of their collection. As Hoare (1998, p.381) put it:

> The significance of public libraries, a major source of information – increased through the deposit of official documents.

This view of information provision was equally true of public or academic libraries (Hoare 1998, p.380, Cheng 2000, p.19). In either case the emphasis lay on extent of collection; a collection often imposed by staff on their users, and not necessarily in response to user needs or wishes. As Cheng put it:

> Until a few years ago, the pattern of information access was a discontinuous one. Our users were accustomed to searching the library catalogue or indexes for suitable titles then going to the shelves for the actual full text of books or journals (Cheng 2000, p.19).

Online learning in its early years tended to build on this situation and extend it. Online learning generally took the form of online resources including, quite often, the actual curriculum materials for the course involved. Engineering at Monash University (Aust.) for example, offered "online learning" consisting of entry digitally to a portion of online materials available from the library together with a digital copy of the course workbook previously distributed to students in print form. The only concession to interactive "learning" made, was that tutors emails were included as appropriate.

4.2. Web-based Online services

More recently, a number of institutions have seriously rethought this position. Learning is more than access to information. It includes a high proportion of interaction and reaction with and to resources. One outcome of the Delphi discussion in 1996 was clear indication that web based learning was to grow. As a result, ELTHAM put in place a program of revision in terms of curriculum and learning. At ELTHAM we first tried, as did many other Australian establishments, a Virtual Private Network approach with Citrix software running multiple Windows sessions. The arrangement was only partially successful. While students could operate software and applications remotely, the arrangement proved slow, trouble-prone and lacked the interactivity that made learning outcomes more positive. Additionally, learning could not in any way be tracked, planned or managed. Greater flexibility was needed together with more room for interaction. Our decision to move away from a VPN solution is presented at http://www.elthamcollege.vic.edu.au/arthur/ERResources/VPN.htm.

Like many others we now operate a web based system. This gives us the advantages of speed and cost savings – both hardware and software.

5. A Learning Management System

As conceived at ELTHAM and Corskill, a Student Learning Management System (SLMS) provides a managed environment in which learning is facilitated. It manages the conditions for learning but does not provide the material on which the learning is based. It DOES provide a number of gateways to sources of that information.

ELTHAM has taken the base concept of the SLMS and built round it a Knowledge Community made up of all the stakeholders in a school learning ecology. The Corskill Knowledge Community is a similar model based around tertiary vocational training. While neither is specifically directed towards current university practice, the principles and even the system can be tailored easily, and would suit any digitally biased learning environment.

5.1. The Knowledge Community

A knowledge community can be defined as a community in which knowledge is shared, valued and created. It is an environment where access to information is extended to include response, reflection, discussion and true knowledge building. It is most productive when the knowledge that is so constructed is also itself stored, shared and reflected by all parties in the community.

At ELTHAM, our Knowledge Community connects learners, their families and their educators into an interactive and transparent learning environment. It is the front face of our college timetable, database, archive, reporting and curriculum systems. It makes learning transparent; all stakeholders can view and participate in the learning program. It is a single point of access for all our stakeholders designed specifically to simplify and clarify all aspects of the learning process. It incorporates the requests of all stakeholders so as to meet their needs better.

At the heart of this community is the Student Learning Management System (SLMS) that provides and maintains the data necessary to allow the dialogue between learning materials and human participants.

5.2. The Student Learning Management System

As applied at ELTHAM our SLMS links together all the shareholders in the learning process – in our case, students, educators and parents. It links to the timetable, the student

database, the financial records and a digital archive system. By using a friendly front face, the intention is to build confidence in our users as well as leave positive images of learning. Our concern has been to provide a system that:

- Links all stakeholders together in an environment of shared responsibility
- Guides learning pathways – "gateways"
- Points to resource people
- Links learner and intermediary
- Links learners to each other
- Adds in other stakeholders, eg. Local business
- Defines outcomes
- Links learning to outcomes clearly
- Establishes life-long patterns
- Stores and archives material – cuts down email clipping distribution and provides open access for user selected items.
- Gradually eclipses email
- Rewards and encourages knowledge sharing

5.2.1. Operation

The intranet is operated on the basis of easy access. Connection to it is possible from any machine in the college (and most rooms have at least one computer) or through the remote access VPN. Thus, the various players can add material; take part in discussions or view specific information with relative ease. Considerable work has been undertaken to ensure that the front end is logical and attractive as well as easy to use. Further, considerable effort has gone into providing areas of the intranet that will encourage participation. Chat sessions, interactive material, learning activities that require involvement (games) and even travel hints (add your own) sections encourage engagement and give a real sense of involvement in the whole learning process.

With student management integrated into the web, assessment and reporting has been made as simple as possible while recording results, making judgements and providing assessments are all possible as frequently as staff wish. This arrangement allows a parent or student to log in and check their progress at any time as well as to compare their progress with the requirements and expectations of the course. This arrangement is intended to build on the learning process adding a sense of responsibility as well as removing any "mystery" or uncertainty that might affect a student's progress.

Importantly, while class work sections offer a place for actual course materials to be provided, staff is encouraged not to spend unnecessary time developing learning materials otherwise available. While the Internet is not a giant library in the sky, much material is none-the-less available in electronic form at reasonable cost. A digital learning environment takes advantage of that material by providing gateways to it. Where a really managed environment differs from others (eg. A bulletin board style) is in the ability to flexibly move from item to item in a multitude of pathways. For this reason we have concentrated on a fully interactive web based learning system rather than the bulletin board style. This makes learning to use the system a little difficult but it does enhance the learning that can take place. By providing a multitude of different pathways towards some very definite outcomes that are visible from the start, we plan to allow learners freedom to learn as well as direction and value for their efforts.

5.2.2. Mechanics

To keep the whole arrangement very simple as well as to ensure maximum participation (even our grade 2 are contributing web pages) we have standardised on common software. The network is MS Win 2000/NT4, with web construction using MS FrontPage and Flash. Corskill provided the framework and interactive mechanics and our own data program provides the spreadsheets on which the web system operates. Wherever possible, web based software tools are accessed directly from a "tool bar" at the foot of each page. This toolbox varies depending on who has logged in (simpler packages for the younger students) or what area the user is exploring.

The system is not expensive. Cost–wise the total package would be well within the reach of most averages sized/funded educational establishments. Add-ons can and do cost extra. The extent of infrastructure to support such a system and the size of physical establishment will also impact on cost. However, the returns on such investment can be exciting – not necessarily in terms of financial gain but certainly in terms of client satisfaction and particularly in terms of capitalising on the enormous intellectual capital resident in educational communities and often not more than partially realised.

5.2.3. Flexibility

A structure like that established at ELTHAM allows a new dimension of flexible education. Using the intranet a range of tasks usually carried out in the classroom can be to electronic delivery. This allows more freedom in the way face-to-face teaching can occur as well as providing greater individuality in presentation.

New forms of assessment can be tried, some of them automated, including arrangements that mirror the workplace environment and better prepare the learners for the "real" world. Chat sessions on set topics are easily established and work very well in the areas of mathematics and science where students can bounce ideas off each other while the teacher takes a less active role. Staff and/or parents at various levels can monitor cooperation and peer interaction of this type, guest specialists may be involved, and interaction with other schools or other countries/cultures can be arranged.

Greater flexibility of delivery allows a whole new direction in the learning experience. More individuality, greater control by the learner as to outcomes and more ownership of the process combine to improve the outcomes and build confidence as well as life-skills. Bringing about this development though, has required some effort at change management.

5.3. Managing the Change

As can be imagined the concept of placing together into a very visible location, learning content, methods of assessment and the actual assessments given has been a major change in thinking for some educators. Issues of responsibility and professionalism have been highlighted. It as a new and sometimes a worrying idea to think that students can access the curriculum they are to be presented with while at the same time shown ahead of time what outcomes are planned and how those will be assessed. Initially some staff were worried that they could no longer "hide". Some too, were concerned that parents and students would be critical of their programs or would choose programs offered by alternative staff who might have "lighter" programs.

In the event, as is often the way with change, few of the fears expressed have been realised. Considerable technical and writing assistance was provided initially to staff so as to get their material published. Some support continues, though most staff lean towards maintaining their own work.

Concerns over increases in workloads have similarly proved groundless. While in the early stages the "safe" players tend to double handle "just in case", the platform on which we operate, because it is both simple and conventional, has quickly given confidence. Again, adequate starting support (and a few well placed financial bonuses) was important in getting the change started. Special assistance was offered in the early stages to staff identified as natural leaders. These could then be relied upon to help encourage others.

With most content and process on view, there is not the level of unnecessary email that has been seen, especially in tertiary institutions, when material has been put "online". Initial fears of flooded email intrays has not resulted, especially where staff have provided clear instruction and support material. Again, the level of learning design support that is offered to staff is important. A sound bases for course construction saves much time and anguish at later stages.

In all areas, staff and students have been encouraged to question learning material, assist with its preparation and presentation – much of the web material is maintained by the students on behalf of staff. Wherever possible and as much as possible, all stakeholders have been encouraged to participate in decision-making as to design, content and appearance. Parent forums, staff-student training days, evening problem-solving suppers and various other arrangements have been provided to assist with this.

Certainly for us, one of the most powerful agents of change has been the student themselves. While adolescents are not known for their desire to have mum and dad see their results first hand, they are very ready to offer advice and technical support to computer based projects. By involving them in the technical and content areas, they have generally been far more accepting of the visible information issues than might otherwise have been the case.

5.4. Quality Control

One of the anticipated outcomes of implementing a student management arrangement of the type Corskill and ELTHAM have developed is that of quality assurance. In a learning environment where the learning transaction is rather transparent, where material to be developed is visible alongside assessment processes and results – there exist certain checks and balances.

An important feature of the SLMS has been its linking of outcomes, material and assessment within the context of easy communication with the educator. Such openness was initially (for some, more than that) something of a challenge to staff. Fortunately, ELTHAM is blessed with a particularly dedicated staff and most saw quickly the value of opening their program for comment, analysis and evaluation. In our environment of flat managed teams openness was paired with mentoring and peer review. Teaching has become more of a team consideration with parents and students viewed as part of the team rather than as recipients.

This is an important step in reshaping the learning context as well as a means of providing ongoing evaluation and quality control. Staff are more often asking themselves why they teach what they teach when they are working within a context of transparency. Self-evaluation, peer review and collaborative learning have all been enhanced, and will continue to be constantly reviewed and enhanced in the future.

In the post-compulsory context, the role of parents is naturally reduced. However, the value of openness, with its peer review and collaborative learning corollaries, remains. Learning needs to be both visible and logical for the learner to form clear views as to the value of learning generally, of specific learning materials and of the value of the intermediaries concerned. Where these are all clearly visible, attitudes to learning and willingness to become a life-long learner (and thus, incidentally, of more economic benefit to the learning institution) will be more positively developed.

5. Technical Considerations

The basis for the SLMS depends very much on existing software's. In most cases, educational institutions will be committed to expensive business software systems. These may or may not incorporate elements of a student records managing type. To cope with these problems at ELTHAM we chose a software development that we could use as a basis to

design our own community. Based on MS Access, this software is simple and very adaptable.

A primary requirement of any modern application of technology to education is a stable platform on which to build. There are some important considerations in this regard. If Australia is anything to go by, and I do realise we are perhaps more insular than our European cousins in some ways, lack of comprehensive forward planning has been a key problem for educational institutions.

This is not the criticism it might sound. One difficulty already mentioned is the speed at which technology changes. Add to this the size of many Universities and schools as well as their diversity as well as commercial considerations, and planning of integrated technologies becomes something of a nightmare. However, it must be done. Technology is too expensive to allow funds to be allocated without it. For these reasons, technology is often viewed by management as something of a "black hole" in their budgets. Money disappears into that hole with frightening rapidity but not much in the way of visible result can be seen.

6. Conclusion

In conclusion, the models established by ELTHAM and Corskill are based firmly on the premise that no institution can provide economically, all of the learning materials need by their clients. Further, it is assumed on the basis of the comments above, that learning best takes place in a complete ecology of learning where intermediaries, stakeholders, materials and specialist skilled intermediaries share the burden of collecting, sorting, evaluating, interpreting and assimilating the information found to be most suitable. While technology can often overwhelm, it is possible to harness it in such a way that the best possible learning outcomes can be realised.

As with any workable knowledge management scheme, that implemented at Eltham College functions in relationship to its ease of use and value to the user. By making required materials and functions easily accessible, the various players are encouraged to participate and the vehicle quickly becomes also a means to its own growth.

Change has been facilitated by a steady emphasis on ease of use as well as a systematic program of involvement at many levels. Without this move to involve people from where they are (or were) we could not have expected the level of involvement we can now enjoy.

Returning to our starting point … what we have attempted to achieve is a technology application that might not be biggest or best but which is manoeuvrable. Firstly, we should be able to navigate through the knowledge economy iceberg field. Secondly, we have attempted to navigate out system according to the best possible sources of information, learning from the mistakes of others and profiting by them. In this regard, the Delphi studies have been enormously helpful in identifying future directions. What we hope to have achieved is a vehicle, a ship if you wish, that will enable a safe and sensible journey through the ice fields. There are lifeboats aboard – we still rely principally on real live teachers and their teaching skills. Steering our ship is not the task of a single captain but of a unified learning team made up of all the stakeholders – all of those who are most interested in keeping our ship afloat.

Finally, it is important that the learner themselves can see learning as valuable, even exhilarating, so that a realistic outcome of life-long learning, a learning that can provide success in a changing world, is a possible outcome. At ELTHAM, we have a fair bit of fun on board the good ship Education.

Further information

More information on the SLMS and its philosophy together with copies of presentations on this subject, can be found at http://www.elthamcollege.vic.edu.au/arthur/infosystems_home.htm

Demonstration sites

http://corskill.com.au/Cor_Website1/

References

Cheng, Yin Cheong and AK, Allan 1997, Multi-functions of school-based teacher education, *International Journal of Educational Management*, 11(2), from *Emerald Library* (database), MCB.

Dowler, L (ed)(1997). *Gateways to Knowledge*, MIT Press, Cambridge, Massachusetts.

Farrimond, B (2001). Teaching with Dynamic maps on the web, BITE 2001 Proceedings, Netherlands. p.10.

French, F (2001). *Online Learning Resources – the students' perspective*, BITE 2001 Proceedings, Netherlands. p.11.

Glasgow, Eric 1998, Bootle's first public library, *Library Review*, 47(4), p.233-237.

Glasgow, Eric 2000, The origins of the Library Association, *Library Review*, 49(6), p.299-302.

Hoare, Peter 1998, The development of a European information society, *Library Review*, 47(8), p.377-382.

Kerr, J (ed)(2000). *Online Information 2000, Proceedings*, Learned Information Europe, London.

Lee, M (2002). *The Practicing Administrator,* Vol.24(2).

Prytherch, R (ed)(1998). *Gower Handbook of Library and Information Management*, Gower, London.

Raitt, D and Jeapes, B (eds)(1996). *Online Information 96, Proceedings*. Learned Information Europe, London.

16 A Gradual Process for Integrating E-learning in a Higher Education Institute

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Abstract

We describe an incremental process for integrating E-learning in a higher education institute. Our basic assumption is that the burden of integrating E-learning lies mainly on the shoulders of the teachers. We suggest a process based on XML technologies that enables the teachers to: (1) separate content from presentation and concentrate on content (2) develop learning materials incrementally and implement easily at each stage (3) reuse any learning materials they have already prepared (4) reuse learning materials prepared by other teachers. In this paper we describe the process along with the various roles of each of the following: the technology, the support technical team, the individual teacher and the evolving community of practice.

Keywords: XML, incremental development, reusability

1. Introduction

Integrating E-learning in a higher education institute is not an easy task as it involves several groups of interest (such as students, teachers, technicians, policy makers etc.), as well as different kinds of considerations (such as economic, quality assurance, organizational etc.). Because of the obvious complexity it make sense to do it gradually, in scalable steps. Scalability is considered a desired characteristic, but the main question to be answered is the nature of the scalability, on which dimensions the scalability should be planned. In this study we propose a way to implement some dimensions of scalability for integrating E-learning in a higher education institute. The burden of integrating E-learning lies mainly on the shoulders of the teachers, therefore, any planned process should take into account the capabilities and limitations of the teachers and should be directed at steps and manner that suit each teacher. The technology that enables this is based on XML, where it is possible to separate between issues of content and issues of presentation. In this way we can have a relatively small multidisciplinary technical team that deals with the implementation issues, while the teachers can concentrate on the content and the ways they would like the content to be presented for effective learning. Teachers can get more and more creative and can integrate more and more interaction possibilities as the experience with the course evolves and as the overall experience of the college teachers evolves. XML is a language of tags that enables the tagging of content elements for the Internet. The pool of tags that one employs is defined by a schema that enables to distinguish (automatically) between adequate tags and other strings. Our plan is that this schema will be defined gradually according to the various possibilities that teachers employ in their online courses. The set of useful tags is expected to evolve through the teachers' experience with online learning and the expected (and encouraged) interactions and influences within the teachers' community. This is the scalability we want to employ and implement - a gradual construction of XML schemas. The advantage of our approach is that the metadata tags, which is the principal concept of XML, evolve from the teachers' conceptions, as opposed to metadata tags defined, and so forced on, by external experts. This methodology enables the teachers to develop a course according to their own conceptions, expressed by their choice of metadata tags, for their further reuse. The use of these tags will result in an automatic translation to an online learning unit. Teachers will be guided to evaluate the results and describe their further expectations of presentation, interactivity etc., which will be considered for the next stage of the XML schema. The task of the special technical team is to guarantee the respective proper presentation for each teacher processed material along with the development of an integrated dictionary (of metadata tags) for a group of teachers. This dictionary enables reuse of learning material at the organization level. The whole process is iterated for a gradual process of integrating E-learning in the educational activity of our college.

2. Integrating E-Learning in higher education - ways to go

We see the teachers as the most important factor determining the success of E-learning implementation program. Teachers can be viewed as the bottleneck or barrier on one side and as the principal carriers of change on the other hand. Several approaches can be employed to empower teachers. One approach is to introduce an e-learning delivery system such as WebCT, BlackBoard, HighLearn etc., which are easy to use and can be a platform for already prepared learning material. The main disadvantage here is that usually this approach does not involve any meaningful change in the learning materials and learning methods, in a way that takes advantage of the computer. Another approach is using authoring tools such as ToolBook, Authorware etc. A disadvantage of this approach is the time it takes to learn to use such a system. With both

approaches usability of learning materials by the same teacher in another context or by other teachers is problematic.

Use of XML technology, which will be described in more detail in the next section, enables separation between content and presentation and so provides a way to deal with some of the disadvantages just mentioned. Because it is possible to let the teacher not bother with the presentation, it is a lot easier for him to prepare the learning materials. This separation of content and presentation also enables reusability and gradual development of learning materials in incremental steps that can be tried and evaluated.

Fitzpatric (Fitzpatric, 2001) describes an XML approach to creating an interactive multimedia learning environment for science curriculum. The motivation for using XML in this project was that certain parts of the same basic content or learning material may be required to respond to different learning occasions, e.g., a lesson, a tutorial, or an exploratory exercise. Cap (Cap, 2000) advocates the use of advanced mark-up techniques for computer-based education, especially for standardization of content structuring and usage patterns. Use of XML technology can be further used for dynamically generating interactive course adapted to the student's goals, preferences, capabilities, and knowledge; as demonstrated in the ActiveMath learning environment (Melis et al., 2001).

Our approach is similar to the previous examples with regard to the use of XML technology to enable flexibility and reusability, but our overall goal is different. Our goal is to establish a process of integrating E-learning in our college, a process that is incremental and adhere with teachers' conceptions, habits and limitations, as opposed to forced standardization. The following sections elaborate on the use of XML and related technology and how the teachers can use it.

3. XML technology - What is it and what does it enable

XML stands for eXtensible Markup Language. XML was designed to describe data. XML tags are not predefined; one must define his own tags. The idea was to construct a genuinely open standard, driven by user needs. These needs include:

- **Extensibility**, to define new tags as needed.
- **Structure**, to model data to any level of complexity.
- **Validation**, to check data for structural correctness.
- **Media independence**, to publish content in multiple formats.
- **Vendor and platform independence**, to process any conforming document using standard commercial software or even simple text tools.

This list of users' needs, which motivated the development of XML, is exactly what is required for designing E-learning materials.

It might be worthwhile to explain what is XML by contrasting it with the familiar tagging language HTML that is used widely in E-learning. HTML is a tag language (more formally, a markup language) -- a set of standard delimiters with standardized meanings that can be put into documents in order to indicate the role of particular pieces of the document. XML on the other hand, is a technology that allows the creation of an unlimited number of different markup languages for different purposes. The point of XML, is that all the various special-purpose languages that can be defined using it can be parsed by a single standardized processor small enough to be built into every web browser. This is the reason that XML is becoming so popular.

Along with the use of XML technology for content, XSL technology can be used for presentation. Presentation files, or stylesheets, are based on XSL (extensible Stylesheet Language), a sophisticated language that visual designers can use to define page appearance. The XSL stylsheets are applied to the XML content files to obtain files, which can be viewed using any web browser without special plug-ins.

XML tags have two major roles (Mizoguchi, 2000): (1) explication of class for each specified text in the document and (2) define arbitrary "data structure" for interpretation of the multiple fragments of texts. These tags provide metadata, which is a data of the data (the document). Examples of XML implementations already exist for chemistry via the Chemical Markup Language - CML (XML-CML.ORG, 2000), mathematics via the Mathematical Markup Language - MathML (Kamthan, 2000), and music via the Music Markup Language - MusicML. There is also development of XML standards for Higher Education www.PESCXML.org .

We do not strive to compliance with some standardization efforts. We can use them for some inspiration, source of requirements or terminology; an inspiration and not constraints. We want the teachers to use their own tags and maybe get some consensus among themselves on some sets of tags. Big standardization projects are motivated by the idea of publishing learning objects, while we are motivated by supporting teachers in using XML technology in a way that enable reuse of existing learning materials and enable easy modification and immediate testing. Such requirements make it easy to reuse learning materials for different levels of students and for different versions of a course.

4. The process

The aim of our paper is to describe the process for the incremental implementation of E-learning in a college. As was stated before, the teachers are the most important factor determining the success of an E-learning implementation program. A basic assumption is that a higher education teacher has already some viewpoint on the subject matter he teaches (significance, issues to emphasize, relation to other topics, etc.) and also a teacher has some viewpoint on how this subject matter should be taught (sequence, type of tasks, media for demonstration etc.). Beside the viewpoint, a teacher usually has some teaching materials he had already accumulated, prepared and used. Different topics have

different terminology, different learning objectives, different emphasizes etc. For example, in mathematics, a proof might be an important learning object (or objective), while in political sciences a debate is an important learning object (or objective). We envision a process that enable a teacher to stick to his conceptions of the subject matter and to the way he believes this subject matter should be taught. According with this basic guideline of ours, we provide the teacher with open and flexible facilities to put his course on the web. We provide him also with various facilities to share and negotiate possible tags with other teachers and the technical team.

The incremental process we are talking about is actually combined of three incremental processes for: (1) an individual teacher (2) a group of teachers teaching similar topics (such as teaching programming with different computer languages to varied audiences) (3) the whole group of the college (or any other higher education institute) teachers. A technical team supports all these incremental processes. The vision is that a teacher gradually improves his course by adding content, adding interaction facilities (interaction with the learning material or interaction among students) etc.; through reuse of his learning materials and maybe even learning materials of his colleagues. The group of teachers of similar courses incrementally (with the help of the technical group) establishes a mutual dictionary (of metadata tags) that enables sharing and reuse of learning materials. And as for the third process, the college gradually establishes norms and procedures for developing E-learning within the college, which enable reusability, collaboration among teachers and some standard interaction facilities for students.

5. The technical support team

The technical team is an interdisciplinary team, composed of programmers experienced in Internet technologies, experts in graphics and interface design, and experts in instructional design. Experts of interface design and of instructional design are faculty members. The technical team is expected to support the teachers while the emphasize is on support initiated by the teachers, not support that is imposed on the teachers. The support is combined of guidelines for using XML technologies, examples, and support for communication and negotiation of XML tags' meaning among teachers, especially among teachers from the same or similar subject matters.

On top of supporting the teachers through the creation of XML files, a major responsibility of the technical team is to enable reusability of learning materials. The support for the individual teacher should promote the reusability of learning materials by the same teacher (e.g. an example that demonstrates several principles, an exercise that serves also as an exam item etc.). For reusability among teachers, which can make E-learning commercially attractive, the technical team should look carefully into the "dictionaries" of the individual teachers, check for parallel notions and initiate meaning negotiation processes between teachers. Such processes, beside enabling a common dictionary, are very important for the college ongoing process of making sure learners are getting a coherent and relevant view of their field of study.

6. The development process from the teachers' perspective

It might be instructive for understanding the overall process to describe the development process as seen from the teachers' perspective. The technical team gives the teachers basic guidelines along with some examples. The basic guidelines include the following:

- Introduction to XML.
- An editor and instructions for writing XML documents.
- Explanation of the use of "name-space" and the requirement of distinguishing between tags of pedagogical meaning (such as lesson, exercise) and tags related to the topic to be taught.
- A dictionary of tags that are mandatory.
- A common dictionary of tags that can be used.

Along with the guidelines, a teacher can get examples of the XML document other teachers had already prepared. With these guidelines and examples, what we call "starting bundle", a teacher can prepare an XML file for his course, using whatever learning material he had prepared before.

The technical team then review the file, prepares (or reuse) XSL relevant file(s) and shows the teacher the online learning material that results from the XSLT conversion. A process of corrections and improvements follows until a satisfactory online learning unit is produced.

From this point on the teacher can modify by himself the learning material; update, change, add examples, illustrations, exercises etc. After any modification, the teacher can also check by himself how it works online. The teacher, of course, can turn to the technical team for support at any stage. The whole process is depicted in Figure 1.

When a teacher prepares any new learning materials he can reuse the XSL files, which were already developed and used for particular presentations in his previous online courses. In this way the teacher can prepare new online courses by himself, with no (or minimal) involvement of the technical team. Figure 2 depicts this mechanism.

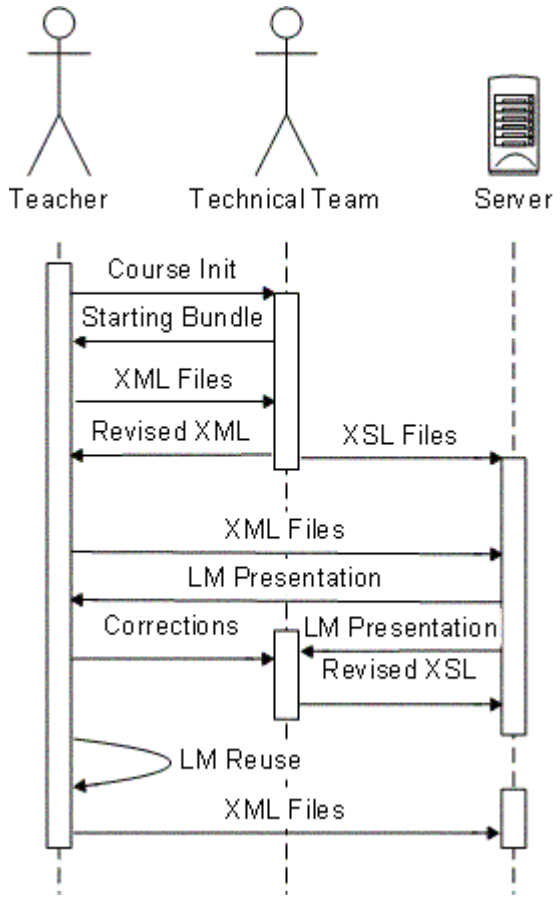

Figure 1: The process of online course development. LM-Learning Materials.

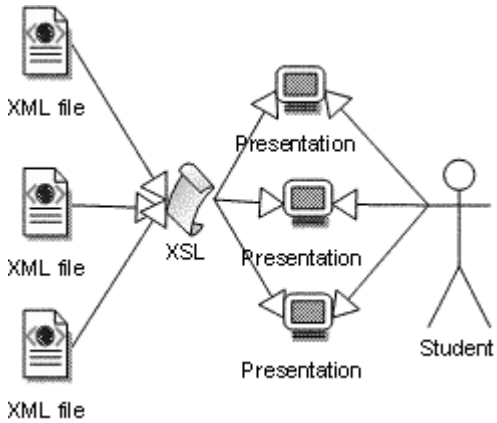

Figure 2: Mechanism for incremental development by a teacher. Once XSL file has been created, the teacher can present new LM in the same way without the technical team involvement.

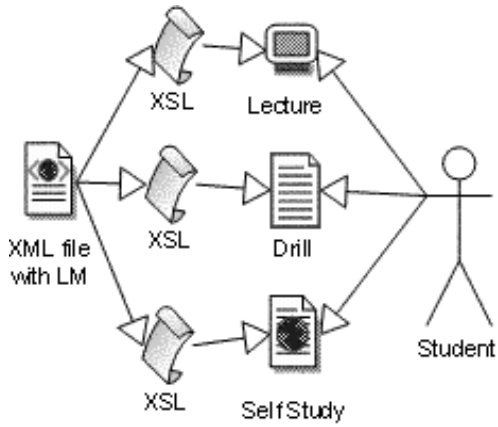

Figure 3: Mechanism for Learning Materials reuse. One XML file with different XSL files can present different part of LM in different ways.

Different XSL files can be used for achieving different presentations of the same learning materials. For example, a question with the respective answer can be used during a lecture for explaining an issue, but can also be presented without the answer for drill and practice. Figure 3 depicts this mechanism.

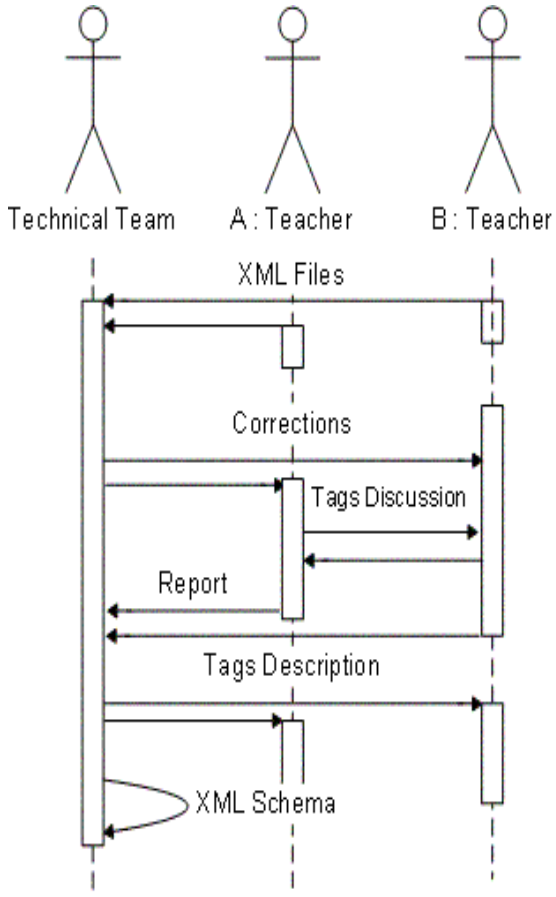

Figure 4: The process of shared dictionary development.

As more teachers are joining the process the pool of examples grows and the dictionary of tags expands. The technical team tries through negotiation with the teachers to establish dictionary tags that are agreed of by teachers of similar topics. These shared tags are necessary for reusability of learning material, which is a main goal of this project (Figure 4).

7. Discussion and future plans

Use of ICT in education should promote learning. This means that considerations about how to integrate E-learning in higher education should emphasize expected effects on learning. Many of the platforms used for E-learning do not enable the teachers the flexibility they need for supporting learning in various situations, for a variety of students etc. We argue that the use of XML technologies provides teachers with the required flexibility and reusability options. As for the higher education institute itself, use of XML technologies in the way we described, enables scalability of the integration process, reusability of learning materials, some uniformity in learning materials, and facilities for quality assurance.

In accordance with our view of the teachers as the main carriers for integrating E-learning in higher education, we were concerned with the needs of the teachers. The main advantages for the teachers that we see in our approach are:

- Teachers can concentrate on content without worrying about style and formatting.
- Teachers can reuse learning materials. These learning materials can be their own from before or during the process of creating an online course, and can also be learning materials of other teachers.
- Content modules can be used in other contexts (e.g. in related courses, for different skill levels).
- Indexes, summaries, glossaries etc. can be generated automatically.
- Evolvement of a community of practice. Through the dynamic establishment of shared dictionaries of XML tags, teachers (especially from related subject matters) dynamically create communities of practice.

Our future plans include the implementation and evaluation of this process in our college, generation of templates, and two research and development directions based on the flexibility that XML technologies provide. The generation of templates will facilitate the first stage of using this XML approach by the teachers. The templates will be based on instructional design principles, demonstrating typical pedagogical strategies. The two research directions we plan are:

1. Using the flexible rendering of the learning materials (by XSL files) to allow experiments with screen designs, navigation concepts etc.
2. Using XML technology for knowledge representation that enables adaptation of learning materials according to learners' needs, learners' profiles etc. The tagging mechanism and the respective schemas can be used for both the diagnosis process for obtaining a learner profile and also for an intelligent tutoring process that adapts learning materials to the learner profile and the context.

References

Cap, C. H. (2000). XML goes to school: Markup for computer assisted learning and teaching, *The European Journal of Open and Distance Learning.*

Fitzpatric, C. (2001). An XML approach to creating web-based learning environments, The 2nd Annual Conference of the LTSN Center for Information and Computer Science, University of North London, 28th-30th August, 2001.

Kamthan, P. (2000). Mathematical Markup Language, [On-line], Available: http://indy.cs.concordia.ca/mathml/.

Melis, E., E. Andres & J. Budenbender & A. Frischauf Goguadze & P. Libberecht & M. Pollet & C. Ulrich (2001). ActiveMath: A generic and adaptive web-based learning environment, *International Journal of Artificial Intelligence in Education*.

Mizoguchi, R. (2000). IT revolution in learning technology, *Proceedings of SchoolNet*, pp. 46-55, Pusan, Korea, August 4-5, 2000.

XML-CML.ORG (2000). XML-CML.Org - The Site for Chemical Markup Language, [On-line], Available: http://www.xml-cml.org/.

17 ICT-rich and Competency Based Learning in Higher Education

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Abstract

In higher education the focus is changing towards development of professional competence of students: Students learn to apply knowledge in professional situations. Their results and competence development must be measured and assessed, just as in professional life. Characteristic of these professional situations is innovation with ICT as integral part. The associated educational concept is known as 'competence-based education'.

What is competence? And how can it be developed and ascertained? A control structure of reviews and assessments for competence based learning environments is proposed. Authenticity is pointed out as an issue.

Three examples of competence based education are presented which are analysed with respect to control and authenticity.

Keywords: Control structure, Review, Assessment

1. Introduction

In their future working and professional environment higher education graduates are expected to effectively work in the "Information Society". This work is knowledge intensive and ICT-rich. Implied is a change from application of disciplinary topics to competence based working where knowledge, skills and attitudes are integrated across the borders of separate disciplines (Hammer, 1993). Traditional knowledge is not sufficient in these dynamic working situations. Knowledge has to be enhanced with 'know how', 'know why' and 'care why' (Duffy, 2001). Emphasis is on meta-cognitive competences and "Tacit Knowledge" [van Weert, 2002].

Students in higher education need a learning environment in which they can learn to operate at the level required for starting a professional career. The learning environment therefore should take realistic account of the future working and professional environment with the main focus on development of professional competences of students. The students learn to apply knowledge in professional situations; their competence development is measured and assessed, just as in professional life. This is the characteristic of an educational concept which is often termed 'competence-based education' (Hezemans, 2002).

In our society Information and Communication Technology (ICT) is becoming an ubiquitous tool. This is even more true in the professional world. It is normal for higher education graduates to use generic ICT-tools like e-mail, browser, text processor, but also discipline specific tools like Mathematica, SPSS or a database on law. These tools therefore also shold be integral part of the higher education learning environment.

2. Competence at work

2.1. What is competence?

In professional practice a switch is being made from job-based to competence-based working (Lawler III, 1994). The tasks of the professional have become more complex and involve both disciplinary and other competences (Hammer, 1993). The modern higher educated professional operates in multidisciplinary environments in various roles**:** for example in the role of facility manager, business consultant, informatics researcher. These roles are characterised by typical, professional problem situations which have to be dealt with. Professionals can be seen to have a particular competence in a particular role when they are able to solve the typical problems encountered in that role in a professional way. And professional problem solving implies use of a professional method, a professional way of working and a result conforming to professional standards. A typical example of this is medical practice.

2.2. How can competence be ascertained?

In cases where professionals deal with innovative problem situations, it is difficult to ascertain that the professional has a particular competence, because the problem solved is not standard In such cases professionals can account themselves and thus show that they have a particular competence. This accounting can be done in two steps: review and assessment. In a review professionals check their competence against criteria. The following questions have to be answered:

- Why is this problem situation typical for my competence?
- Why did the work process conform to accepted professional standards?
- Why is the result conform to accepted result standards?

In the assessment the professional proves to an outside expert that there are reasoned answers to these three questions.

A typical example of this is the way of working in innovative software houses (Symes, 1997).

2.3. How is competence developed?

While working on new problem situations encountered in the professional role, new competence is developed. Modern knowledge intensive organisations work in this way. They tackle innovative problems and thereby further develop their competence. This allows them to stay competitive in a demand driven, continually changing market. An example of this is business consultancy where changing demand changed the focus from making existing business processes more efficient to business process redesign. Many knowledge intensive organisations therefore turn out to be also learning organisations. Learning is done at all levels: business level, team level and individual level.

From the constructivist perspective competence is developed by doing (Duffy, 1993). From this perspective a model for academic education was developed at Nijmegen University (van Weert, 1995 A). The model was developed using established theories on learning, taking account of empirical data. Central in this learning model is a problem solving cycle which is practically identical with the professional problem solving described in Subsections 2.1 and 2.2. This supports the assumption that in knowledge intensive, innovative professional environments working and learning have a symbiotic realition.

3. Learning in a competence based learning organisation

Let us model competence based learning organisations after these knowledge intensive organisations which are also learning organisations.

3.1. Competence development at individual level

In competence based education students work in a professional setting where they have to solve problems, typical for the role they are learning to play. They have to adopt a professional approach to the problem and the result of the problem solving process has to meet professional criteria. They review their achievements against agreed criteria or standards. The result is twofold: they can show their competence at individual level and they learn how to do better still.

3.2. Competence development at team level

As in professional life students have to solve problems, in many cases multi-disciplinary in nature, in team work with other students. This team work has to be effective, conforming to professional standards. Students need to show competence in individual work, but also competence at team level. Team (peer) reviews reveal competences at team and individual level, at the same time allowing team and individual learning to take place.

3.3. Competence at organisation level

Teams of students work in an organisational context. This context decides what roles there are to play, which problems are worthwhile to solve, what methods are suitable and which results acceptable. Students have to show that they are able to work effectively in this context: Both the individual and the team have to show competence at the organisation level. The necessary reviews will also facilitate learning of individuals, team and organisation.

4. Control: Reviewing and assessment

How are the processes of work in a knowledge intensive organisation or business controlled? Take for example software houses where innovative software is produced. One can observe that control is realised through the following means:

1. The work is structured in projects in which teams work following a project method structuring their work;
2. At particular moments in time (typically at the start, when milestones are delivered and at the end) reviews and assessments are planned.

The advantage of this approach is that the same control mechanisms can be used, independent of the particular software developed. The focus is on the process of control, not on what is controlled.

Reviews and assessments typically deal with:

1. The individual professional role: effective role performance, effective problem solving and quality results;
2. The team professional role: effective team performance, efficient project work and quality results, effective communication and co-operation;
3. The organisation professional role: effective organisation performance, synergetic and cost-effective programme of work

An innovative software house has to keep pace with developments and therefore also behaves as a learning organisation. As a consequence there are also reviews and assessments on learning, both of individual, team and organisation. These reviews and assessments deal with:

1. The individual professional development (learning in the professional role);
2. The team professional development (learning to perform better as team;
3. The organisation professional development (learning to perform better as organisation.

4.1. Reviews

Reviews are forward looking. Professionals learn how they do and how to do better from answering "Why"-questions:

- Why is this a "rewarding" problem, both for customer and organisation? Or do we need to adapt our goals?
- Why is the plan to tackle the problem a "good plan": why will it work and why will it produce the desired results? Or do we have to adapt the plan?
- Why are the results produced by this process of the "right quality"? Or do we need to change the process or lower the quality?
- Why is the process of production and development efficient and effective. Or does it need interventions to do better?

Reviews are done against criteria or standards and lead to review interventions that aim to better the process and the results. From a knowledge point of view there is the interesting "by-product" of development of insight by the professionals. This insight allows for enhancement of competence, which is: learning.

4.2. Assessment

Quality of the review process is guaranteed through assessments in which review process and results are checked and judged by professional experts who are not part of the project. Assessments are not forward looking, but take account of the present situation. On the basis of their findings the experts will pronounce a "verdict" on the quality of the reviewing and review results and effects.

5. A quality control structure

On the basis of the above observations a quality control structure for competence based learning organisations can be constructed.

In the project setting in which higher educated professionals work, problems have to be solved following a professional method. Professional project methods identify milestones: Intake Check, Development Milestones and Final Result. Quality of process, results, role performance and personal development are monitored throughout the project in the following way.

5.1. Individual level

At intake: Professional Role Definition (PRD) and Personal Development Plan (PDP).

At Development Milestones and Final Result: Reviewing against the criteria formulated in the PRD and PDP.

5.2. Team level

Intake Check: Project Start-Up Review

Development Milestones and Final Result: Review of Process and Result; Professional Role and Development peer reviews

5.3. Organisation level

Intake Check: Team Contract Start-Up assessment

Half-way at Development Milestone: Team Contract Development assessment

Final Result: Team Contract assessment, Personal Role assessment, Personal Development assessment

6. Authenticity of learning situations

A student as innovative knowledge worker has two roles: working and learning. In both cases the student monitors process and results against criteria that were defined before the project started. Students take responsibility for working and learning (Hezemans, 2002) and review their achievements. In so doing they can better their performance.

For the working and learning of a student to be successful authenticity of the learning situation is an issue. When students perceive the learning situation as authentic, they are motivated to take responsibility. The learning situations therefore should be designed in such a way that the student can identify with the role of an innovative knowledge worker. This implies that a learning environment should allow students to have influence in both problem selection and the process of problem solving (working).

Of particular importance is the authenticity of reviews and assessments. For example, in real life assessment is done by experts in the professional domain who follow an agreed assessment protocol. A teacher, however, is in most cases not perceived as such an expert by the students. It pays to enhance authenticity by involving "real" experts from the professional domain in the assessment.

7. Competence based learning in practice

7.1. Example E-commerce

This example is one of three courses, developed as part of the project " Task based team learning with ICT" of the Hogeschool van Utrecht (University for professional education and applied research) and the University of Utrecht (van Weert, 2002).

- It is a multi-disciplinary course in which participate:
- Third year students from five different part-time higher education studies in Economics (about 100 students);
- A support team of teachers (7 persons);

- An expert from professional practice, in this case the Service Line Manager, Business Consulting, Oracle Netherlands;
- Customers from the business world with a need to know how to apply E-commerce in their business.

The learning situation was modelled after professional practice and students used a professional method to solve the problem from real business life. ICT was used to support the interaction and communication between students, teachers and external professionals.

E-commerce is the whole of business actions (by businesses, organisations, consumers and public authorities) which are executed electronically, to enhance efficiency and efficacy of market and business processes. The processes concerned are both internal business processes and processes of interaction with third parties. Not only transactions (buying and selling) are part of E-commerce, but also processes preceding these transactions (such as marketing, market research) and following these transactions (such as billing, distribution, after sales).

A business plan in which all these processes are reviewed from the E-business point of view, is the basis on which management can decide that E-commerce is efficient, effective and feasible for the business or the organisation. The task for the students is to develop such a business plan.

Criteria were given for the business plan, the innovation definition (analysis and choice of E-commerce strategy) in the business plan, the method used and the work process. These criteria were developed in co-operation with the Service Line Manager, Business Consulting, Oracle Netherlands.

Students were asked to prepare a Personal Development Plan covering: Professional and business creativity, Co-operation skills, Sensitivity for developments in the market and the business environment, Problem analysis competence and decision making, Oral and written communication. The Personal Development Plan was used to assess student performance during the project work through peer assessment, expert assessment and project coach assessment.

The final assessment has two components:

1. The business plan, developed by the team of students, is assessed against the result criteria.
2. The development of student competences is assessed against overall criteria and the criteria in the Personal Development Plan.

Discussion The learning environment in this example is fairly authentic, but influence of students on the process is limited. Reviewing as a means to let students themselves control quality, is underdeveloped. There is a form of intake assessment, but only with respect to the project plan. There is a limited form of half-way assessment of process and intermediate results. An external expert is involved in the final assessment, but only with respect to the final result.

7.2. Example Virtual Environmental Consultancy Agency

The "Virtual Environmental Consultancy Agency" (VECA), described in (Ivens, 2002) was first started in 2000 by the Open University of the Netherlands in co-operation with Maastricht University. It was further developed in 2001 and is currently operating in the context of the Dutch Digital University. It is based on earlier experiences within the Open University of the Netherlands with the concept of a 'virtual company' (Westera, 1998), (Westera, 2000).

The VECA is mediated via a computer network. It combines the flexibility of distance learning with integration of learning and working.

Within the VECA, all processes are dominated by the concept of *competence learning*: learn how to complete tasks by integrating complexes of knowledge, skills and attitudes. Therefore before start-up an exhaustive inventory has to be made of the competencies required. The resulting *competence map* is pivotal because it acts as a frame of reference for all processes involved: it limits the range of products and services rendered, and defines what can be learned by the students.

In running a VECA one can distinguish three main phases: the preparatory phase, the actual working period en the final assessment.

Preparation During the preparation phase potential orders are acquired from external clients. These orders are mapped into a competence map, first of all to decide whether they will be accepted or not.

Furthermore, students have to be recruited. Competence counsellors, who are members of the educational staff, diagnose new students against the competence map. Identified gaps in competence constitute the student's career plan. The career plan is subsequently used as the starting point for assigning sensible tasks to the students.

The work period The work starts with a plenary face-to-face introductory meeting. Thereafter project teams start carrying out their work. An extensive system is established that monitors and assesses students' (in)competencies. It includes traditional teacher controlled evaluation (co-assessment) procedures as well as methods for self- and peer-assessment by the students themselves. The latter are used to assess the individual's informal knowledge and functioning. The working period is concluded with a final face-to-face meeting where results are presented to the external clients and all members (students and teachers) of the VECA.

Final assessment All documents produced in the course of a student's career, for example results of assessments and results produced for customers, are collected in a personal portfolio which forms the basis of establishing and formalising performance levels. By asking the customers to assess the merit of the final result an external assessment of the student's work is made. This too is incorporated in the portfolio. Collectively these assessments also contain a

reflection on the effectiveness and quality of the entire learning environment, including the teaching. Based on the portfolio the examiner establishes a final mark for each individual student (Figure 1).

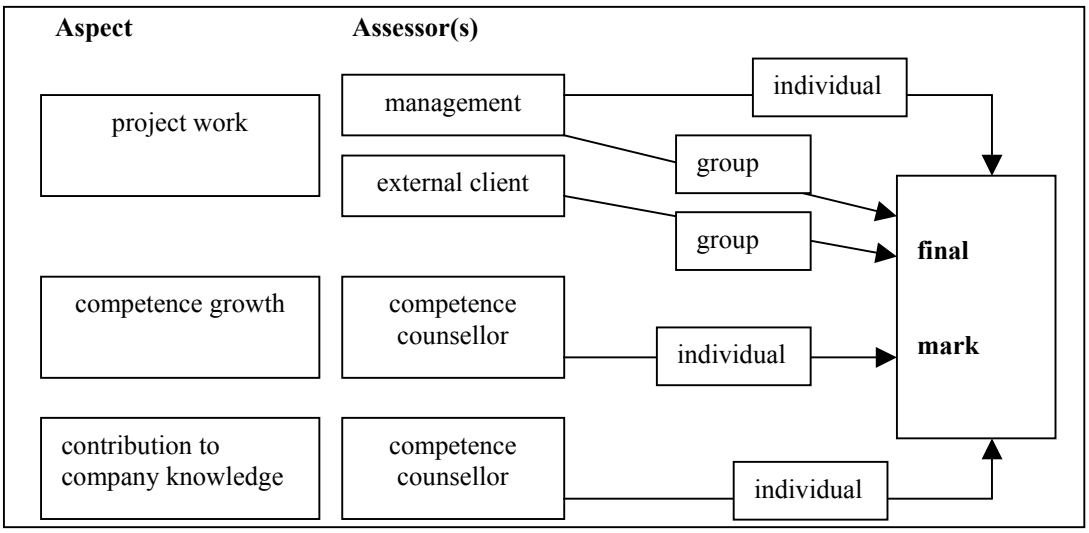

Figure 1: Schematic presentation of the final assessment (Ivens, 2002).

Discussion The learning environment in this example is fairly authentic. Student influence on the process is limited. Reviewing as a means to let students control quality, is integrated in the process. There is intake assessment, but only with respect to student competencies and their relation to the Competence Map; students are not involved in the project selection. The students themselves create a Personal Development Plan, but the teaching staff decides on the project, the role of the student and competencies to be developed. Authenticity here could be better. There is on-going reviewing and assessment of process and intermediate results. An external expert is involved in the final assessment, mainly to assess the final result and its presentation, but also to assess customer management.

7.3. Example Student Software House 'GiPHouse

The professional student software house GiPHouse is described in (van Weert, 1995 B). The software house produces not too complex software systems for real-life customers. Students in GiPHouse learn to "help themselves". They start their projects with a general problem description of half a page, the address of the customer, a GiPHouse manual explaining the basics of the organisation (Symes, 1997) and a GiPHouse standard development method. After that it is up to the students to find suitable techniques to tackle their project, to organise, plan, manage their teams etc. However, students who have been involved in earlier phases of GiPHouse, bring their knowledge over on younger students, thus providing a learning network. These more experienced students perform senior roles such as Senior Developer, Project Manager, Quality Manager, Human Resource Manager or Contract Manager. Focus point of the management is the GiPHouse Director, an external professional with extensive experience in development of large software systems and quality control. GiPhouse has been modelled after modern, innovative software houses. The working methods are geared towards effective project work and the business culture is one of participation and shared responsibility. Reviewing and assessment is integrated in the work process (Figure 2.).

Discussion The learning environment in this example is very authentic. Students have important influence on the process, because all roles in the software house are performed by students, except the director role performed by a professional. In their role the students have responsibilities, but also the decision power associated with these responsibilities. More experienced students are involved in all assessments in a professional role. Reviewing is used extensively as part of the GiPHouse working method (Figure 2). Intake reviews (Intake Check, Project Start-Up) and Intake Assessment (Contract Start-Up Review) are well developed. There are on-going reviews (Progress Review, Quality Review) and a half-way assessment of Progress, Quality and Role Performance (Development Review). In the final assessment (Contract Evaluation Review) customer satisfaction is also input.

The review and assessment structure is basically identical with the quality control structure outlined in this paper.

8. Conclusion

A quality control structure is needed in competence based higher education learning environments. In this paper a control structure based on reviews and assessments is proposed. This structure is derived from authentic professional environments. Three examples from educational practice were given in which (part of) this control structure is used, illustrating the feasibility of the approach.

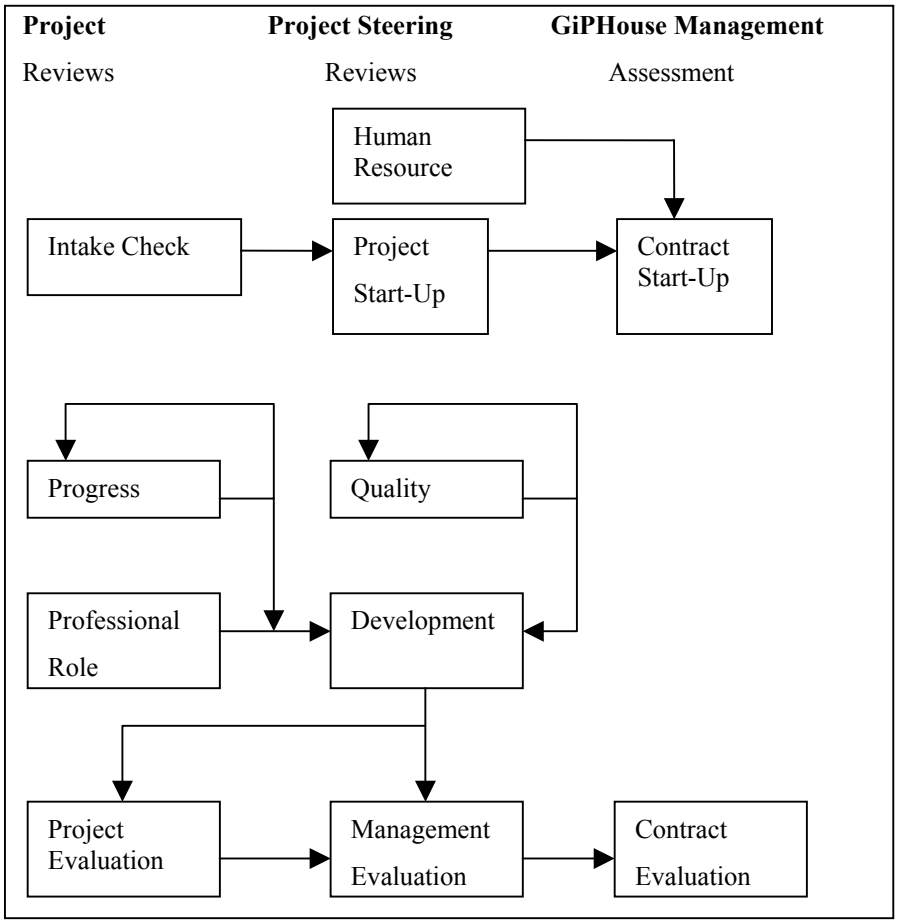

Figure 2: Review and assessment structure of GiPHouse (Symes, 1997).

References

Duffy, T.M., J. Lowyck & T. M. Welsh (1993) *Designing environments for constructive learning*. Berlin: Springer Verlag.

Duffy, T. M. & C. Orrill (2001) *Constructivism*. In: A. Kovalchic & K. Dawson (Eds.) *Educational Technology, An Encyclopedia*. Santa Barbara, CA: ABC-CLIO.

Hammer, M. & J. Champy (1993) *Re-engineering the corporation*. London: Nicolas Brealy Publishing.

Hezemans, M. & M. Ritzen (2002) *Learning environments and responsibility*. In: Proceedings of the TelE-learning Stream of IFIP Congress 2002. Norwell, MA: Kluwer Academic Publishers.

Ivens, W.P.M.F. (2002) *New ways of academic education: chances for sustainability*. In: Michelsen, G., M.C.E. van Dam-Mieras (Eds.) The Lueneburg Declaration, Stepping stone for universities and development in the context of globalisation (in print).

Lawler III, Edward E. (1994) From job-based to competency-based organizations, *Journal of Organizational Behaviour*, Vol. 15, p.p. 3-15.

Symes, J. & T. J. van Weert (1997) GiPHouse Handbook. Nijmegen: Universitaire School voor Informatica, Katholieke Universiteit Nijmegen.

Weert, T. J. van & P. Jongepier (1995 A) *Een model voor academisch informatica-onderwijs*. Nijmegen: Universitaire School voor Informatica, Katholieke Universiteit Nijmegen.

Weert, T. J. van (1995 B) *GiPHouse, a professional student software house*. In: Tinsley, J. David and van Weert, Tom J., Eds. (1995) IFIP World Conference on Computers in Education VI, WCCE'95 Liberating the learner. London: Chapman & Hall, p.p. 429-439.

Weert, T. J. van & A. Pilot (2002) Success factors in the design and development of new learning. Submitted to: *Education and Information Technologies.*

Westera, W. & P.B. Sloep (1998) The Virtual Company: towards a self-directed, competence-based learning

environment. *Educational Technology*, Vol. 38 (1), pp. 32-38.

Westera, W., P.B. Sloep & J.F. Gerrissen (2000) The design of the Virtual Company: synergism of learning and working in a networked environment. *Innovations in Education and Training International* 37 (1), pp. 24-33.

18 Design, Implementation and Evaluation of PsyWeb, a Learning Environment in a Problem Based Learning Curriculum.

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Abstract

In this article we describe the design and implementation of PsyWeb, a rich learning environment for the new problem based study in Psychology at Erasmus University Rotterdam Experiences are reported for the first five (of eight) courses of the first year of the new study. Students opinions have been collected as part of a survey at the end of each course. Results indicate that students are positive about PsyWeb. The overall appreciation shows a slight increase over time. Starting with the second course, usage of PsyWeb has been logged. Usage has been quantified in terms of the number of unique IP-addresses per day. Using this measure we assume that PsyWeb has a student reach between 25% and 100% per day. Usage shows a slight increase over the courses. The implementation of a series of additions to PsyWeb has been planned for the next year.

Keywords: computer-facilitated learning, learning environment, problem-based learning.

1. Introduction

The World Wide Web (WWW) has been the last in a long line of emerging technologies that has been applied to education. However, applying a new technology is not automatically a pedagogical innovation. Based on the observation that most efforts on technology-based innovation fail, Kearsley (1998) states that these efforts "... distracts us from the really important problems and issues that need to be addressed." The last few years there has been an enormous effort to implement WWW-technologies. Has this been just another distraction? There are indications that, at large, this is the case. After analyzing 436 web based learning environments, Mioduser et. al. (2000) summarized their findings as "one step ahead for technology, two steps back for pedagogy".

The history of education shows pedagogical innovations that do address 'important problems and issues'. One of these innovations is problem based learning (Barrows & Tamblyn, 1980; Schmidt, 1993), which claims to offer a solution to difficulties that students have in dealing with the application of knowledge in practical contexts, dealing with complex problems, and becoming life-long learners. Problem based learning (PBL) has been around since the late nineteen sixties and it there is some evidence that it lives up to its claims (Norman & Schmidt, 1992; Albanese, 1993).

Given a sound educational model, could ICT be used to improve educational practice? Koschmann et. al. (1996) argue that it can, and they propose a principled approach to the innovation of learning with technology. The underlying assumption of this approach is not the exploitation of the capabilities of a new technology, but that "Design should be informed from its inception by some model of learning and instruction". In their article, they present a case study in which this approach is applied to problem based learning (PBL). Using this approach Ronteltap & Eurelings (1986) identified several issues in PBL at the University Maastricht that could be addressed by the use of information and communication technology.

In September 2001 a new study in Psychology has been started at Erasmus University Rotterdam. This curriculum has problem based learning as its prime pedagogical method. The first year consist of eight courses of five weeks. Students follow only one course at a time. During a course students come together twice a week in tutorial group meetings, in which they discuss a problem and formulate a set of common learning issues. These learning issues are the starting point for self study, the results of the self study are discussed in the first half of the next meeting. The second half of this meeting is used to discuss a new problem. In the second year problems will increase in time and complexity, culminating in complete projects in later years. Besides PBL meetings, each course has other educational activities, like skills training and lectures, and during each course movies are shown that are related to the topics of the course.

The shape of the curriculum has been influenced by the belief that the WWW can be used to take PBL another step forward by providing students with a richer learning environment. This electronic learning environment is being developed under the name PsyWeb. For practical reasons, PsyWeb is incrementally developed. In the first year the general framework has been developed as well ass the general content and services and the course specific contents for the courses of the first year. During this first year several projects have started to prepare the implementation of facilities that target specific innovations, like a literature search, contextualization of theoretical concepts by means of documentaries, and on-line skills training .

In this article we describe the design of PsyWeb, the implementation of and experiences with this electronic learning environments during the first five courses of the first year of the new study.

2. Design & Implementation

A team of staff members formulated a list of general requirements for the learning environment. The three main requirements were:

1. The learning environment should use the semantics of PBL, e.g. a problem should be named "Problem", not "Task" or "Assignment".
2. Relevant information, learning resources and functionality should be available in the context of the problem that a student is working on.
3. Navigation should be simple, using 'flat' menu structures that are always available.

This team also formulated what should be available in the electronic learning environment. Requirements were formulated regarding general and block specific information and services. Block specific requirements covered general information about the course; the current problem and other problems; online learning resources and literature suggestions; information about and on-line resources for practicals and skills training; a bulletin board with last-minute information; a course schedule; a feedback facility; information about students and staff and an assessment facility. Requirements for general information and services for the student covered study progress information; general information about the study; information about the educational organization and a study specific search engine. Additional requirements were formulated for additional roles in the curriculum (tutor/coach, member of planning group, librarian and administrator).

Based on these requirements a decision was made about a platform to implement the learning environment. After review of several learning environments, it was decided to use basic web technology to implement the overall structure of the learning environment and the general information and services. For course specific information the Electronic Blockbook system was selected. This system has been developed at Universiteit Maastricht to provide course specific information and services for PBL-courses. The system was developed with flexibility an adaptability as design goals. It allows a flexible structure and semantics at course level and a custom interface at the curriculum level. In order to be used for PsyWeb, a customized interface was implemented and several other adaptations to the software were carried out, including the support of a different software package for the creation and editing of contents.

The interface of PsyWeb is shown in figure 1. The screen is partitioned in three areas: a horizontal menu on top of screen for navigation of global information and services; a vertical menu structure on the left of the screen for navigation through course specific information and services, and a working area, where information and services are displayed (the white areas containing the text and the photograph).

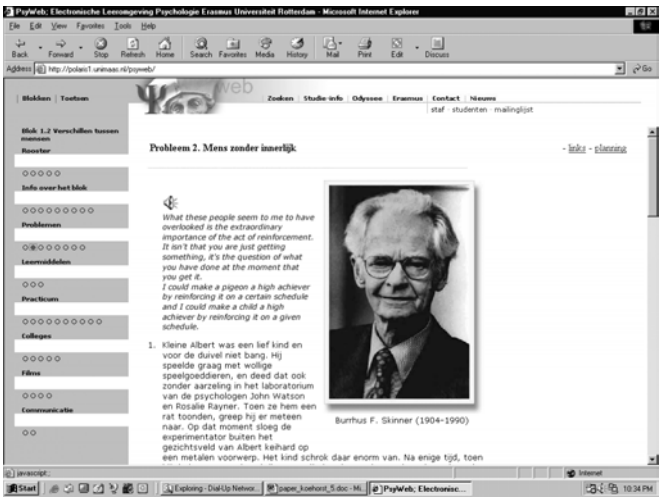

Figure 1: The PsyWeb Interface.

Two staff members of EUR have been developing PsyWeb. They have implemented services and materials, updated PsyWeb, have sought on-line available resources, acquired licences and settled authoring rights when necessary and informed and supported students and teaching staff. PsyWeb was hosted at Universiteit Maastricht, where employees of the Learning Lab provided technical support and consultancy.

Psyweb has not only been used for educational purposes, it has also fulfilled a social function. The student association 'Odyssee' has a place in PsyWeb and 'Ithaca', the associations e-journal, is made accessible through PsyWeb. The association also has access to the news facility.

3. Evaluation

3.1. Method

Subjects are the cohort of first year students that were enrolled in the study psychology. Student numbers for the different courses varied from 89 to 66. Lower numbers are mainly caused by exemptions. Demographics were available for 87 students that are currently enrolled. Of these students 60 are female, 27 are male. Ages range from 18 to 43, with a mean of 21, a median of 21, and a mode of 20.

The study "Psychology" has a quality management system: each course is evaluated by means of a survey. The survey consists of 55 items which cover all aspects of a course. In this paper we have included the data collected in the first five periods of 2001-2002, we will only consider the ten items that are about PsyWeb. These items are:

1. PsyWeb had added value over the paper study guide.

2. PsyWeb was a useful supplement to the other information services in this course
3. I could easily find the information I needed.
4. The content was up-to-date.
5. The screen lay-out was pleasant.
6. The contents of PsyWeb was suitable for the education.
7. PsyWeb was accessible when necessary
8. The content was free of errors
9. Rate PsyWeb with a school grade.
10. What did you miss or appreciate with regard to PsyWeb?

Items 1 to 8 are rated on a Likert scale, 1 corresponding to "totally disagree" and 5 corresponding to "totally agree". Item 9 is scored on a 10-point scale, from 1 (worst) to 10 (perfect), which corresponds to the rating used for school grades in the Netherlands. The tenth item invites students to write a short comment. The survey is paper based, the data are processed by the OECR, the educational expertise center of EUR. All students were required to fill in an evaluation form in order to be admitted to the test at the end of the course.

Usage of PsyWeb has been studied by means of log file analysis. The measure for usage is the amount of unique IP-addresses per day. An IP-address uniquely identifies a computer from which a web service is accessed. We assume that each unique IP-address roughly corresponds to one student. Log files have been collected starting with the second course. Log files are analyzed using SPSS.

3.2. Results

The survey has been filled in by all enrolled students at the end of a course. This yielded respectively 81, 82, 72, 73 and 66 usable evaluation forms. Result for the survey are summarized in table 1. Except for item 7 (accessibility) in course 5, all results are positive.

	Course 1	*Course 2*	*Course 3*	*Course 4*	*Course 5*
Item 1	3,49 (1,00)	3.29 (1.11)	3.36 (0.97)	3.70 (1.09)	3.79 (0.89)
Item 2	3,91 (,957)	3.61 (0.90)	3.51 (0.99)	4.05 (0.78)	3.33 (1.26)
Item 3	3,78 (,886)	3.49 (1.03)	3.60 (0.94)	3.84 (1.00)	3.67 (0.97)
Item 4	3,81 (,963)	3.61 (1.03)	3.83 (0.77)	3.79 (1.09)	4.11 (0.95)
Item 5	3,89 (,795)	3.70 (0.70)	3.64 (0.74)	4.12 (0.71)	3.30 (1.11)
Item 6	3,41 (,913)	3.23 (1.02)	3.27 (0.87)	3.41 (1.04)	3.53 (1.07)
Item 7	3,75 (,788)	3.63 (0.84)	3.58 (0.96)	3.97 (0.82)	2.86 (1.18)
Item 8	3,75 (1,028)	3.32 (1.24)	3.75 (1.06)	3.77 (1.21)	3.86 (0.84)
Item 9	7,18 (,884)	7.2 (1.05)	7.55 (0.81)	7.53 (1.09)	7.61 (0.78)

Table 1: Summarized results of survey

Figure 2 shows the overall rating over a period of five courses. The rating shows a slight increase over time.

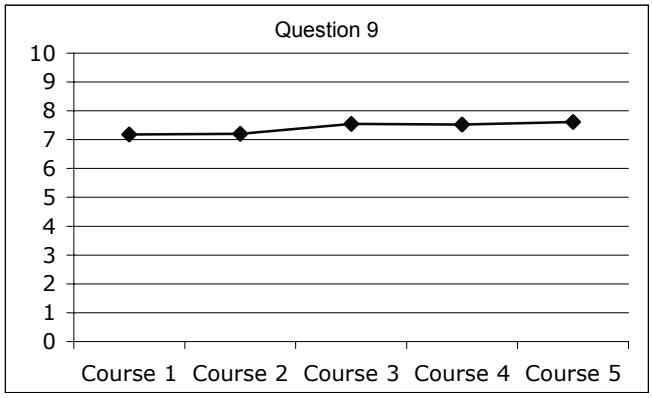

Figure 2. Overall rating over a period of five courses

Analysis of the comments reveals 211 negative and 160 positive remarks. The top three topics of negative comments were on-line articles, college sheets and accessibility. Together these make up 62% of all negative remarks. The quantitative results on these topics are summarized in table 2.

	Course 1	*Course 2*	*Course 3*	*Course 4*	*Course 5*	*Total (n)*	*Total (%)*
Articles	2	4	11	9	1	27	24
College sheets	2	7	13		1	23	20
Accessi-bility	3	9	8	1		21	18

Table 2: Quantitative summary of negative comments

The top three topics of positive comments were on-line articles, usability and news. Together these make up 51% of all positive remarks. The results on these topics are quantitatively summarized in table 3.

	Course 1	*Course 2*	*Course 3*	*Course 4*	*Course 5*	*Total (n)*	*Total (%)*
Articles	1	2		21	2	26	23
Usability	5	2	3	5	3	18	16
News	4	2	6		2	14	12

Table 3: Quantitative summary of positive comments

Log files have been analyzed by unique IP- addresses per day. Analyses of the log files show that the amount of unique IP-addresses varies from 31 to 95 on working days.

Figure 3 shows the average amount of unique IP-addresses per day per course. This amount is significantly different for the courses F(3,97)=13.788, p=.000), and there is linear increase over courses (p=.000).

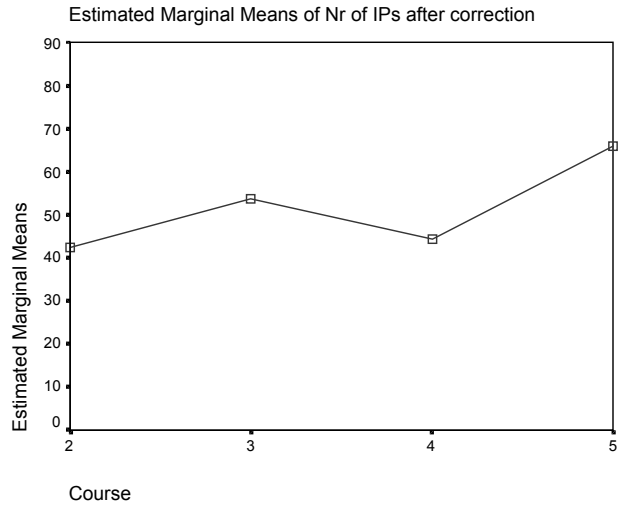

Figure 3. Average amount of unique IP-addresses per day per course

Figure 4 shows the average amount of unique IP-addresses per day of the week. Analysis shows a significant difference between days, with a peak for Wednesday (F(6,97)=11.273, p=.000).

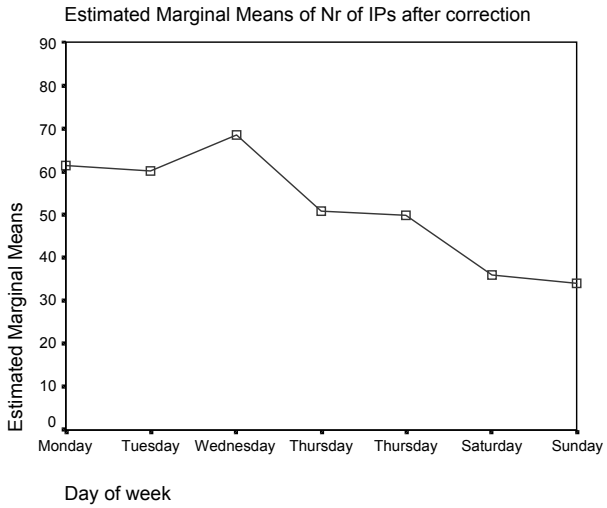

Figure 4. Average amount of unique IP-addresses per day of the week.

Figure 5 shows the average amount of unique IP-addresses per week in a course. There is not a significant difference between weeks.

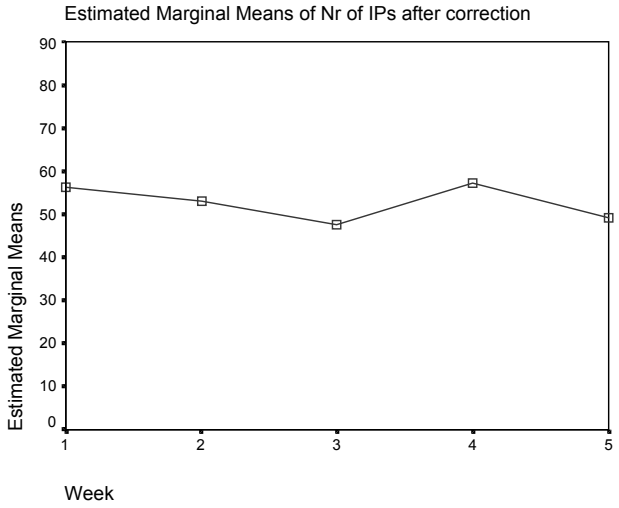

Figure 5. Average amount of unique IP-addresses per week

4. Discussion and conclusion

The general framework for PsyWeb has been implemented and the contents learning environment is co-developed with the curriculum. So far, the design goals for PsyWeb have been met. Evaluation shows students are satisfied, and the

overall appreciation shows a slight increase over time, from 7,2 for the first two courses to 7.6 in the fifth period. When assuming that each unique IP-address corresponds roughly to one student[1], this means that PsyWeb has a student reach between 25% and 100% per day, with a mean of 69%. During weekends and holidays PsyWeb has a student reach between 16% and 65%, with an average of 37%. Usage also shows a slight increase over time. An explanation for higher usage on Wednesdays could be that training and practicals are then scheduled. These activities are often supported by PsyWeb. Absence of a peek of activity in the last week of a course is positive. One of the goals of PBL is that students study evenly, and do not prepare at the last moment for a test.

Results for appreciation and usage indicate that PsyWeb does not suffer from a fading novelty effect. It should be noted however, that this study only covers the first five courses of a total of eight in the first year. It is planned to complete the overview in this paper by supplementing it with a study including the data for the last three courses.

The implementation of PsyWeb successfully shows that the Electronic Blockbook system can be adapted to support problem based learning courses in a curriculum outside the university in which it was developed. Adaptation was required and realized beyond what the designers of the system had envisioned, which proved that flexibility and adaptability are worthy design goals .

The current study only incorporates quantitative data on usage of the learning environment, these data shed no light on what PsyWeb is really about: how students use it in their learning process. Additional research has been planned to gain insight in this area.

Next year PsyWeb will be extended with motivational content. Also, the implementation of a series of ambitious additions to PsyWeb, that have been prepared in the last year, will start. It has been planned that in the beginning of the next academic year, a custom search engine will be operational and that the first psychological documentaries will be available for on-line, on-demand viewing. Later that year a start will be made with on-line psychological experiments, and facilities for computer supported collaborative learning will follow. This way we hope to improve PBL step-by-step.

Acknowledgements

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The E-Blockbook and PsyWeb are team efforts which have only been possible by the contributions of the many people involved, in particular Eveline Osseweijer, Ton Derix, Marcel Kentgens and Jo Beerens.

References

Albanese, M.A. (1993). Problem-Based Learning: A Review of Literature on Its Outcomes and Implementation Issues. *Academic Medicine*, 68 (1), pp. 52-81

Barrows, H. S. & Tamblyn, R. M. (1980). *Problem-based learning : an approach to medical education*. New York: Springer Publishing Company.

Kearsley, G. (1998). Educational Technology: A critique of Pure Reason [On-line]. Available: http://home.sprynet.com/~gkearsley/critique.htm

Koschmann, T., Kelson, A.C., Feltovich, P.J. & Barrows, H.S. (1996). Computer-Supported Problem-Based Learning: A Principled Approach to the Used of Computers in Collaborative Learning. In T.Koschmann, *CSCL: Theory and Practive of an Emerging Paradigm*. Mahway, New Jersey: Lawrence Erlbaum Associates, Publishers.

Mioduser, D., Nachmias, R., Lahav, O. & Oren, A. (2000). Web-based Learning Environments (WBLE): Current Pedagogical and Technological State. *International Journal of Research in Computers in Education,* 33(1), pp. 55-76.

Norman, G.R., & Schmidt, H.G. (1992). The psychological basis of problem-based learning: a review of the evidence. *Academic Medicine*, 67 (9), pp. 557-565

Ronteltap, C. F. M., Eurelings, A. M. C. (1996). *User* requirement *analysis of POLARIS*, Universiteit Maastricht.

Schmidt, H. G. (1993). Problem-based learning: An introduction. *Instructional science,* 22(4), pp. 247-250.

Notes

[1.] The relationship between an IP-number and a student is not very hard, but as long as students have anonymous access it is the best approximation we have.

Appendix: Questions in Dutch and their translation in English

Questions in Dutch

1. PsyWeb heeft meerwaarde ten opzichte van een papieren blokboek PsyWeb has added value over the paper study guide.
2. PsyWeb was een goede aanvulling op andere informatievoorzieningen in dit blok.
3. Ik kon gemakkelijk de informatie vinden die ik nodig had.
4. De schermopmaak was prettig.

5. De inhoud van PsyWeb sloot goed aan bij het onderwijs.
6. De inhoud van PsyWeb bevatte geen fouten.
7. De inhoud van PsyWeb was up-to-date .
8. PsyWeb was toegankelijk wanneer ik het nodig had.
9. Waardeer PsyWeb met behulp van een schoolcijfer.
10. Wat heeft u gemist of gewaardeerd met betrekking tot PsyWeb?

Translation in English

1. PsyWeb has added value over the paper study guide.
2. PsyWeb was a useful supplement to the other information services in this course.
3. I could easily find the information I needed.
4. The content was up-to-date.
5. The screen lay-out was pleasant.
6. The contents of PsyWeb was suitable for the education.
7. PsyWeb was accessible when necessary.
8. The content was free of errors.
9. Appreciate PsyWeb with a school grade.
10. What did you miss or appreciate with regard to PsyWeb?

19 Information Technology of the Educational Planning and Curriculum Development

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Abstract

Optimal design of teaching process in higher school is realized to a considerable extent intuitively or on the basis of expert evaluations. Such an approach allows to achieve an approximate solution of the problem only. The experimental study of the teaching process and learners' characteristics, computer-aided technologies of statistical processing of experimental data, computer simulation of the educational process, computer analysis of simulation results are proposed as methodology of this problem solution. This curriculum design is prominent for the logical project development of education, the content areas of each course, and for the professional qualification. Other opportunities of using this procedure are linked with the development of a new and modifying existing curriculum.

Keywords: education, computer simulations.

Paper

The major problem of the educational planning and curriculum development is the lack of its flexibility and multifunctioning. The impact of this problems is becoming especially acute nowadays due to the increased complexity of the tasks and need of new curriculum design.

Today the effectiveness of project curriculum in education is based on subjective estimates by education experts. This complicates the process of taking decisions and judgements.

The computer-based procedure for educational project in higher educational institutions is being worked out at the Computering & Mathematical Modeling Department of the Tambov State University. Arzamastsev A. & Kitaevskaya T. (2001) described a similar procedure

The procedure is based on the computer simulations, the computer-assisted testing the students and on the statistical processing of the educational outcomes.

The object of investigation, projecting and having an optimum effect is the educational process. It is represented in fig.1 by a graph. It's made up of the student's steps of mastering the content of the curriculum. The starting level corresponds to Situation 1 describing the knowledge, creativity and other aptitudes of a future student. The aim of the education is to move a student from Situation 1 to Situation 2. Situation 2 is described by the level of professional qualification.

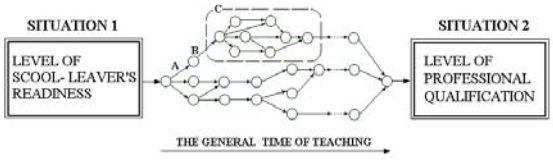

Figure 1: Graph of educational process.

The optimum effect is achieved through:

- the duration of a disciplines;
- components of disciplines;
- the distribution of time for course models according to the student's level of knowledge;
- contents of the disciplines.

In full, the steps of the procedure are represented below.

Step 1: Diagnosis of a student's background knowledge, motivation and aptitude, adaptation of the curriculum to the student's individual differences.

Step 2: The curriculum design is based on the student's individual differences and needs. Contents of the discipline are the standard for professional training and decision-making in the local context.

Step 3: Out all the possible variants the one is selected that meets the optimal criteria. The curriculum of the educational process is shown on fig. 1.

Step 4: The graph being a large system splits into subsystems, each of which corresponds, to a single subject. The requirement is that every subject is naturally integral.

Step 5: Individual duration of studying the contents of subjects is determined by interviewing students. All these data are the basis for the distribution of time of studying the contents.

Step 6: The simulation of the distribution of time of studying the contents (step 5) is performed by the computer.

Step 7: The distributions of the discipline duration are summed up. The outcome is the general time of professional training in a higher educational institution - the basis for the distribution for the discipline duration.

Step 8: As a result, the two alternative aims of the optimum effect of the educational process are being solved:

The general time of teaching is defined by the level of educational process (minimizing of resources).

The level of educational process is defined by the general time of teaching (maximizing of the quality of education).

The technology of the educational planning and curriculum development is shown in fig. 2.

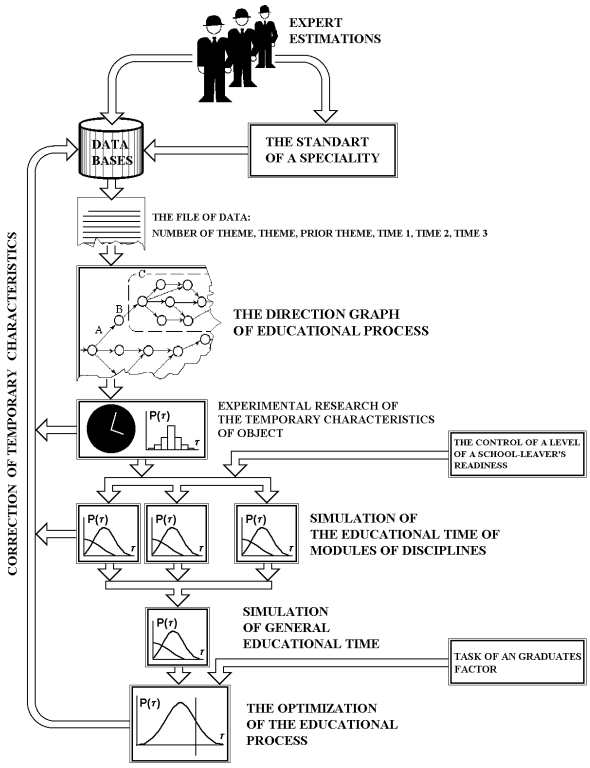

Figure 2: Technology of the educational planning and curriculum development

Out of the content areas a file is formed that meets the national standard and experts' estimates. It's made up of the notes about previous topics, duration of a modules of disciplines and the level of students' knowledge. The graph of a curriculum design is based on this information.

The next stage is the experimental research of the temporary characteristics of disciplines. They are intended to perform computer simulation to get the information about the distribution of time for modules of disciplines.

A specially worked out program – the universal generator of the accidental numerals - performs the simulation modeling. It makes getting the set numerical streams possible. The algorithm and the generator program are described in the article of Arzamstsev A. & Kitaevskaya T. & Ivanov M. (2002). One can contact us in the Internet: www.chat.ru/~emsd.

The final stage is the optimizing of the educational process.

Temporary characteristics is corrected according to the educational results, computer simulation and optimizing the process of education.

This curriculum design is prominent for the logical educational planning and curriculum development, the contents of each disciplines, and for the professional qualification.

This technology of the educational planning and curriculum development in education affords to overcome difficulties of curriculum design.

1. The graph of education process sometimes can have important shortcomings:

- the contents areas of disciplines describing the knowledge and aptitude of the students are not always systemized;
- the subjective discipline modeling can result either in repeating or excluding some of the content areas.

2. A student who passes the entering exams is believed to show the background knowledge. But in reality this background knowledge is an accidental characteristic.

3. The duration of time for the discipline models is considered to be fixed and its significance is mirrored in the curriculum. The duration of each discipline is an accidental characteristic.

4. When the discipline duration of an “average student” is designed there can appear paradoxical situations:

- outgoing students cope with the material very quickly and are bored the rest of the time;
- students that are legging behind do not pass credits and exams (that results in higher percent of selection and this is totally unprofitable both to the higher educational institutions and the state);
- a student’s unfounded mark in this case leads to the non-professional qualification;
- as a rule, the general time of teaching is equal to 5 years. However there is no a well-grounded reason to design curriculum within this period of time.

This technology of the educational planning and curriculum development in education has been designed in the form of programs and approved by the departments of Physics & Mathematics and of Art & Culture of the Tambov State University. The procedure distributed time between the subject models for the following disciplines: ”Computing Science & Programming”, “Mathematics & Computing

Science". It also helped to get spare time for teaching other modules of discipline.

Other opportunities of using this procedure are linked with the development of a new and modifying existing curriculum.

References

Arzamastsev A., Kitaevskaya T. and others (2001). Computer technology of optimmal design of educational process, *Computer technology in education*, volume 4, pp.79-82.

Arzamastsev A., Kitaevskaya T., Ivanov M.(2002). Universal generator of random numbers for computer simulation, *Computer technology in education, volume* 3, pp.39-42.

20 Stimulating E-Learning in Europe: A Supply Chain Approach

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Abstract

This 'research in progress' paper examines a supply chain approach to stimulate e-learning in Europe. It builds on a recent study (van der Linden and van Baalen 1998), which found that it is possible to add a new dimension through distance learning to traditional pedagogical techniques. One of the unexpected side effects reported when using electronic mail was the disappearing of cultural boundaries. From a socio-cultural perspective within an increasingly international setting optimal e-learning requires a supply chain approach, in which face-to-face meetings play a critical complementary function to ensure that important clues such as body language and tone of voice are not filtered out (Lee 1994:143).

A relevant issue for institutions of higher learning is whether or not it is desirable for ICT applications to complement or substitute traditional forms of management education (van der Linden and van Baalen 1998:15). There is an increasing need to interact in the complex international environment, which implies that students must obtain the skills to bridge five identified gaps in the polycontextual learning environment (Fenema, 2001). In the early 1990s the Rotterdam School of Management, Erasmus University internationalized its curriculum. It is currently responding to the challenge of applying digital learning techniques to deliver management education. The diffusion of knowledge plays an important role in innovation processes. (Hertog and Bilderbeek (2000:222). This paper concludes with a summary and research agenda for higher education in the global knowledge economy.

1. Introduction

The emerging twenty first century global society is characterized by crisis, the convergence-divergence paradox, and conflict. The turbulent landscape affect how civic and business leaders make decisions and how policies are translated into actions within communities and corporations. In particular, the issue of competitiveness has raised the overall level of performance in terms of productivity, quality and profitability. Whilst the introduction of global performance standards can be very threatening, institutions of higher education in Europe have little choice but to acknowledge the global shift from a labor-intensive economy to knowledge-based economy. Assessing the consequences of such shift, within the context of the global era in human history, is fundamental to the appropriate future development, delivery and evaluation of educational programs.

Towards these ends this paper has three major objectives:

1. to assess the implications of globalization on the provision of higher education;

2. to determine whether higher education is presently meeting the learning needs;

3. to explore the future higher education agenda for e-learning in Europe.

This paper builds on the authors' backgrounds, teaching and research interests in the economics and management domains. This paper elaborates the theme e-learning from a supply chain perspective and why this subject matters to higher education. First, following an evolutionary innovation theorical perspective, it is assumed that higher education plays a key role in the efficient distribution of knowledge in a National Innovation System (NIS) which is 'at least as important as creating new knowledge'. (Hertog and Bilderbeek, 2000:222) the competitive environment is characterized by rapid technological change, globalization and blurring boundaries of competition. Second, the Internet and the World Wide Web generate substantial increases in the volume of information available to higher education. Therefore higher education faces complexity and has to decide not only how to compete but also with whom to cooperate. Third, these forces combined cause higher education to focus more on the emerging of 'a trans-European data communication network linking all its research institutes, universities and ultimately the educational system as a whole'. (RTD info 2000).

2. Implications of globalization

A recent study (van der Linden and van Baalen 1998) indicates that it is possible to add a new dimension through distance learning to traditional pedagogical techniques. One of the unexpected side effects reported when using electronic mail was the disappearing of cultural boundaries.

Increasingly, one of the key issues for higher education is how to address the local-global paradox in relation to learning and knowledge creation, transfer and application.

In this paper knowledge is understood as the content of

learning with behavioral outcomes that reflect the patterns of cognitive associations that have developed (Daft et al, 1984). Knowledge is the result of the interaction between tacit (subjective) and codified (objective) components of knowledge (Nonaka, 1993). Tacit knowledge is embedded in specific relationships between a number of parties and transferable only within the specific network of interpersonal relationship that is based on commonly shared values at the local level. In contrast, codified knowledge is globally accessible because it is based on a set of assumptions that are commonly accepted independently from the specific membership of the parties'. (Ganzaroli 2002).

Nonaka (1993) views knowledge creation as a four-stage process: socialization, externalization, combination, and internalization. Value can be derived from the knowledge creation process if an organization has the capacity to transfer the potential value that resides within the organization into a value proposition that is of value to external stakeholders. The mission of higher education may be viewed as imparting knowledge through formal instruction that supports the learning process, i.e. learning as cognitive development and learning as behavioral development (Fiol et al 1985).

Presently, the learning process still depends on tacit knowledge creation that is tied to trust creation, which in turn is derived from socialization and the internalization of common values and experiences between members of a community of practice. (Nonaka and Takeuchi, 1995).

It implies that within the traditional higher education supply chain the classroom, the project work area and the library are still the focal points for purposes of learning management and assessment.

Meanwhile the value creation process increasingly depends on the ability to transform internal value into external value. Higher education must mobilize its abilities to capitalize on the new educational benefits of ICT, but making it happen in practice is not simple due to complex issues.

First, in the next five to ten years higher education will be inextricably linked to the new knowledge infrastructure that is emerging in the European Union. Developments in the European Union are driven, among other things, by new technologies (nano-technology, peer-to-peer networks, encryption), economic structures (e-markets, codes of conduct), and dependability (systemic dependence). The emergence of ICT is one of the expressions of a tendency known as the globalisation of the economy". The increasing international integration of economic activity is often at odds with existing governance structures, including those in higher education, that are closely tied to geographically defined nation-states. ICT revolutionized the way higher education processes function at present. Knowledge exchange occurs increasingly within 'global space' and in a new knowledge infrastructure that will be largely driven by e-learning systems. How will the stakeholders within the EU - EU bodies, higher education, the private sector, EU member states - interact to generate appropriate regulation?

Second, today's higher education system is characterized by *"mass" education*. In the introductory classes in many major universities today, the learning environment is less than ideal. Students are often herded into huge lecture halls and sit in cramped seats, accompanied by several hundred fellow students and listen to a lecturer read a pre-scripted lecture. The professor who wrote the course they have to attend may neither be present and nor interface with any of the students during the entire course. Any new system that would be learner driven for instance, allowing the student to read the lecture at his/her leisure and respond in writing with illuminations, would likely encounter significant internal resistance.

The third issue concerns the current *quality of e-learning in higher education* and what can we be done about improving it. Learning does not stop at the door of the lecture hall. The best ICT has to offer currently is a "chat" room environment where students can discuss topics with other students either in mass or one-on-one. This discussion is truncated by distance and time constraints. One of the authors has a friend who actually did this. He attended a philosophy course, which was taught this way, and said that the bulletin board worked fine that people posted things and got things, the course material was fine, the reading and all that. He was learning a lot, but when they did the interactive chat, it was a total disaster. There were 10 or 12 people in the room and everybody was afraid to say anything, there was no trust, no community feeling emerged. Consequently, everybody was afraid to ask questions and the course flopped.

Within the 'borderless' supply chain framework higher education is affected by the issue of the '*international restructuring race*.' (Ruigrok and Tulder 1995). That is, organizations are continuously engaged in competition with existing and new providers and the opportunities and the need for co-operation. Multiple stakeholders with diverse backgrounds, interests and aims have become involved in the design and delivery of curricula, including, corporations, business associations and non-governmental organisations (NGOs). The faster pace of knowledge creation, transfer and application, the dynamism of shifting relationships and increase in costs have a considerable impact on higher education.

The fifth issue regards the emerging extended higher education network. It has its roots in ICT and the concept of *lifelong learning*. The latter implies that progressive curricular development is dependent not only upon institutions of higher education, but increasingly also on a 'shadow' educational network comprised of corporations and international institutions with their own governance structure and cultural values. It calls for higher education insight and foresight with respect to the competencies that exist are emerging within the substantial 'shadow' education network within the corporate structure. Therefore, higher education shall have to explore the lifelong learning needs within global corporations and international institutions.

Finally, the issue of the *governance of cyberspace* and how

social norms and principles are being designed to regulate the use of the Internet.

This is of critical significance, because as a result of cyberspace higher education will enter Baudrillard's fractal stage where everything interpenetrates; we will be in the era of what might be called the 'trans-educational'. Since education will be everywhere, since everything will be educational, in a sense nothing will be educational. (Ritzer 1998: 160) Without a thorough reflection on the ethical aspects and value issues in e-learning it will be impossible to be practically or theoretically adequate in the field of e-learning. Privacy and data-protection, responsibility for adequate information and trust are among the most important ethical issues. The nature and dynamics of e-trust need to be understood as it is a moral phenomenon, that is a necessary condition for successful e-learning practice. From a socio-cultural perspective optimal e-learning requires an approach, in which face-to-face meetings play a critical complementary function to ensure that important clues such as body language and tone of voice are not filtered out (Lee 1994:143).

Within this context, it follows that institutions of higher education require a new governance structure. In the next section we present a supply chain approach as a perspective on the potential re-structuring in higher education governance.

3. Supply chain perspective

The supply chain approach enables higher education to gain membership of a community that has access to codified knowledge whilst sustaining simultaneously membership within a network that is embedded in a specific territorial context. The supply chain approach allow higher education to formulate and implement strategic responses considering both the competition from new providers and the opportunities and needs for co-operation. As such the proposed supply chain approach would be typically embedded in the national innovative system. Therefore, it follows that designing the conditions for an international competitive performance in the higher education sector should be a shared responsibility for higher education, business and government. In the next section we present a supply chain approach that enables higher education to improve its coordination and control of relational networks that are required to enhance the higher education e-learning experience process at reduced costs.

3.1. Supply Chain Mapping

'Supply chain management is concerned with managing the flow of materials and information between the operations which form the strands or chains of a supply network' (Slack, Chambers and Johnston 2001:412) that are needed to deliver a given product or service. In this case, higher education is viewed as the deliverable. The suppliers that are part of the supply chain act more or less together to satisfy the end user demand for higher education. Some suppliers may work in one supply chain whilst others may service various competing supply chains. The learner is the end user and the demand for higher education is the stimulus that drives the actions of the participants.

The mapping process (SCOR – Supply Chain Council, 2001) allows us to blueprint he process of creating and distributing a product or service. (See exhibits 1 and 2 page 8). The exhibits use standard SCOR Reference Model icons and terminology. P stands for the planning process that is associated with each aspect of production. S is for sourcing or deriving input to the process. M is for make or manufacture, the process of taking raw inputs and turning them into a product or service. D is for deliver or making the finished product or service available for consumption. The numbers associated with each letter have to do with the type of the same process. In the case of S, M, D, the 1 stands for processes that produce a product for "stock". The product or service is made by the manufacturer and sourced by the end user with limited demand information from the end user. In contrast are type 2 and 3 process that refer to "assemble to order" and "engineer to order" respectively. In P, planning, the numbers refer to plans that take place during each segment of the supply chain process. P1 is the planning of the supply chain in total. P2, planning for sourcing, P3 planning for making and P4, planning for delivering the product or service to the end user. The supply chain, running left to right, involves suppliers of raw material, the process of making something and the process of delivering the finished product or service to the end user, the final consumer or user. The Decoupling point is the place where the needs of the enterprise to control the supply process (push) and the demand of the end user (pull) are exchanged. Findings regarding the Decoupling point is the focus of the analysis in the mapping process for Higher Education in both the traditional and the ICT environment.

The ICT infrastructure framework does not allow for the complete passage of subliminal types of messages. On the other hand, whilst the present infrastructure may be slower in nature, it has withstood the test of time. For example, an instructor who stands in front of a class may be able to collect the subliminal clues that she requires to evaluate how the learning environment should be modified to enhance the learning situation. Currently it is not possible to obtain such clues within the ICT infrastructure framework.

The input vendors may include professors, builders, administrators, projectors, blackboards are all arranged prior to and with the learning experience as its primary goal. The students who make up the end users function to pull the input together.

Presently, ICT software like Blackboard offers a package of interconnection possibilities. The package contains email for both individuals and groups, real time group discussion also know as "chat", discussion board to post articles for class input, post (drop) box to turn in finished assignments for the instructor to view and comment on and record keeping including contact history by time and date, grading and

reports in various formats. Furthermore, the package allows one to send soft files by Internet through either a modem or broadband connection. Most universities like the University of Phoenix, the largest online long distance granter of university degrees, uses writing and reading as the primary methodology for learning stimulation and assessment. The elimination of technology such as Blackboard puts one back to the correspondence schooling that was popular in the 1950 and 1960s in the USA.

In other words whilst ICT may have revolutionized the way higher education processes information at present, the learning process seems still tied to tacit knowledge sharing in specific places. In contrast to the explicit knowledge exchange that occurs in 'global space'. It implies that currently the classroom, the project work area and the library are still the focal points for purposes of learning management and assessment within the Higher Education supply chain.

3.2. Decoupling Model

The introduction of ICT has a major impact because it enables higher education to push the decoupling point further up the supply chain. (Hoek, R. van et al, 2001)

The decoupling point is the place within the supply chain where a product or service changes from push to pull. We shall illustrate the notion of decoupling point with a common product such as canned soup. The production of canned soup has different decoupling points depending on where the demand of the end user takes over to pull the canned soup into their environment. Canned soup is a product that is manufactured to stock and then 'pushed out' to where a customer can take it off the shelf. The decoupling point is the place where the customer collects the canned soup. If there is a system in place to deliver the canned soup to the place where the end user lives, then the decoupling point is where the canned soup is picked for delivery. In supply chain parlance it is called "assemble to order". If the client wants a special soup made for a party and arranges with a soup company, design the soup especially for him and then orders 100 cans for a party, the decoupling point is at the point where the manufacturing process of the custom made portion of soup begins. It is referred to as "engineer to order".

The supply chain for a service varies slightly from that of a physical product in that the decoupling point is at the point of consumption. When a doctor provided her medical advise or an airline provides a seat for a trans-Atlantic flight, the service is pushed to the point of consumption then pulled by the end user through consumption. In both cases, there is a process called postponement where the service is tailored to conform more closely to the value equation.

In the supply chain for traditional higher education, the decoupling point existed within the physical learning environment. However, the decoupling point within the ICT higher education supply chain is shifted from the physical learning environment to the place where the service is produced for distribution earlier in the chain. Why does this development occur? In examining the traditional learning environment, we can observe that although curriculum and lectures are created prior to the students entering the classroom, there the process of postponement taking place to allow the material to be modified through interaction and more closely suit the learning requirements of the end user, the student. Both curriculum and course material are prepared in the supply chain that drives ICT-learning process. But as the ICT lacks the 'face-to-face' interactivity of the traditional learning environment, there is no chance to postpone or modify same to suit the demand of the learner. As a result the subtle clues furnished by face-to-face interaction are not captured and disseminated through the ICT layer. Therefore the postponement process cannot take place. Although the student is free to draw a desired curriculum segment from the ICT layer at his own convenience, there is no real time “teacher” to modify the material to fit the learners’ needs at the time of consumption.

Such a subtle change in the decoupling point has many ramifications in terms of preparation, delivery and evaluation of the learning process and material. Looking at the physical nature of the supply chain, there will be likely less demand for buildings and furnishings, student housing and transportation for commuting. At the same time there will be likely more demand for ICT and facilities that are required to produce, stock and diffuse the desired learning products and experience some learning segments in real time on location. For example, business attachments and excursions are requisites at Business Schools at for instance Nanyang Technological University, Singapore, the University of Southern California and the University of Twente. Although the roles of the professors and students remain relatively the same in both traditional higher education and ICT-driven world, both the classes and projects are pushed into the ICT layer and are thus dependent on the technology to provide context. It is this contextual change that bears great importance in our analysis.

Particularly, it implies that higher education will need to build new structures to accommodate the ICT-supported processes and ICT will need to adapt to the need to deliver these face-to-face clues to enable the learning environment to once again to adhere to the current postponement process. As we move forward higher education must ensure that the content actually does pass, is available because the content is more than just the codified text. The methodology in-use to stimulate the learner, business to understand, the government to respond, may be considered rather old-fashioned. It requires one to call people, send faxes, emails and arrange for meetings and talk 'back and forth'. Higher education requires a system that enables it to exploit the ICT infrastructure to do essentially what is presently done the old fashioned way. Ideally, it will result in the integration of virtual and face-to-face encounters, where perhaps a phone call or a couple of meetings might be required during the entire information exchange process to support the virtual data stream.

In the ICT learning environment, most of the material world

is left out and ICT is substituted. One interesting facet is that most professors have prepared for this encounter the "traditional" way, learning habits of stimulation and assessment in a face-to-face setting. Most students in the Higher Education setting have also prepared in this fashion. (process mapping of traditional and cyber University education). Students who work on an assignment over lunch or in the University library or study rooms experience instant stimulation that is lacking with today's ICT learning tools. ICT promises both connectivity and velocity for the creation of centres of expertise that can be matched to problem situations. Specialities available in other countries and universities. Construct on-demand incubators to bring together students in response to certain needs in a certain area and subsequently, operate and fund it. To maintain objective learning environment, service quality, Stanford University, the learning lab, where they've done a tremendous job in this regard? Will the future of higher education imply the mass customisation of the learning experience? Can higher education create the same kind of trusting, low risk environment that we have in a classroom to foster learning in an ICT context?

4. Higher education supply chain management

A community of practice can be described as a 'space', where according to David Snowden an IBM knowledge management guru, knowledge can be released only on demand as a consequence of the interaction of at least two persons. A community of practice is based on the principle that two minds are better than one. It depends on the connectivity of its members, the dynamics interaction between them for purposes of information and knowledge exchange. Whilst there are different ways of obtaining knowledge, learning typically involves a script, imitating observed behavior of one or more 'masters', in a community of practice (Nooteboom 2000 : 274; citing Brown & Duguid 1996). An important characteristic of a community of practice is the master-student relationship. The role of the master is to provide appropriate stimulation, guidance and evaluation of the learner's performance. The role of the learner is to adopt, practice new patterns of learned behavior, either in a group or individually. Similar to a dancer or tennis player would rehearse with a coach. Learning is a process of creating insight, knowledge and understanding to enhance the learner's effectiveness. The content of learning is viewed as knowledge (Fiol et al, 1985) which is subject to constant assessment to establish if and to which degree learning has been accomplished. Assessment is paramount to the successful internalization of new knowledge and skills and to achieve a learning goal. Because (tacit) knowledge sharing is voluntary in nature, a trusting, non-threatening environment is essential functions for effective learning. A key issue is therefore how to create an ICT-supported, trusting, non-environment that enhance the learning experience.

Attending an institution of higher education, either on a full-time or part time basis offers one the opportunity to experience learning in a world unlike the workaday world. On a college campus, there are constant reminders that knowledge acquisition is the main focus. In that sense the campus of an institution of higher education may be viewed as a "safe haven". Higher education should focus on how to maintain the 'trusting environment' image where students can be stimulated to acquire knowledge on certain subjects, evaluate their level of learning and in the process enhance their own value proposition.

To this extent an open distributed architecture and prototype electronically supported learning market should be developed for use in the European Union. By electronically connecting learners to higher education providers (HEPs) this market will efficiently and effectively connect the diverse and geographically distributed Higher Education resources to individualized demand patterns of the diverse clients. For example, the Rotterdam School of Management has developed international student exchanges with 52 renowned business schools in 33 countries. Every year 150 Dutch students can be exchanged with 150 foreign students. Within the Community of European Management Schools (CEMS) network 17 universities cooperate with 57 multinational corporations. (FBK 2001). Finland is one of the European Union member nations that has taken the information society to heart, with its very high level of internet access. In future, the 'versatile use of networks in studying and learning' EC 2000) is likely to increase. This development calls for a support system that enables Higher Education to enhance international business and management learning experience both within virtual networks and through international exchanges and internships. What seems required is a proposed supply chain architecture and prototype for electronically supported higher education learning within the European Union.

The proposed comprehensive management system came about during sessions between Frank Go and Kuldeep Kumar, professor at Florida International University and applied to e-learning. The system consists of four modules: ***a demand module*** representing the learner's demand for designed learning solutions; ***a supply module*** representing the various suppliers culminating in higher education provision (HEPs); ***a market module*** providing market design and tracking service and ***a scorecard module*** designed to measure and evaluate performance. These modules are described in the sections 3.1, 3.2,3.3, and 3.4 below.

4.1. Demand

The demand consists of a number of independent customers. A software ***Customer Identity Agent*** is used to represent each learner. The customer identity agent, in addition to the learner's profile, includes information about the learner's preferences and requested activities (such as request for course information, request for course registration etc.). A learner may take one or more ***courses.*** In turn, initially each course consists of demand for multiple ***course elements*** or

course-components such as a publication, software, flight and ground transportation, and accommodations. The switching function in the market module matches the demand for available services. Once a suitable match is found by the Switching function, the segment demand is considered fulfilled. A course is built up by incrementally combining matched segments in linear time precedence relationships.

4.2. Market System

The Market System consists of four modules: A Demand-Supply Switching Function; An Online Curriculum Designer; A Curriculum Tracker and Dynamic Re-Scheduler; and A Mobile Financial Payment System.

The ***Demand-Supply Switching Function*** matches the segment demand requirements and the Learner Identity Preference Profiles to available Higher Education Providers in order to satisfy learner's demands. This is a dynamic switching function that allocates appropriate course modules to a learner's specific course component requirements in real-time, within the constraints of the learner's preferences. It further makes reservations when authorized by the interactive curriculum builder.

The ***Online Interactive Course Builder*** is the intermediary between the learner's (changing) requirements and the Demand-Supply Switching mechanism. It strings together the matched demand segments into a sequential course itinerary. While the switching mechanism is concerned only with satisfying demands of individual demand segments, the Online Course Builder ensures the consistency of the learning process by ensuring and documenting that the demand segments are arranged in the right sequence and are within the constraints (such as time, budget etc.) of the overall course.

The ***Mobile Tracker and Dynamic Re-Scheduler*** is a workflow (learner-flow) manager that tracks the learner throughout the course using a combination of GSM and GPS technologies. It also tracks for involuntary (e.g., a traffic delay on the road) or voluntary (the customer wants to switch schedule) course attendance changes. When such changes are detected, through the Interactive Online Course Builder, it co-ordinates with the Demand-Supply Switching function to dynamically re-schedule the remaining course-segments.

The ***Financial Payment System*** is a mobile telephony (GSM) based system that lets the learner pay online for services received. It uses the GSM technology to receive the invoice for service, compare it to price contracted or agreed upon either when the switching match was made or when the service was received, and authorize payments, all online. And can also be used by learners to record their comments about the service received in a *rating service* designed to assess the course content and its delivery.

4.3. Supply

The Supply Module consists of: Higher Education service provision (the university) within the context of the Extended Higher Education Supply Chain. Particularly, this refers to providing access to the 'shadow network' of knowledge that is available in corporations. Corporations around the world are trying to create the learning organisation, a corporate environment that is conducive to learning. For example, the Ford motor Company issued computers to most of its employees to improve connectivity.

According to IBM guru David Snowdon 95% of corporate assets are embedded in tacit knowledge or the knowledge between the ears of employees, not the buildings. People can not be forced to surrender knowledge. They shall only do so voluntarily, under conditions in which they feel trust and friendship. Therefore, an important issue in learning is: Where and how within the Higher Education Supply Chain can 'safe havens' be created that allow for a learning environment, the sharing of information and dissemination of knowledge.

Another key issue is how to bridge the multicultural, multi-lingual and governance gaps in a European Union or global learning environment. Indeed transnational learning can only occur if the cultural gaps that divide organizations and institutions can be bridged effectively and efficiently. Academia, corporations and governments have to begin to support the process of trans-national learning, through the versatile use of networks in knowledge development, sharing and application. This requires a higher education information provision system that designed to cope with complexity.

4.4. Information Provider

As far as possible, the Higher Education Information Provider module will rely on existing online sources of information to provide its stakeholders with related information. It will also rely on publishers', consultants, corporate- and supplied information and data issued by government and regional government authorities. Finally it will connect to both local libraries and those outside the region as sources of information.

In addition this module will include a ***Ratings Function*** (learner-provided ratings function***)*** to capture and organize learner's comments based upon his/her learner's experience. Following the business model of Amazon.com, this service will only store learners' comments and will not assume any liability for the accuracy of the learners' comments.

5. Concluding remarks and future agenda

In our presentation we have taken a look at the globalization in relation to higher education. Knowledge creation is viewed as the product of the interaction between tacit knowledge embedded in local cultures and codified knowledge that is globally accessible because it is based on a set of assumptions

that are commonly accepted independently from the specific membership of the parties'. (Ganzaroli 1999).

Partnerships have traditionally played a critical role in higher education, but in future their relationship to academic success will increase dramatically. The evolutions to strategic alliances in business challenge the notion that businesses are discretely bounded entities. Evidence indicates that alliances facilitate organizational learning (Hamel 1991) speed rates of process innovation and other sources of competitive advantage (Bardaracco, 1991). Clearly, this accumulation of evidence in business over the years underscores the importance of understanding if international competitive ICT-performance plays a role within cooperative strategies in higher education. A major issue for institutions of higher education is to create the conditions for an international ICT-performance.

To this end we introduced the supply chain as a mechanism to coordinate and control internal capabilities, the types of alliances and the scope of relationships with other institutions of higher education resulting in stimulating e-learning in Europe. A relevant issue for institutions of higher learning is whether or not it is desirable for ICT applications to complement or substitute traditional forms of management education (van der Linden and van Baalen 1998:15). When the answer to this question is affirmative it raises yet another question: "What separates e-learning from traditional learning in the higher education context?

One important barrier that stands in the way of virtual and boundaryless e-learning in the pure sense is trust. This paper has dealt with the question when (de-coupling) and why (tacit vs. codified knowledge) parties that develop and transfer knowledge need trust. We have looked at the implications of globalization and the application of a supply chain perspective to coordinate and control student-'master' encounters and relationships in the system, in which a trustful environment is key to overcome uncertainty and stimulate learning. The model that we have presented is clearly at the exploratory stage, requiring both further development and testing. We believe that the potential benefits of ICT in higher education are immense. Optimism about the potential of e-learning for economic, social and cultural development can be heard throughout the UN, the World Bank, and the World Trade Organization. Attaining the actual benefits of policy choices depend on practical implementation conditions.

References

Bardaracco, J.L. (1991*) The knowledge link*, Cambridge,MA: Harvard Business School Press.

Daft, R.L.. K.E. Weick (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review,* 9 (4), pp. 284-295

FBK (2001). Bedrijfskunde Studiegids 2001/2002.

Fenema, P., (2001). *Coordination tensions in Distributed Work Environments: The Role of Collaborative Technologies*, Paper presented to ERIM Conference New Organizational Forms 16-17 November, Rotterdam: Erasmus University.

Fiol, C.M., M.A. Lyles, (1985). Organizational learning, *Academy of Management Review,* 10(4), pp. 803-813

Ganzaroli, A. (1999). *Glocalizing Trust: The role of IT in a De-Coupling Industrial District*, paper submitted to The 8th European Conference on Information Systems (ECIS).

Hamel, G. (1991). Competition for competence and interpartner learning within international strategic alliances, *Strategic Management Journal*, Summer (Special Issue), pp. 83-103

Hertog, P., den, R. Bilderbeek (2000). The New Knowledge Infrastructure: The Role of Technology Based Knowledge-Intensive Business Services in National Innovation Systems. *Services and the Knowledge Based Economy*, M. Boden and I. Miles (eds), London: Continuum.

Lee, A.S. (1994). Electronic Mail as a medium for rich communication: an empirical investigation using hermeneutic interpretation, *MIS Quarterly*, June, pp. 143-157.

Linden, R., van der and P. van Baalen (1998). Models of learning and medium choice in MBA-Education, Report submitted to the MACIS Project, Rotterdam: Rotterdam School of Management (January).

Nonaka, I and Takeuchi, H (1995). The Knowledge Creating Company. Oxford: Oxford University Press.

Nooteboom, B. (2000). *Learning and innovation in Organizations and Economies*. Oxford: University Press.

Ruigrok, W. and R. Tulder (1995). *The logic of international restructuring,* London: Routledge.

RTD info (2000). Magazine for European Research (May).

Slack, N., S. Chambers & R. Johnston, (2001). *Operations Management* (3rd edition). Harlow: Financial Times

4. Papers Track 3: Organisational Change

21 e-Venture: The Making of 21st Century European Learning Regions

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Abstract

Within the context of the evolution of 'Europe of the regions' this paper examines the role of higher education in the information age. It contrasts two perspectives on contemporary society in relation to higher education. Ritzer's (1998: 151-163) Post modern perspective which positions McUniversity in the Consumer Society of mega-malls, fast food restaurants, television shopping networks and infomercials. And Postman's (1999) perspective, derived from the eighteenth century, which re-examines our values and calls for a 'future connected to traditions that provide sane authority and meaningful purpose.'

Paradoxically, the world-wide information explosion and increasing global competition has resulted in the most enduring competitive advantage being created on the local level within the 'triple helix' (Etzkowitz & Leydesdorff, 2001), that is the emerging clustering of inter-connected firms, institutions of higher education and government (Porter 1998).

A new feature of the triple helix is the increased need for higher education to connect and relate with industries and the government and exchange knowledge for funding. It requires the fostering of new partnerships and the adoption of new and better higher education strategies to identify potential 'complementors' with whom to co-evolve towards a value net, that generates a relation rent.

The operation of the resulting system is e-Venture designed to support the rapidly emerging field of event management, a medium which responds to the needs of the consumer society and the values that provide meaningful purpose and contribute to the creation of cosmopolitan citizenship.

The focus of the e-Venture project is on the critical linkage of both e-content in higher education and relationship management that enables the Triple Helix to support and realise 'The Making of European Learning Regions'.

1. Introduction

Trends such as the world wide information explosion, increasing international competition and shifts toward inter-organisational alliances are affecting society and by extension institutions of higher education. We present an analysis of higher education in the information age by contrasting two perspectives: Ritzer's (1998: 151-163) McUniversity in the Postmodern Consumer Society and Postman's (1999) who re-examines our values by revisiting the Enlightenment.

Postman derives (1999) his perspective from the eighteenth century, which re-examines our values and calls for a 'future connected to traditions that provide sane authority and meaningful purpose.' He views the present era as the second 'age of the information', pointing to the eighteenth century when 'a tumult of information was created, along with new 'media' through which the information was communicated (Postman, 1999:82)

At that time, most cities in Europe had their own periodical. 'Their purpose, in general, was to create cosmopolitan citizenship, informed about the best and most recent knowledge of the time.' The same purpose was pursued, initially in France and later in Germany, Austria and England, 'through the creation of salons - gatherings of aristocratic and middle class people who shared ideas and new information in social settings.' (Postman, 1999:82). During the 19th century the focus shifted to the problem of how to get more information to more people, faster and in more diverse forms.' (Postman, 1999:89)

The advancement of computer technology in the 20th century allowed for even faster distribution of even more information and in more versions to more people, at least to those who electronically connected, anytime, anyplace.

In the mid 1990s, 'a shift in emphasis occurred from the computer as desk top tool to the computer as the communications gateway to colleagues and 'content' (database, image, and text libraries, video, and more) made increasingly accessible via computer networks. Courses can be beamed from a central studio, some other university, or even some other country to satellite locations' (Ritzer 1998:158)

Presently, 'some universities exist entirely in cyberspace: the California Institute of Integral Studies, the teacher's University, the National Universities Degree Consortium and the Mind Extension University ' (Ritzer 1998:159) In traditional universities like Northern Arizona higher education is dominated by 'computerised, televised images. These images will be circulating in hyper space side by side with similar images from commercial sources such as MTV, CNN, the Disney Channel, the latter will come to be important competitors of' traditional higher education.

(Ritzer, 1998:159).

In future higher education is likely to retain many of its traditional components but also integrate appropriate elements of the new means of consumption and tourism into existing structures (Ritzer 1998:160). 'Many of the new approaches involve a one-way flow of information, with the result that there is no give-and-take; no possibility of Baudrillard's (1993) symbolic exchange between those who teach and those who learn.'

'Perhaps no term captures the nature of the universities of the future better than 'implosion'. … higher education is imploding 'into the locations of their satellites , the media (especially television), the computer and cyberspace, entertainment, consumption' and tourism. In fact, they are imploding into so many things and so extensively that one is left to wonder: what, if anything, will be left? The image that comes to mind is a Baudrillardian black hole where it is hard to distinguish the university from everything else'. (Ritzer, 1998:159)

Ritzer's (1998: 156) believes that the goal of higher education will continue to be the facilitation of access to its various services, which under conditions of intense competition implies a strategy of decentralisation through small educational satellites. Such satellites may be found in pre-existing sites such as 'community colleges', high schools, work places and' shopping malls. He cites Barker (1994-5) who asserts that 'courses will be available on TV, videotape, via computer', enabling students to access virtually all course related materials from their home computer or via video conferencing, instead of having to go to educational satellites (Ritzer, 1998:157).

Postman believes higher education to be in the 'business' of transforming information or 'statements about the facts of the world,' (1999:91) into knowledge, defined as 'organized information' (Postman, 1999:95). 'Knowledge is embedded in social networks and probably to a great extent tacit knowledge (Nonaka and Takeuchi 1995). It implies that effective knowledge development in higher education depends on social interaction. It raises issues such as how to relate higher education 'more directly to the realities of contemporary life. […] how institutional diversity can be strengthened'. (Boyer, 1990:13)

The goal of all societies is to move from present production levels, through a growth process, to higher production levels in the future. Typically this is accomplished through a process of knowledge development, transfer and application.

The 'Europe of the regions', provides a rich 'tapestry' of cultural diversity that can and should be maintained because, it is the source for the cross-fertilisation of ideas that can lead to both exploration and innovation. This can be achieved by paying attention to the unique differences between various cultural communities. However, it needs to be recognised that beside their unique differences the various cultures in the European Union also share a joint heritage, future and organisational processes that require a concerted approach.

The simultaneous emergence of 'Europe of the regions' and a transnational knowledge infrastructure causes higher education to interact with the complex international environment. It implies that higher education must come to terms with the 'exploitation' and 'exploration' paradox. 'Exploitation requires the maintenance of identity, knowledge and practices with a certain amount of control and coordination in a dominant design [....] Exploration requires their change, with a loosening of control and co-ordination' (Nooteboom, 2000:8)

The e-Venture project addresses such dilemma in that it allows for exploitation of diverse themes that are inextricably tied to the 'Europe of the regions' in the 21st Century. What relevance does the e-Venture project have to higher education?

It can be used in higher education as an experiential learning tool. It uses innovative techniques such as a portal of European cultural events to provide students access to multilingual and multicultural communities across the European Union.

Within the context of 'internationalisation', it enables higher education to 'exploit' the latent potential of European culture and allows students to become aware of Europe's diversity and obtain knowledge through a combination of a modern brand of instructional delivery (Ritzer, 1998) and the 'exploration' of 'traditions, that provide sane authority and meaningful purpose.' (Postman, 1999)

2. Triple Helix

The 21st Century shall place higher expectations on higher education. This 'clarion to arms' is echoed in the Carnegie Report:

'If institutions of higher education are unable to assist students and citizens to enhance their view of an interdependent world and practice their conciliatory and communicative skills, then each new generation will remain ignorant and its capacity to live competently and responsibly will be dangerously diminished.' (1991:42)

It calls for nothing less than 'The Making of European Learning Regions', that is regions that are able to create learning opportunities for all its members and transform themselves as a whole'. Such project aims to foster a structured collaboration between higher education, business and government and should result in 'cosmopolitan citizenship, informed about the best and most recent knowledge of the time.' (Postman, 1999:82).

Since the 1990s the Communication School has advocated the view that individual and organisational learning are significant components of the innovation process (Nonaka and Takeuchi 1995). In this context innovation is considered a process revolving around the generation of new knowledge and the application of such knowledge. It is assumed, that communication of information and knowledge between the

various parties involved in the acquiring, generation, and application of knowledge process plays an essential role.

The e-Venture project seeks to simultaneously borrow from the past and adapt to the future. It places higher education central stage in the explication and transfer of social interaction and knowledge creation (Nonaka and Takeuchi 1995) within social networks. The project challenge is to build a semblance of coherence and power from a diversity of cultures that can be found in the countries and higher education systems within the European Union.

It implies that users of the system must be aware of the reasons that cause miscommunication to occur in international project. These are the gaps caused by physical distance, language barriers, psychological distance (mental models), and cultural barriers (different styles and behaviour).

The building of critical mass through a European cultural events calendar portal is a means to bring together a network of 'communities' across the European Union, under a 'collective brand'. Such collective brand should be interpreted as a vehicle enabling brand value transfer between multilingual and multicultural communities, including potentially higher education.

A major challenge in brand building and content fuelling is to seek identification with the collective brand amongst the multiple identities of multicultural suppliers of higher education. Visual identity is more than a logo representing a system of higher education, large corporation or a regional community. Instead it represents 'a community of values, convergence, assimilation, diversity, hierarchy, a respect for particularity; of what makes a region more than simply a collection of government departments' (Floch, 2000:7).

Higher education institutions typically serve a particular region and to be successful need to create feelings of belonging and influence student motivation. At the same time the emerging knowledge infrastructure demands that they be internationally connected.

In future the process of European integration is likely to give impetus to the convergence on the level of higher education development, structure and information exchange. At the same time it needs to be remembered that the European Union does not represent a homogeneous region because it lacks the definition of a set of objective, internal similarities. In that sense there is a divergence between member states of the EU. This divergence is amongst others expressed in the regime of knowledge construction involving beside higher education, industries and the government. Therefore, despite the information age higher education is likely to become 'more physically embedded in, and intellectually intertwined with, the community. Another way of saying this is that [higher] education will become more local.' (Ritzer 1998:158).

Various other authors provide diverging, but complementary explanations for the intertwining of higher education with industries and the government that Etzkowitz & Leydesdorff (2001) refer to as the 'triple helix'. For example:

Sutz (2001) offers a logical and well-known explanation for the closer co-operation between higher education, business and government:

'The increasing demand for funds from universities and research institutes gets a similar response world-wide: support yourselves! That is to say, connect yourselves with industries and the government, offer your knowledge and your capacity to generate new knowledge, and charge for it. Only in this way will you be able to extend your laboratories, hire young people, and increase your salaries. (Etzkowitz and Leydesdorff, 2001:5)

Porter (1998) believes clusters of inter-connected firms, institutions of higher education and government to represent 'a new and complementary way of understanding an economy, organising economic development, and setting public policy. Understanding the state of clusters in a location provides important insights into the productive potential of its economy and the constraints on its future development. Paradoxically, then, the most enduring competitive advantages in a global economy will often be local' (Porter 1998:266).

Wim de Ridder (1999) points to the significance of regions as the driving forces behind economic development. Successful cities such as Barcelona, Dublin and Glasgow have capitalised on their function as meeting point, liaison centre and stages of action.

The regime of communication that emerges as a result of the differentiation in society and the effects of information technology, implies that the needed integration can no longer be solely community based. Therefore integration needs to be considered as the result of translations between otherwise differentiated spheres. The changing codes of communication require a mutually exchanging systems both at the 'salon' level that capitalises on territorial proximity and allows the gatherings of people from different backgrounds to share ideas and new information in social settings. (Postman 1999) and at the information technology level. The application of information technology to support the exchanging of information within linked higher education networks on the global level.

International developments place pressure on higher education to join the information society and extend education and training throughout life. At the same time higher education must create and maintain relationships with students, businesses and other stakeholders who have increasingly different ethnic or religious backgrounds. Stakeholders with different domestic and foreign backgrounds can learn from each other. However, international contacts have been often limited because attitudes, orientations, emotions, and expressions tend to diverge strongly.

Europe's cultural diversity may be considered to represent a potential differential edge. But Europe's higher education

sector needs to institutionalise the game rules to overcome the constraints that shape human interaction. In the last two decades the number and variety of inter-organisational relations and networks such as strategic alliances have accelerated. The network process is aimed at the development of partnerships that deliver 'relational rent'. The latter is defined as 'a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners' (Dyer and Singh 1998:662).

3. e-Venture

The e-Venture project seeks to bring about the development of partnerships that deliver 'relational rent' using events marketing and organisation in combination with the application of innovative information technology within the 'triple helix' context. The operation of the resulting system is e-Venture designed to support the rapidly emerging field of event management, focusing on the critical linkage of both e-content in higher education and client relationship management needed for the 'Making of European Learning Regions'.

Event management depends on a regime of 'face-to-face' communication. It helps to foster new partnerships through the incorporation of age-old 'nomadic values: every guest is in the beginning a stranger, the 'right to visit' and the creation of symmetry between host and guest by serving and accepting the other at least temporarily (Ciborra 1999).

The 'high-tech' virtual dimension provides world-wide access to the identification of potential complementors with whom to co-evolve towards a value net, that generates a relation rent.

Observation shows that experiential learning, that is learning that occurs from experience, is on the rise within the European Union. For example, there is growing interest amongst students attending the Community of European Management Schools to gain 'hands-on' experience abroad for instance through internships, projects and excursions. The e-Venture project could support such experiential learning in a substantial manner.

The overall learning process may be defined in terms of four modes: concrete experience, reflective observation, abstract conceptualisation and active experimentation (Kolb, 1984). Effective higher education incorporates all four learning styles. The most difficult to incorporate into the traditional class room is concrete experience; the aim of the e-venture project is to provide an opportunity for some concrete experience learning beyond the classroom, across boundaries involving multicultural and multilingual e-learning.

Our experience shows that a critical success factor in multicultural and multilingual e-Learning depends on one partner who takes the lead in formulating and communicating the opportunity, identifying compatible partners, setting the agenda, and facilitating the process of formulating the strategy and operational plans.

We will refer to this role as the e-Venture cyber-mediary, which is the engine behind the dynamics that can result from a partnership between higher education, business and government partnership. Presently, complex and comprehensive modelling, remains largely confined to knowledge institutions. The core technology of the project will be to apply e-learning to the system dynamics technique. It has been widely applied, for example, in engineering and social studies.

The e-Venture application demonstrates that it is feasible to provide multicultural and multilingual personalised access to fragmented content and introduce a method of leadership that bridges time, space, digital and cultural divides in European regions and contributes to disseminating knowledge so that it results in experiential learning that in turn would contribute to economic development.

4. Information technology

Advances in information technology allow for the tracking and tracing of demand patterns in an almost real time way. There has been an explosion in the number of distribution channels, products and services and the boundaries between them are disappearing.

We anticipate a transformation from the industrial economy to the information society. The effects of the resulting ambient 'intelligence revolution' are profound in that they are spreading fast and change not only the methods of production but what is being produced as well. The intelligent revolution and subsequent international restructuring race will have a big impact on Europe's higher education sector.

The major innovation in this project lies within the overlap between three knowledge and planning fields that have, hitherto, developed largely independently of each other. These are:

- an approach whereby higher education integrates its efforts with those of business and government intervention to pool knowledge and resources;
- e-learning and interactive presentation of academic provision that is accessible to multicultural and multilingual learners, who are
- the cultural sector which connects to higher education through an electronic site under the umbrella brand of a Calendar of Events aimed at multicultural and multilingual students and publics.

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provide multicultural and multilingual personalised access to fragmented content and introduce a method of leadership that bridges time, space, digital and cultural divides in European regions and contributes to disseminating knowledge so that it results in economic development.

By involving students in an experiential learning context, for example a cybermediary incubator, they should be able to leverage their learning process through interaction with students in other countries on the net. For example, it is anticipated that through practice they would learn some of the following principles.

First, that users feel and assert their individuality and expect this to be recognised. Put differently, users want to be listened to and respected and look for both stimulating sensations and safe and familiar environments.

Second, that advances in information technology allow for the tracking and tracing of demand patterns in an almost real time way.

Third, with the emergence of the 'civil society', the public authorities remain unable to decide and control which services are likely to sustain.

Last but not least, the effects of intense competition on distribution channels, products and services and the blurring of boundaries between them.

Learning about these developments would trigger students to understand the position of various actors in the chancing 'landscape' and how to create and maintain relationships of value. Within the European market this would increasingly imply the need for bridging linguistic and cultural differences.

In order to maximise the learning process the following pressing questions could be posed in the e-Venture incubator context:

How to ***converge*** the fragmented content industry, which is dependent upon a dispersed market?

How to ***match*** supply and demand efficiently?

How to ***use content as a means*** to give expression to local identity within a global system?

How to create more unity and alliances ***within a market characterized by increasing fragmentation and flexibility***?

The E-venture project intends to develop a European calendar of events, rooted in the arts and culture and founded on a system of integrated and user-friendly services according to user patterns that would be accessible through one-user-interface (e.g. a cultural or tourist portal on the web) to a multicultural and multilingual audience.

This value-added brokerage would combine unity and diversity to derive:

(1) scale economies in the production of online content and services through digital infrastructure and

(2) scope economies in the front-office, by addressing the needs of different target groups for specific linguistic and thematic areas such as the relation between international business the arts and cultural heritage.

These developments are forcing most organisations, including higher education, to create and maintain relationships of value and bridge the gaps in linguistic and cultural differences that are characteristic of the European market.

Europe's cultural amenities tend to be a non-profit and public, foundational asset for learning and innovation in an international context. Europe's cultural amenities are extremely varied and include art manifestations, museums, monuments, theatre productions, literature, films, videos, historic inner cities, archeological sites and landscapes. Culture has a tremendous potential to build both prosperous business. Due to hyper-textuality and digitalisation the cultural realm is increasingly linked.

The e-Venture incubator could play an ongoing role in higher education and develop co-operation through fostering understanding within the 'Triple Helix' context. The project would be aimed at both building employment and life skills, and rekindling pride and belief in a region. The e-Venture project may be viewed as an incubator blueprint for integrated virtual entrepreneurial and community development in the cultural amenity context.

Following our own experience, the lack of Cultural Entrepreneurs is a limiting vector to business growth, and wealth and job creation. The proposed service renders the knowledge, methods and tools to develop co-evolution, where the divergent worlds of entrepreneurship, cultural heritage, tourism, and urban governance can converge.

Therefore, we propose to involve students in an experiential learning process designed to learn how enterprises should capitalise on e-commerce and cultural institutions in regions and industrial districts. Students should assume the role of the 'Cultural Entrepreneur' whose aim would be to create value, through a combination of 'collective branding' and the cross-fertilisation of the complementary strengths found in the 'Triple Helix'.

Historical evidence indicates that Cultural Entrepreneurs exist. They understand the differences and the interplay between the value-adding processes of the 'cultural world' and the 'business world', see clearly the strategic issues of global competition and internal conflict, and the effects they pose on organisations.

However, the e-Venture project is innovative in that it systematically poses students the question 'how to exploit the link between virtual communities and culture to create value'. For example students at the Erasmus University may capture and organise the comments from higher education students elsewhere in Europe on Rotterdam or the Netherlands received over the internet.

Following the business model of e.g. Amazon.com, this service will only store and present customer comments and

will not assume any liability for the accuracy of the customer information. In the long run, the e-Venture project will produce more adequate information and have beneficial effects for both students and entrepreneurs. Particularly, it will result in better insight on the matching of supply and demand.

In response, we expect marketing practice to shift from the search for ideas that can be copied without modifications from a successful destination to the strengthening of unique features that can be developed into a regional identity and a resource base for the development of events that fit such identity.

5. Project objectives

The project intends to implement a market-driven business model, including an unprecedented integrated software design, that enables the matching of multicultural and multilingual user needs to the value-added dimensions of e-content products and services.

The project will ensure the wider availability of e-content across markets and communities. It is both know-how and process-oriented and uses a system of integrated and user-friendly services.

Main goals of the project are:

1 Enhancing e-content production amongst suppliers within global networks and in a multicultural environment

2 Promoting multilingual diversity in the information society

3 Stimulating economic activity

4 Lowering barriers for the entry of new actors

5 Developing a globalisation strategy for dynamic network organisations across Europe

6 Development of an innovative supplier strategy

7 Development of effective public-private partnerships (cf. relationship customer - industry - environment)

8 Stimulating the expression of identity of all involved regional layers within the global networks

9 Creating a bearing surface for the production of high quality through the integration, where appropriate, of local, global and virtual knowledge, focusing in turn upon group synergy and organisational learning, leading to economic vitality and sustainable regional development. Hitherto, little systematic knowledge, methods and hardly any tools are available to turn the marketing of events into a veritable profession. The lack of brand identity in the cultural and entertainment sectors is a limiting factor to providing better market opportunities to the individual suppliers of events and enhancement of Europe's presence within global networks.

6. Europe's potential: content and technology

The European Union has a large variety of cultural layers. The market for value-added content products has grown with the spread of the Internet. Therefore, as well on the supply as on the demand side the choice between sheer 'volume' as opposed to 'value' becomes more and more pressing.

The modern consumer of entertainment is in need of a multi-channel system in order to create a number of value-added experiences. Three components are relevant: (1) the 'bricks' (i.e. the existence of an event), (2) the 'clicks' (e.g. the visits on the web with respect to the given event) and (3) the 'cultural content' (i.e. the psychological experience). In this process-driven scenario the experiential level is of great importance for the user.

7. Rating & ranking: an added value in the decision making process

The major added value for the supplier, however, lies in the information gained by means of a rating system. The knowledge of to which extent the event - and its components - has pleased or displeased the consumer is a valuable asset and a major criterion in the supplier's ensuing decision making process (e.g. programming, price structure).

Currently, especially in the case of publicly owned and operated events little consideration tends to be given to the 'return on investment of events. However, due to the 'withdrawal' of government and public budget cut backs, it has become eminent to make some 'hard choices.' A support system is required to facilitate the decision making process. In this regard a rating and ranking methodology - by means of a computer-based information system - can provide a systematic framework to guide and improve decision making, especially in the public and private partnership context.

8. Linking events and sales

From a regional development perspective, events can be viewed as a relevant component of higher education. The knowledge and skills needed for the marketing and management of urban events is sizeable and has been only partially 'mined'. In order to 'capitalise on the potential revenues the development of further integration between the events industry and involved vendors is needed. However, practice demonstrates that only few cities are able to organise effectively new routes, products and services that are designed for visitors and generate a significant impact on the composition and spending pattern of visitors.

9. Potential of public-private partnerships

Public-private partnerships have been used to achieve greater organising capacity within the public sector. The complex

environment of culture and events management requires a configuration that facilitates the co-operation between, cultural content providers, the private sector, educational institutions and local administrators. The development of public-private partnerships will be applied in this project as a tool to bring about modern governance. It implies a pro-active and entrepreneurial attitude by the public sector, based on leadership designed to effectively and efficiently steer developmental processes that contribute to the collective well-being. At the same time, businesses that become involved in a public-private partnership tend to develop a greater sense of social responsibility and acknowledge the strategic importance to contribute to the quality of life, which is a precondition for the continuity of industry.

Students may be challenged to apply a management tool, that support investment decisions in cultural product development. This management DSS is a software tool that calculates the value of a portfolio of projects using estimates of the cash flows during the life cycle of the project, including the development, implementation and commercialisation phases. The tool is based upon a recently developed method, named Dynamic Business Modelling (see Janszen, 2000). Such tool improves the decision process because:

1. it helps to analyse the critical success factors in a systematic and disciplinary way,
2. helps to integrate the knowledge of a large diversity of actors
3. it makes the decision process much more transparent, so that discussions can focus upon the important aspects and additional soft factors that are hard to quantify
4. it helps to decide what to include in the project what to postpone or outsource
5. it helps to communicate decisions to other parties.

Although the tool so far has not been used in the service industry, there are no main reasons why to apply it only to hardware product development.

The e-Venture project helps to address five key issues in 'The Making of 21st Century European Learning Regions' - participation, physical improvements, economic opportunities, cultural opportunities, and quality and safety.

1. Participation. Effective regional regeneration requires that local actors be the primary author of the empowerment strategy, inspired by the needs of 'outside' clients, for instance virtual communities. Question: How to facilitate interactive consumer decision making that results in a 'seamless' cultural experience with the support of the e-Venture project;
2. Physical Assets/Liabilities. A strategy for addressing physical and virtual assets, may include anything that establishes the region's identity, enhances liveability, tourism and employment. Conversely such plans should be reviewed from the perspective of adverse impacts. Question: How to develop appropriate and effective mechanisms for decision making that is based on vision and consensus;
3. Economic Opportunities. Job-based growth is an important driver of economic growth. But unguided growth can have negative impacts. Question: How to meet the challenges of development that is inclusive of the needs and wishes of visitors, entrepreneurs, cultural institutions, and tourist offices, that enables achieving a balance between economic and social goals;
4. Cultural Opportunities. Monuments, museums, libraries, and other cultural institutions should not simply be thought of as heritage repositories, but resources that can raise a region's self-esteem and provide the power it needs to influence its future. Question: How to develop collaboration between diverse actors to capitalise on cultural capital?
5. Quality, environmental health and safety. Regions that create quality, environmental health and safety are attractive to residents and visitors alike. Question: How to develop an adaptive system that updates effectively the new information provided by customers?

The major innovation of the project is the aggregation of fragmented research on dynamic change to create a unique new tool to the conventional process of information search and evaluation of alternatives. In the conventional system, customers have to rely heavily on information provided by suppliers for evaluating destinations and travel options.

This information is incomplete and inevitably coloured by the commercial source. It is well known that independent information sources are considered much more effective in influencing choices of customers (e.g., word-of-mouth of fellow travellers).

Rather than stop here to draw conclusions, the project moves on to develop an understanding of what barriers keep actors in cultural tourism from working together effectively on needs linking. And the processes that affect collaboration between different actors.

It develops the implications that these findings will have on higher education marketing, new course development and developing the extended higher education through e-Venture.

10. Concluding Remarks

In the 21st century higher education is drawn increasingly into the complex international context, causing a tension between convergence and divergence and postmodernism and traditional values. Postman pointed out (1999:98) that "The problem to be solved in the twenty-first century is not how to move information, not the engineering of information. We solved that problem long ago. The problem is how to transform information into knowledge, and how to transform knowledge into wisdom".

It implies higher expextations from higher education, that it must work 'smarter' that is recognise that knowledge creation is its core competency and the challenge is the sharing of information within an extended higher education configuration which has been referred to as the 'triple helix' and across national borders.

Our argument is that the co-evolution of different types of organisation for purposes of knowledge creation does not occur routinely but is based on 'needs-linking'- and difficult to achieve. The e-Venture project could be used by higher education to combine the application of information technology and link it to special events that take place on campus and in the region as a means to build trust amongst divergent players and enhance relational rent. It would position higher education as a potential incubator which contributes to 'The Making of European Learning Regions'.

References

Boyer, Ernest L. (1990).*Scholarship Reconsidered Priorities of the Professoriate*, Princeton, New Jersey: The Carnegie Foundation for the Advancement of Teaching.

Carnegie Council. Carnegie Report on Higher Education. New York: Carnegie Corporation of New York, 1991:42).

Ciborra, Claudio (1999) Hospitality and IT, University of Bologna (unpublished paper).

Dyer J and Singh, H (1998) 'The relational view: co-operative strategy and sources of inter-organisational competitive advantage', *Academy of Management Review* 23(4): 660-79.

Etzkowitz, Henry & Leydesdorff, Loet (2001). *Universities and the Global Knowledge Economy A Triple Helix of University-Industry-Government Relations*, London: Continuum.

Floch, Jean-Marie (2000). *Visual Identities*, London: Continuum.

Janszen, F (2000) The age of innovation, London: *Financial Times*.

Kolb, David A. (1984). *Experiential learning: Experience as the source of learning and Development*, Englewood Cliffs, N.J.: Prentice Hall.

Nonaka, I and Takeuchi, H (1995). *The Knowledge Creating Company*. Oxford: Oxford University Press.

Nooteboom, Bart (2000). *Learning and Innovation in Organizations and Economies*, Oxford: Oxford University Press.

Porter, M.E. (1998) 'Clusters and Competition,' in *On Competition*, Cambridge, MA: Harvard Business School Press.

Postman, Neil (1999) Building a Bridge to the Eighteenth Century, New York: Knopf

Ridder, W.J. de (1999). 'De Ziel van Nederland', *Osmose* No 3 : 11-15.

Ritzer, George (1998). *The McDonalization Thesis*, London: Sage.

22 Digit@l Did@ctics: Development of Teaching Staff

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Abstract

This paper presents an innovative way of development of teaching staff. Teachers prefer to learn and to receive support 'just in time'. As an answer to this demand this project has developed an educational knowledge base containing didactical materials and an educational call centre.

Keywords: Teacher training, knowledge management, didactical methods

1 Introduction

The paper presents an innovative way of development of teaching staff, which is being developed in the project Digit@l Did@ctics. Reason for this project is, among others, the national inventory study of the use of ICT in Dutch Higher Education (Veen a.o., 1999). This inventory study identified some bottlenecks in the introduction of ICT in education: teachers have to make a move to new education, but they lack time; teachers lack insight in ICT development; teachers lack ICT capacities. Finally these bottlenecks lead to the recommendation to stimulate expertise development with teachers by means of an on-line learning environment. In addition, it is proposed to make this happen by exchange of expertise and collaboration between institutions.

The project is based upon the following propositions:

- teachers prefer to learn and to receive support 'just in time';
- teachers prefer to learn at their own speed and in their own surroundings;
- the Web is the medium to give information just in time and to facilitate learning.

By collecting and giving entrance to instruments and material referring to digital didactics, it is prevented that, on different spots, the same activities will be performed to shape the teaching and learning with help of innovative use of new technologies.

The three main Dutch partners in this project are the OECR (Educational Expert Center Rotterdam) of the Erasmus University Rotterdam, EDUTEC of Delft Technical University and ECCOO and UCLO of the University of Groningen. Central in this project is knowledge dissemination and staff development of teachers. An important starting point is sharing, storing and dissemination of knowledge.

2 Problem definition

Within Higher Education a lot of material and experience is available in the field of digital education, both in designing, implementing and in evaluating education. Educational staff members of the different educational centres and education supporting groups use their own material or material from others within their own advising practise. Pioneering teachers have experience with online teaching and much of their practices are briefly or extensively evaluated. Next to the pioneering group there is an extensive group of teachers confronted with the problems using Information and Communication Technologies (ICT) applications in their way of teaching. Not every teacher has easy access to the assistance of educational experts at the moment he is occupied with designing courses or offering instruction. This is partly due to the financial structure of the Education Centre within the educational institutions, but also to the lack of this type of facilities within their own or another institution.

The goal of this project is to stimulate and expand the use of ICT&E in Higher Education by means of staff development.

Within this goal the following elements can be distinguished:

- Offering just-in-time support in the use of ICT&E to Higher Education teaching staff
- Gathering expertise on the use of ICT in Higher Education and making this expertise available for teaching staff
- Creating and maintaining a lively professional community in the area of ICT&E

An important additional goal is that the collection of expertise elements in digital didactics can act as catalyst for innovation processes in educational institutes. Presumably the results of

this project will help teaching staff in overcoming possible reluctance to change.

3. Proposed solution

The project 'Digit@le Did@ctics: Developing Teaching Staff in HE' provides in the before-mentioned demand by offering a didactical help desk for ICT in Education (ICTE). The teacher can be offered assistance at the very moment he is confronted with problems in designing, practising or evaluating within his educational practice. The project is focused at offering help to teachers seven days a week within 24 hours in designing and practising of ICTE. For that purpose objective knowledge is stored in a knowledge management system and is made accessible by a web site. Furthermore a call centre is arranged.

The project is built on three key elements. The most distinguishing part of this project is experimentation with new ways of staff support and development. Next to that, new techniques will be used (e.g. surfing together from different locations). Furthermore, the project will research a system in which 'publication by means of a knowledge database' will be used as incentive for authors and a system in which peer review will be used as quality assurance. At this moment a detailed picture of the way these three elements will interact is not available. In this project careful experimentation, smart 'trial and error' and thorough evaluation are necessary and crucial.

Staff development takes place by gathering and storing expertise of ICT&E experts and using this expertise by other staff members. Ultimately the quality of education will improve. The main characteristics of the expertise that will be made available online are flexibility in use and 'just-in-time' available.

In the first project phase the educational expertise centres involved will gather and further develop their expertise and experience in Digital Didactics and make it available online (**knowledge dissemination**). In a later phase educational experts of other educational organisations are free to participate in the project.

The innovative character of this project is that staff development is offered in a different way, supplementary to the existing services that educational expertise centres offer such as training and workshops. Because of this the project offers new types of relations with clients and new ways of marketing.

Part of the project is research into and experiments with an **incentive system** for teachers that offer expertise elements and a **peer-review system** for judging these elements.

3.1. Target group

The primary target group consists of teaching staff in Higher Education, both universities and Higher Vocational Education. Within this distinction fall prospective teachers, young teachers as well as experienced teachers. A secondary target group consists of teaching staff in other types of education, such as Secondary Education and Vocational Education, and educational consultants.

The target group shows large differences in didactical expertise as well as expertise in online education. Therefore the available material should differ in type and level of detail. Also, sophisticated and efficient ways to search the material are required for these users.

Next to these target groups the project aims at staff of educational expertise centres themselves. The daily practice of these centres might change, in particular the way professional support is offered, evaluated and accounted for. The project might be used as an umbrella project for existing activities of these centres.

3.2. Types of teacher support in this project

Particular in this project is that staff development of teachers is set in a new perspective, which is a major shift from the traditional way in which the service of the educational centres is offered. The innovating character lies in three types of support: the just in time support of teachers, support by means of collaborative teaching and support tailored to the situation at hand, in other words following on questions of individual teachers. The extended and still extending possibilities of the Internet are the designed medium to constitute this new way of staff development.

How does this support work in practise? A teacher can search the tool site for knowledge or material needed to solve a problem that he encounters while designing or practising education. This site is set up and arranged as customer oriented as possible. Many questions of teachers cannot be solved in the above-mentioned way because these questions need to be analysed by the teacher and the educational consultant mutually. Only after mutual analysis a tailored solution can be generated. Although a website might have an user-friendly design, it still will offer little support to a teacher who does not exactly know what he is looking for. For that reason the website and the call centre will be integrated. Support seeking teachers will first, together with an educational consultant, analyse the educational context of the question and then use the tool site (and adjoining sites, see appendix) to find an appropriate solution. This type of support will function synchronous or asynchronous, using the various available web-techniques.

Collaboration between the different educational centres is central to the project. Within the project, knowledge is shared, managed and exchanged. The content of this project is focused on making practical, directly applicable material available and offering know-how based upon concrete experiences.

For a further extension the site will become more self-supporting by teachers contributions. For that purpose, in this project is experimented with an incentive system. Teachers

who provide content to the knowledge management system are rewarded. Among other things, the project researches how a knowledge management system can be used as a publication medium. Besides this the project experiments with a peer review system. This means that users of the knowledge management system can ask questions to each other or can give comment to instruments stored in the system.

3.3. Project results

This project results in an integrated product, containing the elements described below.

- A **knowledge management system**, containing descriptive documents as well as educational materials and instruments. The user can use the content of this knowledge management system in designing, practicing and evaluating online education. Through this mutual collection of knowledge and experience participating educational institutes might benefit from each other's expertise and in this way develop themselves further in this area. The material should be electronically available through a central website. The material is ready to be used in practice and it fits within current educational categories, such as collaborative learning and self-regulated learning.
- Part of this system is an intelligent search program, based upon descriptions and characteristics of material contained in the database. Which specific approach will be used for this system has to be decided upon.
- Different users with different responsibilities can be distinguished, such as users, authors, reviewers, editors and technical system managers.
- A **website** (tool site) to be used by users as an interface for the knowledge management system and as a medium for synchronous or asynchronous communication with educational supporters.
- A **call centre**. For users that cannot find the knowledge they are looking for in the knowledge management system a call centre is available, offering educational support in the field of online education. This centre will answer within 24 hours.
- Results of the research into and experiments with the **incentive system** for teaching staff that contribute to this project by adding content to the knowledge management system. Additional to this are the results of experiments with a **peer review system** for judging these contributions. This system is comparable with an E-learning Journal, in the sense that staff members will see contributions to the knowledge management system as official publications.
- An innovative approach to teacher support, including the necessary organisational changes.
- Co-operation between a large number of educational support centre in different parts of Europe.

During the project a number of measures indicating the use of the knowledge management system and the call centre will be kept up. As for the knowledge management system, interesting statistics include number of users, frequency of use and evaluation results such as user satisfaction. As for the call centre, statistics such as number of calls and question categories will be kept.

4. Content of the knowledge management system

The elements in the management system will be building blocks that teachers or educational developers can use in designing and creating education. The system will not include complete products, such as handbooks or courses.

The focus of the knowledge management system will be the use of ICT in:

- Different educational formats, such as lectures, practicals, field trips, self-study and such.
- Activating educational formats, such as Co-operative learning, Self-directed and self-regulated learning, Case-based learning and Problem-based learning
- Offering feedback
- Different types of assessment
- Course evaluation
- Adapting education to differences in learning styles or learning strategies
- Offering presentations

Arising new technologies will evoke questions on applying these technologies. This project will support users in answering these questions. In fact, the users themselves will to a large extent determine the content of the knowledge management system.

The material in the database can be of different formats. Examples of such formats are 'how-to'-schemes (e.g. 'How to use an electronic discussion forum'), Frequently Asked Questions (e.g. a FAQ on electronic discussions) and lists of 'Do's and Don'ts'. Next to these formats, the system may include descriptions of tools that might be interesting for the use of ICT in education. For example, interactive multimedia applications might be of interest to certain learning goals or target groups.

In a later phase of the project more attention can be given to differences in the relations between didactics and content. In that way the user is enabled to differentiate between content areas, e.g. technical sciences or social sciences.

An example of an online educational support system, including a knowledge management system and a website, is the Catalyst Site of the University of Washington (http://depts.washington.edu/catalyst/home.html)

However, this Catalyst project only aims at offering online didactic support. The users did not supply the content of this database. This also means that an incentive system and a peer review system are not included.

5. Project planning

The project is divided into five successive phases.

(i) Orientation and design phase
In the orientation phase the criteria for the knowledge management system will be defined. Based upon these criteria, an existing knowledge management system will be acquired. The website that will serve as an interface between user and knowledge management system will be designed and developed. Furthermore, an organisation plan will be developed for filling, designing and maintaining the knowledge management system and for designing and realising the call centre.

(ii) Piloting phase
The knowledge management system and the website will be installed. User manuals will be developed and the knowledge management system will be initially filled.

The knowledge management system, the website and the call centre will be made operational. In this phase the use of these functions is limited to staff of the first participants in this project. The piloting phase will be thoroughly evaluated and eventual revisions will be carried through.

(iii)*Preparing implementation*
In this phase a plan will be developed for using the knowledge management system, website and call centre with all Higher Education institutes that are interested.

(iv) Implementation
The knowledge management system, the website and the call centre will be taken into use. Staffs of the participating educational centres will maintain the knowledge management system, implement the incentive and peer review systems and man the call centre.

(v) Evaluation
In each phase the project will be evaluated separately, but the entire project will be evaluated in the last couple of months. In this period a final project report will be written, as well as a business plan for continuation of the activities.

References

Veen, W., J. van Tartwijk, I. Lam, A. Pilot, M. van Geloven & E. Peters (1999). *Flexibel en Open Hoger Onderwijs met ICT. Een Inventarisatie van ICT Gebruik, Meningen en Verwachtingen [Flexible and Open Higher Education with IT]*. Utrecht: IVLOS Universiteit Utrecht en OC&TO, Universiteit Twente. (In Dutch).

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23 ICT: New Opportunities for Higher Education Institutions to Train Employees?

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Abstract

Higher education institutions are confronted with a declining growth in the number of students in initial education. At the same time, the market for training of employees has increased significantly. Between 1993 and 1999, the total training volume on this market has doubled. However, at least in the Netherlands, higher education institutes altogether have only a small and stable share in the training of employees of about 2%.

The central question of this paper is to what extent the growing possibilities of using ICT as a training tool can help higher education institutes to enhance their position in the market of training of employees. The empirical evidence presented does not support the expectation that ICTis already the vehicle leading to drastic changes. A large scale survey among companies at the end of the nineties in the Netherlands showed that the use of ICT as a training tool was at that time limited to only 12% of all training incidences. Moreover, the companies did not expect a strong growth. This has to do with a large variety of bottlenecks companies perceive. Succesful implementation means dealing with considerations from many angles: pedagogical, technical, organisational and last but least cost-efficiency.

Even if the use of ICT as a training tool would rise considerable, this would not automatically mean an improvement of the position of higher education institutes. The survey results do not give indications that higher education institutions have a relative large share in ICT-based training.

Keywords: ICT, continuing training, training market

1. Introduction

Life long learning has become an important focus point in social-economic and educational policy. Owing to a number of developments, some supply-driven, others demand-driven, competences tend to become obsolete faster and faster. On the demand side, technology and consumer preferences change more rapidly then they used to do. The process of globalisation of the economy continues. Partly in response to these developments, companies adapt their organisational structure. As a result, the job structure and the contents of jobs tend to change continuously. Workers, then, have to keep on investing in human capital during their working career to remain employable.

On the supply side workers feel a growing need to adjust working hours and job contents to their - increasingly diverse – preferences, owing to the process of individualisation (see for example Schmid, 1998). The traditional pattern with men working full-time and women concentrating on non-market activities is disappearing. Both women and men wish to participate in the labour market and must then share non-market activities. Consequently, changing family situations will lead to changes in the number of hours worked. Care taking activities may take so much time that people even wish to withdraw temporarily from the labour market. The same is true when workers, wishing or forced to change profession, have to spend considerable time on training. Workers may not always be able to realise these transitions without changing jobs. Job-to-job mobility will often be accompanied by training.

The ageing of the population is the second major factor, affecting labour supply. Older workers are more likely to face outdated skills than younger workers. Until now most workers withdraw from the labour market long before reaching the official retirement age. Given the labour shortages the Dutch economy is experiencing, there is need to increase participation rates among people older than 50 years of age. This would require considerable efforts in the field of training.

This all add up to a situation in which participation rates in continuous training will have to be increased considerably. As will be illustrated more deeply in section 2, existing figures do show such a strong growing participation in the training of employees. This growing market of continuing training and education offers a number of opportunities for higher education institutions and regular schools in general. However, traditionally, the activities of higher education institutions are very much focussed on initial education.

The central question of this paper is to what extent the growing possibilities of using ICT as a training tool can help universities to enhance their position in the market of training employees. The use of ICT in training of employees has a number of potential advantages. For example, ICT means flexibility in time and place of use, which means that training is easier to combine with working obligations. Higher

education institutions do not have bad starting position in this area. Being large institutions, they often have already a quite well developed ICT-infrastructure and have experience using ICT for initial education. On the other hand, private providers are also increasingly trying out to find the relative advantages of ICT as a training tool. Moreover, ICT also gives opportunities for universities from outside Europe to compete with their sister institutes in Europe.

Concerning the importance of the role of ICT in training of employees, little research has taken place. This even more the case for the specific position of higher education institutions in this area. In the recent years, the Research Institute of Labour Market Policy has carried out a few studies in this area (Gelderblom, de Koning and Blanken, 2000 and Gelderblom and de Koning, 2000). This includes:

- A review of existing literature;
- A great number of face to face interviews with representatives of companies and training organisations, using ICT as a training tool for employees.
- A large scale survey among companies;
- A study on the costs and benefits of using ICT as a training tool in the area of training of employees.

In this paper we will highlight the findings out of these studies which are of particular relevance to the issue of potentials for higher education institutions to further develop their share in this market.

The structure of the paper is as follows. In section 2 we will describe the growing importance of continuing training for employees in general and the present role of higher education institutions in this market. In section 3 we elaborate on the importance of ICT as a training tool and the expected influence this has on the position of higher education institutions in this market. In order to know better what limits the use of ICT as a training tool, we describe a number of bottlenecks (section 4). In section 5 we stress the importance of a better insight in (factors contributing to) the costs and benefits linked to ICT as a training tool, before more definitive conclusions on future prospects can be made. Finally, in section 6 we end with a number of concluding remarks.

2. The growing importance of continuing training and the role of higher education institutions

Participation in higher initial education has increased for a number of decades. However, in recent years this increase has slowed down. For university education, there has even been a decrease in participation (table 1). For the coming years a small growth is expected.

	95/ 96	97/98	99/00	04/05 (prognosis)
Higher vocational education (full-time)	218	226	239	256
Higher vocational education (part-time)	41	42	52	71
University education	175	164	158	164

Table 1. Participation in higher education in the Netherlands (in thousands). Source: OC en W in kerncijfers 2001, Ministry of Education, Culture and Science.

In contrast to this, the (potential) market in the area of continuing training of employees is clearly growing (table 2). The total costs of companies for training of employees is estimated to more than 3 million Euro in 1999 in contrast to less than 1 million Euro in 1986.

Year	Training incidence per 100 employees	Total costs of companies (in million of Euro)
1986	25	946
1990	33	1311
1993	38	1531
1999	77	3052

Table 2. Developments in volume of training of employees. (These figures include all types of training which are at least partly financed by the company. Companies with less than 10 employees are not included in these figures.) Source: Central Bureau of Statistics, Netherlands

Higher education institutions have a very small share in this market (table 3). In 1999 both for higher vocational schools as well as universities, somewhat more than 30 thousand training incidences took place in 1999. This is a small proportion compared to the whole market (both somewhat more than 1%) and compared to the volume of participants in initial education (table 1). The share of higher education institutions has also been quite stable. Also in 1993, their common share was 2% of the whole market. The market for continuing training is largely dominated by companies supplying their own training (45%) and by private training institutes (31%).

	Training incidences (in thousands)	%
Universities	31	1
Higher vocational schools	39	1
(Other) public education and training institutes	290	10
Private training institutes	900	31
Suppliers of machines and software	130	4
Mother or sister companies	82	3
Unions	1	0
Chambers of Commerce, branche institutes, employers organisations	98	3
Company itself	1306	45
Others	18	1
Total	2896	100

Table 3. Training incidences by supplier of training, 1999
Source: Central Bureau of Statistics, Netherlands

3. ICT: changes in the market of continuing training?

So, until recently the role of higher education institutions in the area of training of employees is limited. The increasing use of ICT could mean a change in this respect. The potential changes because of ICT depend on the extent to which:

1. ICT (is)/(will be) used as a training tool for training of employees. If the role of ICT is limited, than expected changes in the structure of the market because of this will be limited;
2. ICT as a training tool can be considered as additional training in the sense that ICT helps to organise training in situations where otherwise no training would have taken place. Points 1 and 2 together determine to what extent the market of training of employees grows as a whole because of the use of ICT as a training tool.
3. the use of ICT could improve the relative position of higher education institutions in this market.

The potential changes for higher education institutions because of ICT will be higher, the more important this training tool turns out to be, the more this will lead to additional training and the more this will change their market position compared to other suppliers. In the following of this section, we will go into these three aspects.

3.1. The importance of ICT as a training tool

In the Netherlands NIDAP organises a yearly survey on continuing training among approximately 800 companies with at least 50 employees. For the survey over 1999, we made use of the possibility to add a number of questions to this survey about their use of ICT-based training. The outcomes of the survey lead to the following estimates for the quantitative use of ICT-based training of the employed (table 4). Some of these figures are constructed by combining the survey outcomes with other data sources of training participation in general. The figures refer to the year 1999.

Proportion of larger companies (>50) using ICT as a training tool	32%
Proportion of larger companies (>50) using a CBT as a training tool	23%
Number of employees trained through ICT (including extrapolated figures for smaller companies)	300.000
Participants in training through ICT as a proportion of all trained employees	12%

Table 4. Estimates for some indicators for reach of ICT as a training tool in the Netherlands (1999)

About a third of all larger company (also) makes use of this way of training. In most cases this concerns training by using a CBT on a cd-rom. Those who use applications using the Internet have often used a CBT on cd-rom before. Using the Internet without former experience with CBT on cd-rom is less common. In terms of employees, training through ICT concerns about 300.000 employees, which is already a considerable volume, but is still quite a small proportion of all training. We have also asked about expectations for the future. The answers from company side reflect growth, especially in the area of applications using the Internet. However, the expected growth cannot be characterised as spectacular. For all applications concerned the expected growth is about 2 or 3 percentpoints of "extra" companies using these applications in the next year.

So, the share of training in which ICT is used as a training tool should not be overrated. However, the figures mentioned above related to the total market. It is possible that ICT is much more important in the segment of the market in which higher education institutions operate. We know that the use of ICT in general is more widespread among these groups. The low-educated and the older workers have more problems in using ICT (Gelderblom, de Koning and Mosheuvel, 2002).

In the survey, companies admit that the advantages of ICT in terms of easier access to training are more felt for the young and higher educated employees. An example of concentration of the use of ICT as a training tool in a segment in which higher educated employees are concentrated is the ICT-sector itself. This seems logical, because in this case the training tool as well as the training content are very related. From all larger companies who are involved in training for their employees, about a third makes use of a CBT. For companies in the ICT sector, this is two-thirds. For other (internet-related) applications, the differences compared to other sectors are often even higher.

However, we have also found several examples of the use of ICT in other segments. For example ICT is also often used for courses which are linked to getting acquainted with certain standard or compulsory procedures. These procedures could be for example safety-procedures as well as quality procedures. Examples of ICT-based courses are safety-procedures in a heavy metal company, in using electric machinery, and safety procedures linked to working on a train. In all of these examples most of the trainees concerned were not higher educated. We even came across ICT-application in training of employees working in state-subsidised social working places in which workers with very low qualifications are employed. ICT was considered to be advantageous to these types of workers because it offered possibilities to use multimedia and to be less text-oriented.

All in all we can argue that ICT is somewhat more important in the specific segment in which higher education institutions operate, but the differences should not be overrated. This means that the conclusion of a limited role of ICT also stands for the segment of training of the higher educated.

3.2. ICT: additional training

Concerning the second point, one of the crucial finding of the survey among companies using ICT as a training tool, is that more than half of them acknowledged that ICT as a training tool had increased the volume of training in their company. A confirmation of these subjective perceptions is that the volume of training in companies making use of ICT is larger than in other companies in which employees are trained, but without ICT. However, the latter is on itself not a 100% convincing argument, because it is also possible that companies with already high training volumes could have a higher incentive to make use of ICT, because of economies of scale.

Much higher	18%
Higher	39%
No effect	39%
Smaller	4%
Much smaller	1%

Table 5. Effect of ICT as a training tool on training volume
Source: NIDAP-survey among companies.

From the interviews among companies and training institutions making use of ICT, we know that the increased flexibility of time and place is a crucial background factor for implementing this. In the field of training of the employed, the workers to be trained have often problems to combine obligations from work, household and training. Conventional forms of training usually require that groups of trainees attend a course on the same place and time. This must be organised well in advance. The training will thus often coincide with periods of high work pressure. Some types of work, training of pilots, for instance, are by nature difficult to combine with conventional forms of training, because the workers involved are 'in the air' and “over the world” with complex and various time schedules. If there is more freedom in the choice of time and place to be trained, these types of bottlenecks can be relieved.

The flexibility of place also means that regional borders for potential trainees are less relevant. This means that the potential target group for training suppliers could be enlarged. However, this of course also increases the potential number of competitors. In general the competition will be stronger. Even competition from institutions from other countries can appear. An example is the University of Phoenix.

Another underlying factor for the potential of ICT to increase training volume, is that ICT makes training possible in some area for which effective training was difficult to realise. The most obvious examples are simulations. An example is the Rotterdam School of Management which has made a simulation for those responsible for selling and buying electricity in a liberalised energy market. The high reality value of such a sort of “game” cannot be approached by more conventional ways of training. Another example are sailors practising on a sea-ship bridge simulator.

3.2. Market share

The influence of ICT on the relative position of higher education institutions is more difficult to predict. In first instance one could argue that the starting position of higher education institutions is relatively strong. They often have already experience with using ICT in initial education. Moreover, they can profit from the fact that economies of scale are very important is this area. The use of ICT is generally linked to high fixed costs and relatively low

variable costs. So one has a more advantages position if the potential number of trainees is high. Potentially, this is the case for higher education institutions. However, in reality this advantage of economies of scale should not be overestimated. First, it will not always be easy to combine ICT-applications in the areas of initial education and post-initial education. The pedagogical demands can vary between the two fields. In the area of post-initial education, the link with work practice of the trainees can be very important. In initial education, the development of conceptual thinking and abstraction is crucial. Many institutions have chosen for a clear separation of the post initial training within the institution, because this requires a specific approach. Secondly, higher education institutions generally try to use "quality" as a strong marketing point in comparison to for example private training institutions. However, there can be a friction of quality and economies of scale. Quality can for example mean that in a computer-based context, the interaction with other trainees and the teacher still has an important emphasis. This could mean that the training still takes place in the context of relative small groups in order to facilitate sufficient interaction. Quality could also mean that the possibilities for "re-using" content are more limited, because training demands change and updates regularly have to be made. Moreover, the content of the training could be quite customised, so the potential target group is in that case small. Thirdly, exploiting economies of scale requires a coordinating administrative hand. However, in practice many decisions in this field are made at a decentralised level without clear coordination in order to exploit economies of scale. An obvious example of a crucial decision to be taken at central level is a uniform choice of electronic learning environment software.

So in some respects (experience and scale of operation), one could argue that higher education institutions have a favourable starting position in using ICT as a training tool. The earlier-mentioned NIDAP-survey offers some possibilities to test the actual position of higher education institutions. In the NIDAP-survey there is information about the importance of various types of suppliers in the area of training of management at medium and higher level. In this area we can also make specific selections of companies making use of ICT as a training tool. We can compare the composition of suppliers of these companies using ICT-tool with the general picture of training suppliers (table 6).

The proportion of higher education institutions in the supply of training for management and executives is on average about 17%. If we only select companies for which ICT is used as a training tool in external training, this proportion is roughly comparable to this. These figures do not confirm that the market position of higher education institutions is stronger when ICT is being used as a training tool.

The conclusion of this section is that the position of higher education institutions in the continuing training market has not drastically changed because of the emergence of ICT as a training tool. ICT is only used in a small proportion of all training incidences. Moreover, there are no indications that higher education institutes have improved their relative position if ICT is used.

Type of companies	Average proportion of higher education institutions in the supply of external training of management and executives
All companies offering external courses for management and executives (n=686)	18%
All companies using CBT on cd-rom in external training (n=133)	17%
All companies using an online connection in external training of management (n=43)	17%
All companies using distance learning with the computer in external training of management (n=62)	24%

Table 6. Training suppliers of management training, with specific reference to the training tools
Source: NIDAP-survey

4. Bottlenecks

The former section shows that the importance of ICT as a training tool in continuing training is rather limited. To have a better understanding why this is the case, we have to know more of existing bottlenecks appearing when ICT is used as a training tool. Both in the interviews and the large-scale survey we have paid attention to these bottlenecks. The main conclusion from both sources is that problems do show up in varied areas:

- The training process itself (e.g. problems caused by the lack of social interaction). A continuous danger of these types of applications is that in the development phase most attention is given to "technical" aspects, while the pedagogical considerations are soon out of sight;
- The lacking ICT-knowledge and competences of both users and trainers;
- Technical problems. These technical problems are also diverse in nature. Table 7 illustrates this.

Problems in provisions	*Problems in support and maintenance*
– The problem of band-width with Internet, especially for using multi-media – Videoconferencing is still a "non-proven technology" – Available computers are not powerfull enough – Participants have outdated Internet-browsers – Employers are not familiar with certain applications (this was for example the case with using cd-I for training) – Training participants have to work in a software environment they are not familiar with	• Problems in installing • Installed training programmes are "by accident" mutilated by others who use the same computer • Confusion about who is responsible for support: the training department, or the general ICT-help-desk in the company • Technical support is easily available during working days, while trainees study in the weekend • The management of necessary accounts is underestimated: – Import and authorisation of new trainees – Assignment of e-mail addresses – Assesment of training progress – …….. • Problems of security • In times of a transition towards a new computer system, training programs are lost or not convertible • Updating of CBTs turns out to be difficult, while this is crucial in an environment with constant changes

Table 7. Examples of technical problems

Other studies conform this variety of potential problem areas (see for example Fastrack consulting, 1999 and Green and Stahmer, 1996). Consequently, introducing this type of ICT-applications requires constant attention and well-considered choices in various fields. We have come across many projects that have failed or nearly failed as a result of a number of problems in the starting phase.

5. Costs and benefits

The bottlenecks mentioned in the former section can influence costs and benefits of using ICT as a training tool in such a way that the overall balance is negative. Changing from conventional to ICT-based training just because the latter "has the future", without any assessment of the costs and benefits involved, may lead to a waste of money. ICT-based training only has a future when it outperforms classroom training and other traditional forms of training in terms of its cost-benefit ratio. It is not self-evident that this is the case. In general the views on the economic impact of ICT have changed dramatically. The developments on the stock markets indicate that nowadays there is serious doubt about the profitability of ICT activities and products. This is in sharp contrast to the opinion that ICT would increase productivity for decades to come, which was common only a few years ago. ICT activities and products often require large investments of which the returns are highly uncertain. This is also the case for ICT-based training. The reason for publishers, IT-companies and training companies to start developing and using ICT-based training is partly due to the fact that they are afraid to miss future markets. If ICT-based training would ultimately prove to be more effective and efficient than conventional forms of training, and would gradually replace the latter forms, it is of vital importance for these companies to start investing in ICT-based training now, even if this is loss giving for the time being. From our interviews with a number of these companies it appears, in fact, that so far many forms of ICT-based training have been loss giving. According to the respondents in the NIDAP-survey, the use of ICT in training increases rather than decreases the operational costs of training.

However, we also noticed that there is a lot of uncertainty about the costs and benefits of ICT-based training compared to conventional training. Very little is known about the costs and benefits of ICT-based training compared to conventional training. This is both true for the cost-benefit ration on the macro level and for the different actors individually. Gelderblom and De Koning (2000) have developed a cost-benefit model in which the different types of costs and benefits for both variants are included. Furthermore, they

have performed numerical exercises in which values were attached to the various costs and benefits. Partly these values could be based of a concrete example of a company-training course, which had been given in both an ICT-based form as well as a conventional form. In other cases assumptions had to be made. Sensitivity analyses were made to deal with the uncertainly arising from this. The simulation results indicate that a shift towards ICT-based training is particularly profitable when:

- it leads to a considerable increase in the number of trainees;
- the number of foregone productive hours is limited;
- the dropout rate among trainees is reduced;
- the input of trainers can be reduced.

The simulations clearly demonstrate that ICT-based training is certainly not profitable under all circumstances.

If uncertainty about (the balance of) costs and benefits continues, actors may hesitate to further invest in this area. More research is necessary to have a more clear view on these matters and to have an overall picture of the cost-benefit issue.

6. Some concluding remarks

Life-long learning is of crucial importance in a continuously changing social economic environment. Skills and competences have to be updated regularly. Therefor, the market of training of employees is a strongly growing market. Until now, higher education institutions have a very limited position in this market. One could argue that this picture could be changing drastically because the whole market of training of employees will be structurally influenced by the rise of ICT as a training tool (e.g. "E-learning"). For example, ICT means flexibility in time and place of use, which means that training is easier to combine with working obligations. However, the use of ICT as a training tool is still limited to a small proportion of all training incidences. Most companies expect only a moderate growth in the use of ICT-based training for the next years. Succesful implementation means dealing with considerations from many angles: pedagogical, technical, organisational and last but not least cost-efficiency. Firms and training institutes will use ICT-based training in the longer term only when they can be sure that the costs are outweighed by higher benefits. In many cases the impact on cost-efficiency is simply unknown, although the general impression is that at least some cost factors are considerably increased by using ICT.

On the basis of our findings we conclude that so far ICT has not been the electronic highway to life-long learning. It is not more than 'a' way. This is line with the general scepticism concerning the profitability of ICT activities prevailing nowadays. However, on long-term things may be somewhat different. Probably, most of the practical problems will be solved in the next years. Further research may reduce the uncertainty concerning the costs and benefits of ICT-based training. However, we cannot exclude the possibility that this form of training will not prove profitable in many cases.

Even if the use of ICT as a training tool would rise considerable, this will not automatically mean an improvement of the position of higher education institutes. The empirical evidence presented before, does not give indications that higher education institutions have a relative large share in ICT-based training.

One of the factors contributing to succesful implementation can be cooperation between several actors. Cooperation can mean that costs are more spread, while the reach of trainees is increased. Two studies inventorising the situation in other countries (Boezerooy and others, 2000 and van der Wende and others, 1999) stress the importance of such cooperation. The type of cooperation can vary. For example, several institutions can distribute their courses under a common heading leading to better marketing opportunities and a strong actor with a varied supply of courses which helps to become an interesting partner for business. An examples of this type of cooperation in distributing is the eUniversity in the UK. Another possibility is for software companies and training institutions to join forces in order to raise sufficient funds for development and to reduce uncertainty that the investments will not lead to products which will not be used.

Acknowledgements

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- Gelderblom, de Koning and Blanken (2000). This research project was sponsored by the Ministry of Social Affairs and Employment in the Netherlands
- Gelderblom and de Koning (2000). This project was carried out in cooperation with CINOP and Bureau Telecoach.

References

Boezerooy, P., W. van Casteren, B. Cordewener, T. Dousma, R. van Elderen, M. van Geloven, M. Soeters and F. de Zwaan (2000), Van heinde en verre. ICT in het hoger (afstands)onderwijs. Verslag van twee studiereizen in juni en oktober 2000 (ICT in higher (distance-)education. Report of two study visits in June and October 2000). Enschede: CHEPS.

Collis, B. and M. van der Wende (eds.) (1999). The use of Information and Communication Technology in Higher Education. An International Orientation on Trends and Issues. Eschede: Cheps.

Fastrak-consulting (2000), Web delivery of Interactive Learning in the UK, survey report, 1999. http://www/fastrakconsulting.co.uk/tactix/Features/survey/survey_report.htm

Gelderblom, A., J. de Koning and M. Mosheuvel (2002), ICT en de oudere werknemer: geen rimpelloze relatie ('ICT and the older worker: not a relationship without wrinkles'), Rotterdam: Research Institute for Labour Market Policy.

Gelderblom, A., J. de Koning and R. Blanken (2000), Scholing van werkenden via ICT (Training of employees by using ICT as a training tool), Rotterdam: Research Institute for Labour Market Policy.

Gelderblom, A., and J. de Koning (2002), Kosten-baten van ICT bij scholing (Costs-benefits of ICT as a training tool), Rotterdam: Research Institute for Labour Market Policy.

Green, L. and A. Stahmer (1996), Partnering for Learnware: Critical Succes Factors in the Use of Learnware and Industry Associations in Canada by Human Resource Councils. Office of Learning Technologies. http://olt-bta.hrdc-drhc.gc.ca/publicat/green.html

Haughey (1999), Pan-Canadian Research Options: New Information Technologies and Learning,. http://www.edu.pe.ca/wsb/disteduc.htm

Schmid, G. (1998), Transitional Labour Markets: A New European Employment Strategy, Berlin: WZB.

24 Creating a New Learning Model to Avoid Skills Gaps and to Fulfil the Future Needs of the Knowledge Society

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Abstract

The situation in the education institutions and the challenges for human resources activities inside companies changed rapidly the last years. It is not (only) because of the integration and use of new technologies. It is due to a general need to change the paradigm of new learning models (and theories) in accordance with new demands in the knowledge society.

Strategic blended eLearning is an opportunity for institutions, universities and companies to utilise the "power" of technology for real social and educational change bringing benefits to all its users.

Online education and learning can make a huge impact on the way companies and educational institutions do business. The Web can increase their potential significantly, giving them awareness on a larger scale and increasing or even creating revenue. From a corporate point of view it is recognised that in this day and age where use of technology and business methodologies are all relatively similar organisations need something more unusual to be considered "leading edge".

Creating a corporate university or online learning environment, can educate the people who work on the frontlines of a business. If they are well informed, impart a consistent message and feel valued they become positive ambassadors for the organisation, giving them a competitive advantage, increased productivity and an enhanced knowledge capital.

Therefore it is in any case useful to be aware more clearly what the effects of strategic blended eLearning and the IT-integration can offer.

The speech/workshop will highlight some of these effects looking at promising examples and methods and discuss the need of the creation of a new learning model. Furthermore the speech/workshop will argue, how this change can influence the requirements to all actors inside the "old" and "new" learning model.

Keywords:

State of the Art of Strategic Blended Learning, Experience Based Learning, Learning-Generations

1. Background

In today's fast moving society working environments get more and more complex and request highly skilled people being motivated and willing to adapt their competencies to the requirements of the market. One of the risks within these evolving industry is that there is an increasing demand for special competencies, which may not be satisfied due to a lack of adaptive learning programs.

But why and how to prevent these skills Gaps?

1.1. Why detect Skills Gaps?

This is a delicate question, because the answer is based on assumptions, but the arguments are quite convincing. People who don't have all the information and knowledge to fulfil a task will certainly have difficulties in reaching the demanded result. This might have an important impact on the success of a company and should therefore not be neglected.

The detection of skill gaps is directly linked with the identification for training needs, which would be beneficial for the interests of the company as well as the employee. For the company the identification of skill gaps will help assure quality and competitiveness in the market. The possibility to increase personal competencies and skills will contribute to a higher motivation and therefore better working result. This shows that the identification of skill gaps may be crucial for the success and progress of a company.

1.2. How to prevent skill gaps?

Forms of skill gaps

The identification and analysis of skill gaps needs to distinguish two types of skill gaps.

Career development: Companies which don't foresee a long-term career planning in order to guarantee that the evolution of competencies follows the needs of the market.

Complex job profiles: Knowing that job descriptions get more and more complex it is evident that the ideal candidate is difficult to find, but a person which almost corresponds to the profile will be selected and training be necessary to fill the gaps.

Skills support

In order to guarantee an effective skills support pre- and post assessments for customising the trainings depending on the needs, (pre-) knowledge and abilities of the learners are necessary.

Based on the result of a pre-assessment the instructor or training department can propose the users an individual training embedded in a training plan, which includes future training opportunities adapted to the individual needs of each employee.

In order to make the skills support even more powerful it should be directly linked to the HR department, which has an overview on how people evolve and also may influence the decisions taken by the training department. This co-operation could guarantee the support of the career- and training plan of each employee. The company would be strengthened due to an efficient manpower planning and the people highly motivated due to the perspectives offered by the various training possibilities and career opportunities.

1.3. How to detect Skill Gaps and react accordingly?

The following graphic illustrates how to determine skill gaps, who are the parties involved and how to come up with a solution.

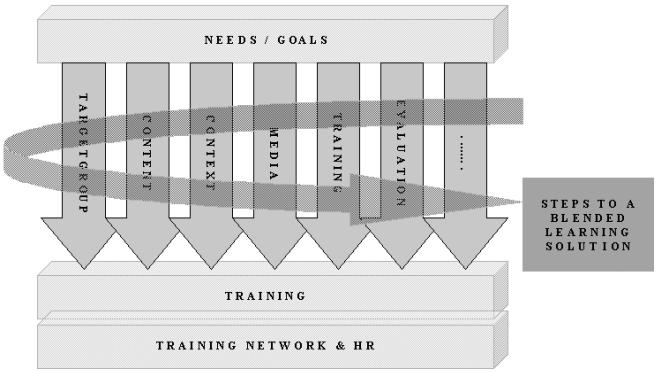

Figure 1: Steps to a Blended Learning Solution

In resume it can be said a Blended Learning solution will be the outcome of a training need analysis, which means a solution combining all aspects of training in a global learning solution.

2. What is Blended Learning?

A Blended Learning solution takes into account that individuals have changing training needs. In some regards it might be extremely useful to have a personal tutor, whereas in others an individual repetition might be adapted. The following graphic illustrated how to combine different aspects of training.

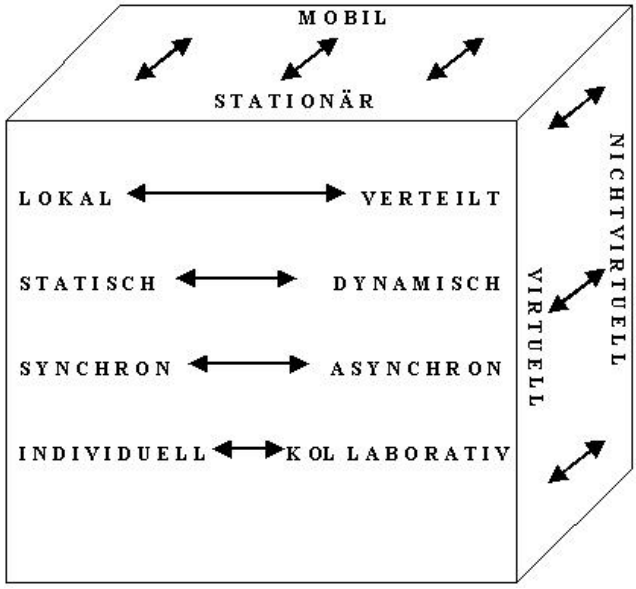

Figure 2: Blended-Learning-Model (Technology-System-Level)

2.1. How to detect which training is adapted?

The specific learning needs depend on various factors such as:

- Training content
- degree of difficulty.

The following graphic shows how distance/eLearning can be effectively combined with tutor sessions.

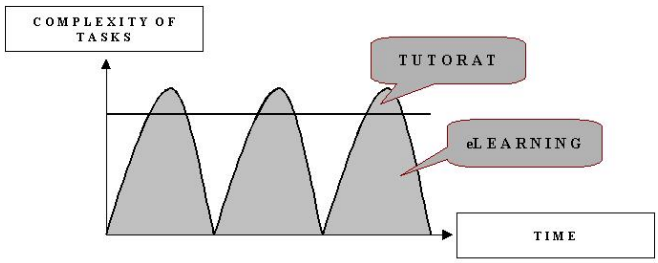

Figure 3: Tutoring and/or eLearning

As mentioned above the content type also has an impact on the training structure and methodology. In this context the following graphic illustrates that the more complex content needs tutor support, whereas a simple repetition might be done individually without trainer support.

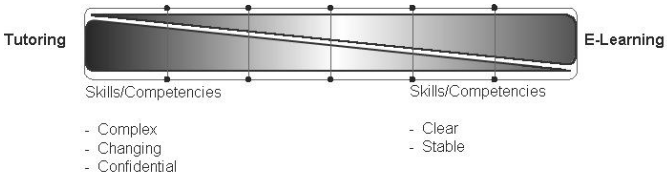

Figure 4: Combination Tutoring/eLearning

Furthermore a decision about the adapted support needs to be taken.

The following graphic illustrates partially which questions have to be considered in order to determine the suiting media support.

	Print	Audio	Video	Inter-active Video	Prac-tical Work	Com-puter Simu latio	Inter-active Video	Multi-media	Com-puter Confer-encing	Lec-ture	Face to face Tutor	Dis-tance Tuto--ring
Provide a carefully prepared analysis												
Provide an idea of sound and sight												
Integrate learners' feedbacks												
Learner has to give answers												

Figure 5: Which media might best do what?

3. What are the future trends?

Whereas in the early beginning "Skinnerian" behaviourist feedback and reinforcement schedules were predominant, today's learning environments are determined by a constructivist approach, where the learner takes an active role in order to allow him to solve problems and think in a creative way. Of course there are multiple paths for learning from incidental to intentional events, from information access to performance support, from training and instruction to education and professional development and beyond. Instructional/Educational designers are increasingly called upon to build learning systems that employ a wide range of theoretical constructs to correlate learner attributes, learning preferences, contextual variables, content resources, desired learning performances outcomes, desired time-to-learning/performance and other relevant variables. The actual trends have a considerable influence on companies and organisations offering eTraining.

Some trends in the matters of eLearning:

1. The first trend deals with issues of technology infrastructure. The ubiquitous availability, scalability and interoperability of information technologies make e-Learning a viable alternative for even small, geographically remote organizations.
2. Second, increasingly complex, competitive workplaces need information for workforce performance improvement. This leads to an increased demand for better management of an organisation's intellectual assets. Its knowledge history, shared experiences, discoveries, record of successes and failures, innovations and when or where these resources are needed most.
3. A third trend in eLearning concerns knowledge. management focuses on the accessibility and reusability of organizations intellectual assets and its core competencies. Competency based eLearning solutions employ competency models as the pattern template for compiling and assembling learning objects in meaningful relevant ways.
4. The fourth trend concerns learning architecture and learning object standards in order to ensure the interoperability of Learning management systems and settings. As these trends converge, knowledge commerce emerges. This term describes a specialised subset of the internet economy where knowledge is achieved through the judicious assembly and use of learning objects

4. In resume the learning society needs

- To preserve competencies and keep them as an asset subject for continuous evolution and improvement.
- To respect learning generations, transfer knowledge from one generation to another and integrate different point of views in order to boost a society's knowledge and competencies.
- To create various learning spaces allowing creative and progressive interaction, which encourage and motivate the potential of the future: "THE LEARNER"

5. Resume: Creating a new learning model

Based on the context mentioned before, the creation of a new learning model seems to be a must to guarantee that the future needs of the knowledge society can be fulfilled in the right way. The new learning model should integrate all mentioned aspects in the right way: taking the "learned lessons" from eLearning in the past and combine them with the trends in the future.

The presentation from Avallain will show how this can be realised - demonstrating best case examples and an actual project from Macmillan Publishing (UK).

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References

Rowntree, D. (1996). Preparing Materials for Open, Distance and Flexible Learning.

Abbadini, R. (2001). Several articles.

Back, A. and others, (2001). eLearning in Unternehmen.

Hohnbaum, C. & Grasset, S. (2000-2002). Several articles.

25 Integrating Technology into the Activities of a Traditional University: Facing up to the Problems.

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Abstract

This paper describes the evolution of an institutional strategy for on-line learning development at a traditional campus based university. It evaluates the implementation of this strategy, mainly by analysis of feedback obtained from staff attending ICT related training courses. One conclusion from the evaluation is that it is possible to avoid unnecessary duplication of resources, even in a highly devolved organisational structure, by a combination of central leadership and appropriate locally based support. Other conclusions include the fact that a majority of staff are quite eager to use ICT tools to improve what they do and that the major factor which prevents them is confusion about, and reliability of, both networked and local ICT tools and services. There is also evidence to show that concerns about technology taking a lead in the future design of pedagogic approaches are not well founded. It is quite clear that most, if not all staff are sufficiently professional in their approach to ensure that any use of ICT benefits, rather than harms, the student learning experience.

1. Introduction and Background

The information and communication technology (ICT) revolution, coupled to changes in society, have placed great pressure on institutions like the University of Westminster (UoW). There is a continual need to improve ICT infrastructure and develop innovative approaches to teaching and learning that fully exploit ICT (DTI Report, 2000).

Different institutions are responding in different ways, organising infrastructure and support to best suit their institutional culture (CRE Report 2000; Jost & Schneberger 1994; Liber 1998). Many previous reports have highlighted a range of difficulties that can be encountered in trying to embed learning technology across an institution (see for examples Butler 1997; Bull & Zakrewski 1997; Liber 1998; Liber 1999; Ramsey et al., 2001; Butler & Sellbom 2002). In recent years similar problems have been encountered in the strategic drive to make greater use of learning technology at the University of Westminster (UoW)

This strategic drive began in 1997 when UoW published a new institutional strategic plan that emphasised the use of ICT both for the management of information and support of teaching and learning. At this time, like many other institutions in the UK a minority of academic staff were using ICT extensively in course delivery. After publication of the strategic plan, involving many more staff in the effective use of ICT to support and share the vision of an ICT enabled culture became a priority.

A major organisational theme of the new strategic plan was devolution. As part of this the central computing services were essentially split into two distinct parts. Responsibility for the network and user authentication processes remained as a central function. However face-to-face support for students and other users was devolved down to campus level and each campus (there are four campuses at the UoW) formed its own computing and audio-visual aids service. Inevitably each campus team has evolved differently, fulfilling the aim of better matching provision of services to local needs. However one consequence of this mode of operation has been overlap and duplication of some developments.

This paper will first describe a series of major events and changes that have occurred in the 5 years following publication of the strategic plan. This will serve to set the scene for an evaluation of the success and failures of a development approach ultimately characterised by a combination of devolved support mechanisms with central leadership. The later sections of the paper will specifically consider staff development approaches and issues, the sharing of technology resources and know-how, and the views of staff generally towards the use of ICT.

2. First Steps: Development of an institutional Intranet

Shortly after publication of the strategic plan, a few individuals, from academic and central departments, applied for university development funds with the intention of developing an intranet to provide an institutional focus for the distribution of information to students and the development of staff skills in ICT. An intranet was established and very rapidly several central departments established sites to provide information to other staff and to students. The development attracted much attention and was to a degree supported by central computing services but not, at least overtly, by local campus computing services. Shortly afterwards funding was obtained to establish distinct campus intranets with the intention of specifically stimulating the development of teaching support websites on each campus.

Establishment of the intranets was based on Microsoft technology. At the user end the web authoring tool Microsoft Frontpage was used in an attempt to enable staff with little technical expertise to easily author their own web pages and manage their own web sites. Staff development courses in the use of Microsoft Frontpage proved very popular. In the space of a few months as many as 150 academics had attended such courses. The policy at the time was that any member of staff who had attended a course could if they wish have a website established for them which they were then expected to maintain and manage. This inevitably meant that the early development of module teaching support websites was very much a bottom up approach. Efforts to engage heads of school and departments in any concerted effort to increase the number of teaching support websites lagged behind the capability to empower junior colleagues.

In the first year of the intranet development the number of academic staff with rudimentary teaching support sites increased dramatically, with nearly 200 such sites being created across the four campus intranets (Iacconi & Saunders 2000). During this period central departments made a clear commitment to develop their use of the intranet to provide information to both staff and students. However academic departments remained to a large extent dichotomous in their approach. Some made use of the centrally supported intranets whilst others continued to use existing or newly developed local arrangements for the publication of internal websites. There were one or two exceptions where entire schools or departments decided to have teaching support websites for every module and course.

It is estimated that only 20% of those staff introduced to web publishing through the development maintained their websites for any length of time. Any exceptions occurred in schools and departments that chose to make clear commitment, as a group, to the use of such websites. Again it is notable that in the one school where a high proportion of teaching support sites remained relatively up to date, a member of staff was employed full time to help maintain them. Although the percentage of staff who continued to maintain a web site once setup was disappointing, the overall development served to raise the profile of ICT generally and to stimulate debate on the use of ICT for the support of teaching and learning and administration.

3. Development of a policy for on-line learning

Nearly three years after establishment of the first intranet the University took steps to re-emphasise the corporate intention to develop the use of ICT to support teaching and learning. Up to now the institutional teaching and learning strategy had said little in depth about the potential for exploitation of ICT. Although it made statements about the need to promote the use of ICT on a fitness for purpose basis, it did not provide any clear strategic direction or state how ICT should be used. Recognition of this fact, plus the growing realization that the developments in campus based computing services was leading to duplication in tools to support on-line learning development, the institution established an on-line learning group (OLLG).

The OLLG was made up of representatives from every academic school (11 in total). All 4 managers of the local campus computing services and the two most senior staff from central computer services were also members of this group. The group was chaired by a senior academic with experience of the use of ICT to support on-campus teaching and learning. The role of the group initially was to identify the main reasons why a policy on on-line learning was desirable within the UoW context and subsequently to identify priorities for development across the University as a whole. All of the academic representatives were chosen on the basis that they had experience of exploiting ICT in teaching and learning. The main reasons identified by this group as drivers for the development of a policy on on-line learning are summarized in table 1.

Reasons to have a stated policy for on-line learning developments
• To increase opportunities for the delivery of independent, student centred learning.
• To make ourselves more accessible to students with all types of study need whether first time or returners to HE.
• To increase the potential for innovative forms of study, thus improving the quality of our offering.
• To provide flexibility of study mode and give students of all types an extra skill by increasing their IT literacy, thus implementing our mission of educating employable people.
• To remain competitive because increasingly all HE institutions will have an element of OLL.
• To continue to be cost effective

Table 1: Stated reasons for an on-line learning policy at the University of Westminster

Within six months the group had drafted a relatively brief policy statement that sought to highlight the major strategic direction the University would go in its development of the use of ICT in teaching and learning and academic administration. An underlying theme of the policy statement was that on-line learning developments should be for all staff and not for just an elite few. Equally the policy sought to emphasize that high quality ICT based teaching and learning did not necessarily require the use of anything other than routine ICT tools (e.g. e-mail), with which increasing numbers of staff had become familiar in recent years.

The policy statement was presented at a range of internal fora and a number of internal committees and groups. After revision, in the light of comments received, the policy statement was considered and approved by the University's academic council. A key element of the approved policy was a proposed categorization of on-line learning into a series of levels, differing mainly in the degree to which face to face activities could be replaced by some form of on-line alternative (see table 2).

At this stage in time the University had not allocated any recurrent central funding for on- line learning developments.

Level	Characteristics
1	The routine use of e-mail to maintain contact with students. Replacement or enhancement of classroom sessions used purely for information delivery by electronic information.
2	Elements of level 1 but including a wider variety of web based file types requiring increased technical skills to produce (e.g. sound and video files)). At level 2 the pedagogic approach would be expected to have changed with use of the on-line material geared towards reduction in the number of classroom based lectures, making contact potentially more flexible.
3	Elements of level 1 and level 2 plus the replacement of some interactive activities normally undertaken in class by electronic processes. Activities at this level would entail the use of asynchronous and synchronous on-line discussion and on-line assessment enabling the use of a variety of question types, automatic marking and provision of automatic feedback.
4	All of the above level specific elements plus the use of interactive multimedia tutorials and live delivery and discussion components (e.g. video-conferencing, multicasting). At this level it would also be appropriate to make use of some form of managed on-line learning environment to collate the various elements that make up the level.

Table 2: On-line Learning Level Descriptors

Equally no senior member of staff had been formally appointed as responsible for on-line learning matters. In the absence of any recurrent core funding, initial developments after publication of the on-line learning policy relied upon the continued use of University development funds. In addition as no senior member of staff had been designated as responsible for implementing recommendations arising from the policy, the OLLG assumed that role. This group was accordingly asked to make recommendations for the use of development funds to support teaching and learning.

In the first year after the publication of the on-line learning policy, as a consequence of recommendations made by the OLLG, £30,000 of development funds were used to purchase a University wide license for the on-line assessment tool QuestionMark Perception. In addition a number of 'in-house' tools for the support of web based communication and distribution of information were commissioned. At this stage there was no recommendation to implement any commercial virtual learning environment (VLE) across the institution. Part of the reason for this was a perceived general lack of interest within academic departments for such a development, coupled to the fact that the policy set the direction clearly to be the support of 'traditional' campus based students rather than the development of distance learning courses.

4. Central support for on-line learning development

In June, 2000 the University seconded a senior academic to oversee the development of on-line learning across the institution. One of the major recommendations of the on-line learning policy was that a mechanism should be found to provide dedicated support, part technical and part pedagogic, to staff wishing to develop their use of ICT to support teaching and learning.

All four campuses were persuaded to include a new post, loosely termed on-line learning support officer, in their next annual business plan. Income into the University in that year was such however that the campuses were unable to fund these new posts. The University subsequently took the decision to finance these posts on a temporary basis from its block government grant. A hybrid form of management was adopted for these four post holders. Although physically based on each campus (one person per campus) the post holders reported to the senior academic with responsibility for on-line learning development. This required the senior academic concerned to work very closely with the heads of each local campus computing service as well as central computing services. This model was thought at the time to be the best way to ensure an appropriate balance between matching of provision to local requirements and the need to avoid each campus separately re-inventing several wheels. In 2001 these four posts were made permanent by the University.

5. Virtual Learning Environments (VLEs)

Part of the reason for not attempting to implement a VLE across the institution prior to 2001 was the perceived need to have in place an appropriate infrastructure for the support of staff at local level. By 2000, one of the four campuses had already started to use a VLE for the delivery of some undergraduate and postgraduate modules and courses. The other three local Campus computing services were becoming interested in developing their own use of a VLE. At one point there was the possibility that two other campuses would begin

piloting different VLEs to each other and to the VLE that was already in use at one campus.

Early in 2001, the senior academic with responsibility for on-line learning development commissioned from central computing services a widespread review of commercial VLEs. This included conducting a needs analysis across the institution with a view to recommending a particular VLE product for institutional rollout. In the event the VLE Blackboard (not the one already in use at one of the campuses) was chosen. Early in 2002 a license for Blackboard was purchased and the on-line learning support officers have recently started the process of helping staff to begin using this product. The initial results and levels of interest have been exceptionally high and already a proposal to upgrade the license to one which permits direct integration with student records and user authentication systems has been made. In addition the one campus that had already invested quite substantially in an alternative VLE agreed to migrate to the use of Blackboard.

6. Evaluation of the last 5 years

There have been a number of areas of activity or features of the environment at UoW that have and are continuing to feature prominently in implementation of recommendations arising from the on-line learning policy (OLLP). These areas include staff training and development, the sharing of resources and good practice, tensions between centrally driven initiatives and local computing services, the importance of network reliability and the attitude of staff generally towards developing their use of ICT. These will now be discussed in turn.

7. Staff Development and Training

One of the very few clear conclusions that can be drawn from the events of the past 5 years is that staff simply cannot get enough of training in the use of ICT tools. Any course related to the use of technology in teaching is invariably full. It therefore is something of a mystery that so few staff who master a tool, (e.g. a simple web authoring tool) have gone on to use their new found capability in a regular and sustained manner. The most often cited reason given for this is a lack of time. Sometimes this means lack of time to use the newfound knowledge immediately after the training session and then finding, when time is available, that what was learned on the course has been forgotten or worse, cannot be applied in the local environment. In this respect follow up local support is essential for staff who cannot implement what they have learned straight away.

When such local support is absent, more sustainable results can be obtained if staff are given training in their own surroundings (e.g. in their office). It often also helps if staff are trained in small cognate groups that are discipline related, as the more able among them can then support the others after the trainer has gone. Previous reports of the integration of technology across institutions have highlighted the significance of local support mechanisms (Butler 1997).

With respect to staff development and training the approach at the University failed to a degree, as between 1997 and 2001 staff were almost wholly dependent on one member of staff for training and follow up support. Appointment of the campus based on-line learning support officers has eased this problem and already, with the recent implementation of Blackboard, there is a sense that staff taking initial training courses in the use of this VLE are then going on to develop much further when back at their own local part of the University. Part of the reason for the already perceived greater success with Blackboard is probably due to the relative simplicity of this tool when compared to say the web publishing program Microsoft Frontpage. However there are also reasons related to the general ICT infrastructure that have undoubtedly led to poorer than expected take-up of network based tools. The paper will return to the issue of network services impeding staff progress in a later section.

8. Sharing and Dissemination of Good Practice

The sharing and dissemination of good practice is a very popular term with staff developers. However, it is important to remember that what is good practice in one situation is not necessarily true for another. This is very clear with respect to the use of ICT to support teaching and learning, where the success of a particular approach can be very context specific.

Experience at Westminster has shown that most staff attending development sessions want to know how to make the technology work. They are interested to see examples of how the technology has been used, but if they go away from a session without having experienced ‘hands on’ the technology in action they are disappointed. If they experience the technology and it works they go from the course with a very positive attitude. As a consequence it can be hypothesised that in staff training courses the emphasis should be on the technology and not the pedagogy. This is not to say that technology should drive the pedagogic approach but rather that staff developers should have greater faith in colleagues to use any new found technological expertise in a sensible manner, to facilitate and improve student learning. By and large most staff are professional enough to realize that ICT offers opportunities to deliver education in a different way. However they also see the potential pitfalls very rapidly and understand that any approach to teaching and learning, whether centred around ICT or not, requires thoughtful, careful planning. There was a period at Westminster when the ‘ogre’ of ICT was much feared and the impression given that staff would in some way misuse it, providing students with web pages to read and little else. The over emphasis of staff developers on ‘the pedagogy’ is a complete turn off to most staff who just want simple ideas and ideally, simple

technology, to help them deliver the pedagogic model that they have used for many years and are comfortable with.

Local events for the sharing of good practice are favoured by staff on the campuses and are often the best way to ensure, if worried, that pedagogic issues are given their rightful place by facilitating discussions of examples of the use of ICT. However, centrally organized 'larger scale' events have also worked well. In June 2001 an on-line learning symposium was held and attended by over 250 staff from across the University. At the symposium all presentations, bar one, were made by staff of the University. This event turned out to be extraordinarily successful at the sharing of ideas with a major feedback from attendees being that they had little idea, prior to the event, just how much was already going on in the University in this area.

By far the greatest success has been achieved recently through the use of the VLE Blackboard to offer a wholly on-line course on teaching and learning on-line (in essence a distance course but mainly for staff within the institution). The first time this course ran around 30 staff started and completed the full 4 weeks of the course. The course combined the use of discussion boards to address a range of issues associated with the integration of technology into teaching and learning. The very nature of the delivery inevitably made the technology the core of the course but in some respects this seemed to stimulate discussion of non-technological issues. Much of what will follow in the next section was actually gleaned from the discussions that took place on this course. The on-line approach to staff development is an interesting one as it facilitates collaboration with other institutions on such issues of the effective use of learning technology (Cannata *et al*., 2002).

9. Attitudes of staff towards the use of ICT

As stated earlier there has never been any problem in getting staff to attend short courses on making web pages, using e-communication tools and latterly, using a VLE. This tends to suggest that there are substantial numbers of staff who are not too worried about the consequences that ICT might have on their job (around 350 out of a total number of some 750 full-time academic staff have attended centrally provided courses in the past 4 years). Over the past 4 years only a handful of staff have explicitly stated that they felt an increased use of ICT might put them out of a job or lead to a greater workload.

As stated earlier, the single most often stated reason for minimal progress with ICT is a lack of time, coupled to insufficient follow-up support at local level. To a degree the University has responded to this through the appointment of on-line learning support officers. However it is too early to ascertain whether these appointments will lead to a greater take-up by staff of tools that they are shown on short courses. Initial signs are encouraging in that attendance at recent locally provided workshops has been high. However overall success will depend upon how many staff are prepared to make a go of it by using the tools themselves rather than relying on technical staff to always be there to do the technical 'bits' for them. There is some hope that as tools, such as Blackboard, become easier and easier to use significant numbers of staff will see the benefit in making direct use of such tools themselves.

The ease with which technology can be used is naturally significant. Closely linked to the 'lack of time' reason is the perceived unreliability of networked services and local computing services. Recently (November 2001) a set of 'in-house' tools designed to promote communications and the distribution of information between staff and students and between staff were made available. Accessible from the intranet homepage these tools (collectively known as the Westminster Network Applications, see table 3) relied on the user being able to authenticate to the Microsoft NT operating system. At UoW most student network authentication is done via NOVELL rather than NT (or Windows 2000). An attempt to automatically synchronise the passwords required for the 2 separate operating systems (to avoid the need for 2 separate passwords) was made and failed badly. This meant that at the time of the launch of the applications the passwords for the NT system became very unreliable. As a consequence many staff found that when they tried the applications from their own offices they appeared not to work. Indeed it subsequently emerged that the whole issue of passwords was one of complete confusion to the 'average' member of staff with central computing services essentially using 3 different operating systems to provide the range of basic services (e-mail, file storage and the web).

For on-line learning developments to succeed it is absolutely vital that the tools to be used work seamlessly and reliably. The need to make networked systems operate together, with minimal effort on the part of the end user, has not been met at UoW. The net result has been that a number of web based tools that could have a significant impact on internal communication, an underpinning feature of any learning environment, have been largely ignored by a majority of staff. This is unfortunate especially as their introduction was led by staff at campus level.

The negative impact of unreliable networked systems has been highlighted previously as a major problem in effecting the integration of learning technology (Butler and Sellbom 2002). By and large however staff are fairly sure that ICT can make a difference to the quality of educational provision in the 21st Century, bringing them closer to an ever diversifying and growing body of students. Certainly there is little evidence to suggest that staff feel ICT opportunities are over-hyped or that seizing ICT enthusiastically will mean a loss of jobs. Rather there is the view that if a lecturer in the modern age does not start using ICT to support their teaching and learning they are likely to be replaced by one that does. There is clearly a concern though that the use of ICT needs an up front investment of time and that unless properly managed when implemented, an increased workload can result.

Application	Main Features
Student Noticeboard	Text messages can be sent to groups of students; can include an attachment of any file type and size; distribution lists dynamically/ automatically generated; can programme messages to 'disappear at a pre-set date.
Staff Noticeboard	As above but for staff to send to other staff
Document Library	Can archive documents to the Intranet and selectively make documents (or other file types) available to selected groups of staff.
Question & Answer Database	Enables the posing of questions and archiving of both question and provided answer in searchable database.

Table 3: The Westminster Network Applications

10. Tensions between local and central initiatives and support

The decentralised model of operation for a University has its advantages and disadvantages. An obvious advantage should be that local provision is better matched and suited to the needs of users. However a major potential disadvantage is that disparate local groups will separately develop systems and tools that overlap and lead, at the institutional level, to cost ineffectiveness. The desire at UoW with respect to on-line learning developments has been to develop and promote centrally supported initiatives that provide what staff at the campuses require. Initial developments, such as the launch of the University Intranets, sought to do this by working very directly with individual staff, a truly 'bottom up' approach. However if you cut out the 'middle-man' he (or she) will find something else to do and this will often be different to the initiative started. Indeed the development of the intranets is a good example of this. Significant numbers of campus based staff made use of essentially centrally provided help but local campus computing services, missed out to a degree in the 'bottom up' approach and either did not provide support at all or did not know the right support to provide. Indeed, when separate physical servers for each campus intranet were purchased from central budgets, they remained located centrally despite the offer to allow them to be sited and managed locally.

In the latest developments with Blackboard, the local campus computing services have been more closely involved. Already there are more encouraging signs of greater collaboration both in the provision of training and also with respect to the sharing between campuses of scarce hardware and support staff.

11. Discussion and Conclusions

There is every indication that a majority of staff want to use ICT to support what they do. This is evidenced by the immense popularity of any courses to do with the use of the web or network. Staff who come on these courses state 2 main reasons for doing so. These are firstly that they need to start using web based tools because everyone else is and secondly, that they hope that using such tools may help them to do their job better or more easily. Most administrative staff are unequivocal in their belief that effective use of such tools can help improve what they do.

As a group, academic staff are somewhat less convinced, but increasingly seem to accept that future students will expect at least a part of their learning to feature the use of on-line systems. Additionally there are growing numbers of academic staff who seem confident that some on-line approaches can help to combat the failings of traditional campus based delivery to ever larger student cohorts. This increase in desire to rely on on-line delivery is coming at a time when there is growing evidence to suggest that a majority of students have term-time access to an Internet connection away from the University premises. The matching of staff interest to student capability is no co-incidence. Rather, it is a strong indication of the professionalism and common sense of staff in waiting for the right circumstances before committing themselves and their students to an on-line learning experience. These circumstances undoubtedly include the increased simplicity of tools like the VLE Blackboard.

In the recent past there has been a tendency for so called pedagogists to be overly concerned that staff may in some way misuse the information technology revolution to 'sell' campus based students an inferior experience. Just as these fears are proving to be unfounded so too has the assumption that staff are fearful that ICT may put them out of work. All in all the common sense approach of the 'average' member of staff towards ICT, their eagerness to learn and try new tools, suggest a very positive overall attitude towards the integration of technology into learning and learning support. So, where do the problems arise?

Most problems are inevitably related to using the technology. The reality at most traditional universities is that there can never be enough support staff to provide academic staff with the help they need precisely when they need it. This means that it is essential, if the strategy is not to limit learning technology to a select few, to have tools and systems that are foolproof.

Most staff and students know how to use a web browser. Therefore any system for the support of on-line learning that functions in that environment in a user friendly way, is likely to be successfully exploited. VLEs, like Blackboard, are

almost foolproof and provide a host of features capable of re-vitalising the provision of learning opportunities to campus based students in the over crowded higher education system of the 21st century. However, simple to use tools can still be frustrating if staff have difficulty in accessing them reliably. So far, the major failure at Westminster has been the inability to allow eager staff and students reliable access to easy to use tools for the dissemination of information and on-line collaboration. To succeed in the projected learning environment of the future, 24 X 7 accessibility and usability of such tools and systems must be the target. At the moment UoW is not unique in falling short of this target.

References

Bull, J and S. Zakrewski (1997) Implementing learning technologies: a university wide approach. *Active Learning* 6, 7-11.

Butler, D.L. and M. Sellbom (2002) Barriers to adopting technology *Educause Quarterly*, 25, 2, 22-28.

Butler, J. (1997) Which is more frustrating: achieving institutional change or herding cats? *Active Learning*, 6, 1-3.

Cannata, L., Cavanaugh, J., Nicastro, D., Orr, P. & C. Wheeler (2002) Transforming training through collaboration. *Educause Quarterly* 25, (2), 62-65.

CRE Report: Formative evaluation of University Strategy for new Technologies in Teaching and Learning (2000). CRE DOC No. 5, ISSN 1027-67-26

DTI Report: Point and Click: learners in the ICT driving seat (2000), UK Department of Trade and Industry.

Iacconi, A. and Saunders, G. (2000) Developing the use of an intranet – an institutional approach. VINE, 119, 39-43.

Jost, K.L. & S.L. Schneberger (1994) Educational technology adoption and implementation: Learning from information systems research. *Canadian J. of Educational Communication*, 23, (3), 213-230.

Liber, O. (1998) Structuring institutions to exploit learning technology – a cybernetic model. *Association for Learning Technology Journal* (ALT-J) 6, (1), 13-18.

Liber, O. (1999) Embracing educational media: An organisational perspective. *J. for Education Media*, 24, (1), 55-57.

Ramsey, E., Breeden, S.E., Roche, G. & S.T. Evans (2001) One size does not fit all: Two models for support and training. *Educause Quarterly*, 24, (3), 25-30.

26 One year E-learning at the K.U.Leuven: an Examination of Log-Files

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Abstract

At the K.U.Leuven the introduction of a digital learning environment was strongly embedded in an already present and extensively communicated educational concept ('guided independent learning'). Hence, it seems obvious that courses designed within the digital learning environment will be in line with this educational concept. An examination of logfiles however suggests that this might only be true for a minority of courses.

Keywords: e-Learning logfiles

1. Introduction

A few years ago, the K.U.Leuven introduced 'guided independent learning' [GIL] as its educational concept. According to the GIL-concept, every course should aim at contributing to the development of students' independent and critical thinking. Rather than expecting students to reproduce facts, promoting in-depth understanding of scientific findings should be at the focus of university teaching. Rather than aiming at encyclopaedic completeness attention should be paid to underlying research methodology and to the historically situated origins of the facts under study. Rather than introducing students in a discipline by reading out ex cathedra or by having them snowed under with a bulk of information, teachers should create a learning environment that triggers students to actively manage learning materials by designing assignments, by providing corrective feedback and by integrating research and educational activities. In order to facilitate students' ability to argue critically they should be given ample opportunity to express their own understanding and opinions. Time and again occasions should be created to confront students' own comprehension with that of others, both students and teachers. This way students are treated as self-regulated adult learners who will become increasingly capable of contributing themselves to the continuous development of knowledge and being professionally active (Elen, in press).

It is against this background that the K.U.Leuven (like many universities worldwide) has pinned one's faith to the opportunities posed by information and communication technologies. Aiming at the efficient support of (formative) assessment and learning, the project was named 'Toledo' (Toetsen en Leren Doeltreffend Ondersteunen). Within the Toledo project three different software products are used: a digital learning environment (Blackboard), an electronic assessment tool (Question Mark Perception) and –in the near future- learning content will be tagged with metadata and stored in Ariadne's Knowledge Pool System for future re-use. In this paper we will restrict ourselves to the digital learning environment.

In line with its GIL-concept, university management strongly promotes the use of the e-learning environment as an (additional) opportunity for enlarging support facilities and individualised student guidance, as well as for the active participation of students in a variety of research-related activities and for promoting genuine dialogue and interaction among students and among students and teachers.

At the K.U.Leuven, the e-learning environment was available for teaching staff and students at September 2001. The number of actual users (both instructors and students) increased rapidly during the next few months. Already in November 2001 the e-learning platform was used in nearly 800 out of 6400 courses. It thus seems that the platform was used extensively very short after it became available.

2. Research

2.1. Research Question

Although the e-learning platform was used extensively, the question remains if and to what extent quantity agrees with quality. Stated somewhat differently, it remains unclear if and to what extent the popularity of the e-learning environment coincides with an increase of student activities that are in line with the GIL-concept. Furthermore, the unqualified observation that the platform 'is used extensively' provides no information as to the characteristics of the student-population involved (e.g. 'candidates' versus 'licentiates'; students in humanities versus students in biomedical sciences), nor does it allow us to detect ongoing evolutions in the way the platform is put to use (e.g. over semesters in the academic year).

Hence, a more fine-grained analysis of e-learning at the K.U.Leuven is needed. Clearly, this is an empirical undertaking. Neither straightforward hypotheses nor clear

predictions can be put forward. Driven by curiosity however, we felt it might be worthwhile to give it a try.

2.2. Method

As a first attempt to obtain a more detailed picture of the assumed 'quality' beyond the 'quantity', it was decided to examine log-files generated by the learning platform software[1]. More specifically, we were wondering if different 'types' of digital courses could be distinguished. If so, this classification will be related with characteristics of the student population involved and with time periods within the academic year. With regard to the characteristics of the student population we will limit ourselves to two variables: Level of program (i.e.'candidates' versus 'licentiates') and the educational discipline students are in (i.e. 'humanities', 'exact sciences' and 'biomedical sciences'). With regard to the time period within the academic year, a distinction will be made between 'first' and 'second' semester.

However, before logfiles can be examined, a lot of number crunching is required. A brief overview of the subsequent operations involved is described hereafter.

2.3. Number Crunching

Starting point was the main tracking table within the Blackboard (Oracle) database. Every action (e.g. 'sending an e-mail, reading an announcement) of any user of the learning platform generates at least one new record in the database[2] . Amongst other information, a record consists of a time stamp, a course identification number and a marking of the tracking area referring to the action that generated the record. Overall, Blackboard distinguishes 149 different tracking areas (e.g. 'Send Email'; 'announcements'; 'CP_add_users'; ...). Tracking areas with 'CP' as a prefix (e.g. 'CP_add_users') refer to activities on Blackboards' Control Panel. Blackboards' control panel is used by instructors to manage their course. A mark for the tracking area 'CP_add_users' for example indicates that the instructor of the course has added a user (student) to the course. Tracking areas not referring to an activity on the control panel pertain to student activities.

Out of Blackboards' main tracking table records were collected (using a sql-script) separately for the first semester (01-Sep-2001 through 02-Feb-2002) and the second semester (03-Feb-2002 through 04-Jun-2002, date at which data were collected)[3]. Next within every semester, records were collected separately for every course.

Consequently, courses that span both semesters were treated as two 'different' courses.

Next a table with 1.300 rows (one for every course having at least one record in Blackboards' main tracking table) and 149 columns (one for every tracking area) were generated. Every cell in this table contains the frequency with which a particular tracking area for that course was observed in Blackboards' main tracking table.

As it turned out, the resulting frequency table was extremely sparse (i.e. it contains a bunch of empty cells).

Reducing the sparseness of the matrix was obligatory and took several steps.

- First the number of columns (149 different tracking areas) was reduced. Twenty three tracking areas had empty cells for all courses. Consequently those empty columns were discarded. Next tracking areas pertaining to similar user activities were joined (combined) into a single index for that activity. No joining occurred unless it was 'interpretable' and sustained by a principal component analysis[4][5]. This joining operation downsized the number of rows to 45 indices. Seventeen indices pertain to CP-activity[6] and 28 indices refer to student activities[7]. Finally 7 indices (all referring to student activity) with a total column frequency (i.e. summed over courses) of less than 10 were discarded.

-Secondly the number of rows (1.300 courses) was reduced. 190 'test' courses and 432 courses with less than 6 different effective users (instructors or students) were filtered out. The number of users per course was obtained from Blackboards' system level data. Finally all remaining 678 course-id's were matched with course-id's in a central 'education database'. One hundred and seven courses could not be identified as simply and solely part of either a basic academic program ('candidate') or an advanced academic program (licence). Those courses were also filtered out.

The above procedure thus resulted in a table having 571 rows (different courses) and 38 columns (frequencies indicating instructor-activity or indicating student activity).

2.4. Results

As it turned out, it was quite well possible to obtain a classification of digital courses at the K.U.Leuven. First the classification itself will be described. Next, this classification will be related with both characteristics of the student population involved and the semesterial structure of the academic year.

2.4.1. Classification

As indicated above, all 571 courses are described by 17 indices referring to CP-activity as well as by 21 indices referring to student activities.

Two hierarchical cluster-analysis (Ward's method / squared Euclidean distances) were performed. In a first analysis the 17indices referring to CP-activity were used to 'cluster' courses with a like profile. In the second analysis the 21 indices referring to student activities were used to find different 'types' of courses[8].

Classification of courses based on instructor-activity

A cluster-analysis on indices referring to instructor or CP-activity revealed two distinct clusters of courses. A majority of 424 courses (out of 571) are characterised by relative low levels of instructor-activity on all 17 CP-indices. A minority of 147 courses shows off relative high levels of instructor-activity on all 17 CP-activities (cf. footnote 6).

Classification of courses based on student-activity

A cluster analysis on indices referring to student activity (cf. footnote 7) revealed three clearly distinct groups of courses. An overwhelming large cluster contained 489 courses. This cluster is characterised by a z-score of about –0.20 on all indices except for 'course documents'. The z-score for 'course documents' turned out to be zero. Therefore this type of courses was labelled 'document oriented'. A second cluster comprises 80 courses and is characterised by z-scores between +0.33 and +1.40 on all indices. Relative high scores were obtained for the indices 'drop box', 'course documents', 'assignments' and 'tools area'. Hence, this cluster was labelled 'assignment oriented courses'. Finally one cluster contained only two courses (in fact it is the same course spanning both semesters). Extreme positive z-scores (up to +16.6) were obtained for the indices 'address book', 'announcements', 'communication', 'edit homepage', 'email', 'groups' and 'group email'. The z-value for 'course documents' was -0.36 (i.e. markedly lower as compared to the document oriented and the assignment oriented cluster). The third cluster was labelled 'communication oriented courses'.

A crosstabulation (see table 1) of courses classified according to instructor-activity and courses classified according to student-activity reveals a significant relationship between both classifications (Chi^2 (1, N=569)=75,5; p<.001)[9]. Courses classified as 'assignment-oriented' require more instructor intervention (high CP-activity) as compared to courses classified as 'course document oriented'

Course Classification based on		**Student-activity**		
		course document oriented	assignment oriented	communi-cation oriented
CP-activity	low	395 (93.2%)	28 (6.6%)	1 (0.2%)
	high	94 (63.9%)	52 (35.4%)	1 (0.7%)

Table 1: Frequency crosstabulation of course classifications based on CP-activity and student-activity (row percentages between brackets).

2.4.2. Student activity based course classification and Program level

A crosstabulation of program level (basic versus advanced) and the trichotomy of courses that differ from each other with regard to the main type of student activity involved (course document oriented, assignment oriented and communication oriented; see table 2) shows that 'assignment oriented courses' appear more frequently within advanced programmes (Chi^2 (1, N=569)=6,62; p=.01)[10]..

Program level	**Course classification based on student-activity**		
	course document oriented	assignment oriented	communi-cation oriented
basic	247 (89.2%)	28 (6.6%)	2 (0.7)
advanced	242 (82.3%)	52 (17.7%)	

Table 2: Frequency crosstabulation of Program level and course classifications based on student-activity (row percentages between brackets).

2.4.3. Student activity based course classification and Educational Discipline

A crosstabulation of Educational Discipline (humanities, exact sciences, biomedical sciences) and the trichotomy of student-activity based clusters of courses (see table 3) reveals that course document-oriented courses are most prevalent within the biomedical sciences. Assignment oriented courses are relatively frequent within humanities (Chi^2 (1, N=569)=20,9; p<.001)[11].

Educational Discipline	**Course classification based on student-activity**		
	course document oriented	assignment oriented	communi-cation oriented
humanities	220 (80.3%)	52 (19.0%)	2 (0.7)
Exact Sciences	165 (86.4%)	26 (13.6%)	
Biomedical Sciences	104 (98.1%)	2 (1.9%)	

Table 3: Frequency crosstabulation of Educational Discipline and course classifications based on student-activity (row percentages between brackets).

2.4.4. Student activity based course classification and Semester

A crosstabulation of semester (first versus second) and student-activity based classification of courses (see table 4) indicates that the number of assignment oriented courses decreases going from the first to the second semester in the academic year (Chi^2 (1, N=569)=6,35; p=.0117)[12].

Semester	Course classification based on student-activity		
	course document oriented	assignment oriented	communi-cation oriented
first	184 (81.1%)	42 (18.5%)	1 (0.4%)
second	305 (88.7%)	38 (11.0%)	1 (0.4%)

Table 4: Frequency crosstabulation of Semester and course classifications based on student-activity (row percentages between brackets).

3. Discussion

At the K.U.Leuven, the GIL-concept is taken for granted at the central level and internal communication about the concept is continuous and ongoing. Time and again faculty members are invited to adapt their teaching in line with the concept (Elen, in press). Moreover, in several training-seminars faculty members learned how to incorporate the e-learning platform into their regular teaching activities along the lines put forward by the GIL-concept (Laga, et al., 2002). Hence, it might be expected that faculty members know how to take advantage of the opportunities posed by information and communication technologies.

While the large number of teachers that incorporated e-learning into their courses might indicate that this is indeed the case, the analysis of logfiles just presented asks for a more qualified stand.

Firstly, a vast majority of teachers seemed to use the e-learning environment as a vehicle merely to deliver information to their students. Of course, providing students with (additional) digital course-content is not necessarily reprehensible. Students can benefit from having PowerPoint slides (to be) used in a lecture or from having multi-media content at their disposal. The traditional educational approach however is particularly deficient both in providing students with corrective individualised feedback on assignments and in creating opportunities for students to interact with each other (or with their teachers). Hence, -and contrary to what was observed- one should expect that faculty members are particularly attracted by the communicative and assignment functionalities of the e-learning environment.

Secondly, teacher-student ratios are often extremely lop-sided at the onset of the curriculum. In the basic academic programs sometimes one teacher is available for several hundreds of students. Assuming that the functionalities offered by the e-learning platform would be especially helpful in guiding large numbers of students, one might expect that successful introduction of e-learning would be mainly observed within basic courses. As it turns out, this was not the case.

Thirdly, in the past it was observed that the reproduction of information by students is stressed most within biomedical study programmes, somewhat lesser within exact sciences and least within the humanities (Buelens et al., 1998). Hence, one might have expected that especially biomedical courses would gain most by an GIL-embedded introduction of the e-learning platform. Again, the reverse was observed.

Fourthly, a relative increase of merely content delivery e-courses was observed going from the first to the second semester of the academic year. Perhaps this tendency might be rooted in the fact that most faculty members who already had some experience with e-learning platforms previously to its release at the K.U.Leuven (the 'pioneers') started off in the first semester.

Taken together, one might conclude that the introduction of e-learning at the K.U.Leuven resulted mainly in a reinforcement of existing traditional educational practices. One the other hand, one might not overlook the number of courses in which the delivery of electronic course content is sustained by a both communication and assessment opportunities. Perhaps, the challenge for university responsibles and/or trainers is to accomplish and to consolidate the enlargement of such 'good examples' of guided independent learning.

Acknowledgements

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References

Buelens, H. , J. Elen, H. Bamps, T. Maes & G. Ausloos (1998) Praktijkoefeningen aan de K.U.Leuven. Einverslag van het optimaliseringsproject praktijkoefeningen. Dienst Universitair Onderwijs, K.U.Leuven. [Seminars at the K.U.Leuven. Final report; Educational Support Office, K.U.Leuven]

Elen, J. (in press) The reality of excellence in higher education: The case of guided independent learning at the K.U.Leuven. in E. De Corte (Ed.) *Excellence in higher education*, London: Portland Press.

Laga, L., M. Clement & H. Buelens (2002) Learning faculty to teach with an e-learning platform: some design principles. (Paper to be presented at the European conference on "The New Educational Benefits of ICT in Higher Education" september 2002, Rotterdam, The Netherlands).

Notes

[1.] Later on, both instructors and students will be asked to evaluate the introduction of e-learning at the K.U.Leuven.

[2] However, single user action might also trigger multiple record entries. E.g. a student sending a file to his instructor's drop box will generate at least 22 new records, a student consulting a course document will generate at least 6. Due to this recording procedure, absolute tracking area frequencies are difficult to interprete.

[3] As the second semester was not finsihed yet, numbers for this semester will be slightly biased.

[4] Separate principal component analysis were performed for tracking areas pertaining to (instructor) activities on the control panel and for user (student) activity on the course itself.

[5] e.g. the tracking areas 'CP_manage_group', 'CP_manage_groups', 'CP_manage_groups_add', 'CP_manage_groups_modify', 'CP_manage_groups_prop' and 'CP_manage_groups_remove' all were combined in the single index: 'CP_manage_group')

[6] CP-indices refer to activities relating to: 'CP_manage_groups', 'announcements', 'assessment', 'web button', 'digital dropbox', 'classroom archives', 'course images', 'course options', 'course in fo', 'course documents', 'assignments', 'course properties', 'course utilities', 'discussion board', 'send email', 'external links' and 'online gradebook'.

[7] Indices referring to student-activities were: 'fora activity', 'address book', 'announcements', 'drop box', 'communication', 'course info', 'course documents',

[8] Before running ther cluster analysis all indices referring to student activiteies were corrected for the number of students in that course. Additionally, in order to inrease mutual comparability, all indices were transformed in z-values prior to running the cluster analysis.

[9] Chi²-statistic pertains to the crosstabulation leaving out 'communication oriented student-activity' (i.e. the last column in table 1 was dropped before calculating the statistic)

[10] Chi²-statistic pertains to the crosstabulation leaving out 'communication oriented student-activity' (i.e. the last column in table 2 was dropped before calculating the statistic)

[11] Chi²-statistic pertains to the crosstabulation leaving out 'communication oriented student-activity' (i.e. the last column in table 3 was dropped before calculating the statistic)

[12] Chi²-statistic pertains to the crosstabulation leaving out 'communication oriented student-activity' (i.e. the last column in table 4 was dropped before calculating the statistic)

27 Sharing a Top Manager's Experience with the Next Generation: The Use of Electronic Discussions and Short Video Fragments in Teaching

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Abstract

This paper presents an effective educational method to transfer managerial knowledge to students. This method consists among other of online discussions between small groups of students and video clips of lectures. The set-up of the course and the ICT-tool used in the course were evaluated for two years through a questionnaire among the students. The results show that the applied e-learning concept is highly appreciated and serves as an effective tool to exchange knowledge.

Keywords: Teaching methods, online discussions, video clips, managerial knowledge.

1. Introduction

In recent years, the use of ICT in higher education has increased enormously. However, in many cases the application of ICT tools is still limited to making available learning materials via the Internet. Although this has certain efficiency benefits like information being accessible at any time and place, ICT is not really integrated into the educational process. With respect to students' learning process, more benefits of ICT in education may be achieved when ICT has an explicit place in the course.

In this paper the set-up of a newly developed course is presented, based on a well thought-out blended learning concept. The challenge was to make the most of the available ICT facilities, in a situation that students and teacher meet each other face tot face weekly. Furthermore, the lecturer of the course is a former top manager, whose aim is to transfer practical knowledge. This knowledge is not written in books. Finally, next to objectives with respect to content, one of the aims of the course is learning to form your own opinion and share it with others. Therefore, the course was designed from a constructivistic learning concept. How do you transfer a top manager's practical knowledge to students, benefiting from the possibilities of ICT optimally?

The experiments in this course are part of a large project executed at the faculty of TPM, Delft University of Technology. One of the subprojects of this faculty-wide project, called IMAGO, consists of researching the functional use of ICT in education. A few selected instructors implemented ICT in their courses in an innovative way (Herder 2002a, 2002b, Van Daalen 2001, Sjoer en Brakels 2001, Sjoer en Dopper 2002, Brakels et all 2001, Van Daalen et all 2002).

One of these instructors is Professor Wim Dik, a former top manager, who was recruited to teach the elective course "Management of ICT oriented organizations". Professor Dik worked almost 40 years as a manager, 24 years of which with Unilever ("old economy") and the last 12 years as chairman and CEO of KPN, the Dutch post and telecom operator ("new territory"). Furthermore, he was active in politics and served as a minister for foreign trade. He now shares his ample experience, supported by clear management theory, with the next generation.

"Management of ICT oriented organizations" was taught for the first time in the year 2000, and for the second time in the Fall 2001. The course focuses on organizations where ICT plays a dominant role as a product or as a means, for example Internet, e-commerce, digital media, and mobile communication. Due to the fast developments of ICT these organizations have to cope with mergers, break-ups, fast technological developments, higher quality demands etc. In order to react quickly and adequately to the developments, management must have insight in the important fields of decision-making and the ability to formulate adequate strategies.

ICT-tools, like video-clips and electronic discussions are integrated into this course. The next section describes the set-up of the course. The way the course is taught will be explained together with the choices that have been made, relative to the chosen learning concept. The course was evaluated by means of a questionnaire among students for both years. The results of these questionnaires, concerning the use and the appreciation of ICT-tools within the course set-up, will be presented in the third section. Finally, we will draw conclusions in section 4.

2. Course set-up

The course consisted of 12 weekly lectures of 1,5 hour each. In each lecture a main topic was highlighted. In the first 45 minutes of the lecture theory concerning this main topic was discussed. The second 45 minutes were meant for questions and discussion about the theory and for feedback on electronic discussions and assignments. Figure 1 shows a schematic view of the course set-up.

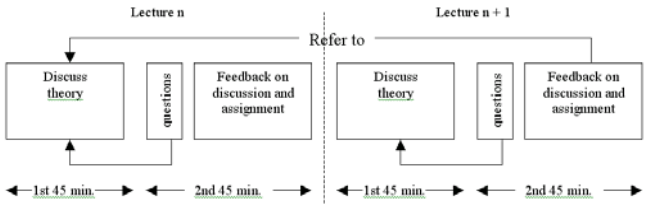

Figure 1: course set-up

Between the lectures students worked in groups of four persons on case based assignments. The assignments had to result in a document of around 2 to 3 pages, in which they had to discuss the main topic of that week's lecture. The assignments had to be turned in electronically within a few days, so the professor could come back to them the next lecture. Furthermore, after each lecture the teacher formulated a provoking statement about the central topic of the lecture, which was posted on the electronic discussion board of Blackboard, a digital learning environment. Each group had to react on this debatable statement and on one reaction of another group at least.

For example, students had to react on statements like:

- UMTS-frequencies should be given away for free.
- The merge between HP and Compaq is doomed to fail

Participation in the electronic discussions about statements was compulsory for groups. The professor did not participate in the electronic discussions, but screened the reactions on a statement and selected those contributions that are important for further elaboration in the classroom. The remarkable things the professor picked out of the electronic discussions were brought forward in the next lecture.

To summarize, half of the lecture time (the second 45 minutes) is spent on giving feedback on the assignments and the group contributions to the electronic discussions. This increases the interactivity of the lectures. By stimulating students to discuss in groups about the topics addressed in the lectures, peer learning will evolve (Dillenbourg, 1999; Knowlton, 2000; McCombs, 2000). Together, students process the information of the lecture and give meaning to it. They form their own opinion and share it with others. Students attend the lectures well prepared and can truly contribute to the discussion. By coming back explicitly on the group work during the lectures, students feel that their opinion is taken seriously, which can be very motivating for students.

Video clips

In addition to the lectures, the assignments and electronic discussions, the course was enriched with video fragments. After each lecture, the professor and his assistant teacher went to a separate room to summarize the lecture on video camera. This resulted in six short video fragments of two to three minutes each. These video clips were put on the Blackboard site of the course in order to be available for students right away (see figure 2).

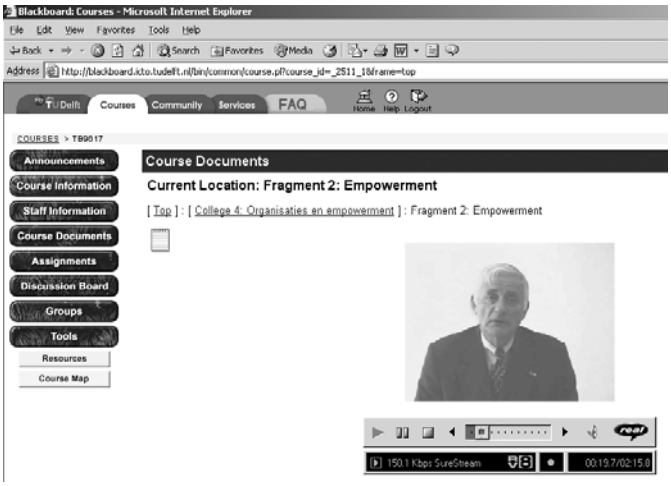

Figure 2: video clip about empowerment on the Blackboard site of the course

The lectures consisted of a mix of practical examples and managerial experiences of the professor, combined with management theories and current information from articles. The professor did not use any slides. The lectures were very appealing due to many anecdotes. However, it can be hard for students to get the main point out of those lectures. Therefore, the video clips were made to summarize the highlights of the lecture. We have chosen for video clips, because they are livelier compared with a summary in text or slides. Students hear the professor's intonation when explaining the main points of the lecture. The video clips are short, because students do not want to watch complete lectures on video (Verhagen, 1992, Collis & Peters, 2000). Finally, the professor also benefits from making the video clips, because he is forced to explain the main ideas of the lecture.

It took around two hours to make the six video fragments. In order to make one good video clip, the professor and his assistant teacher had to shoot approximately 1,5 to 2 video fragments. However, after recording a few video clips, the time needed to make the video clips was reduced considerably.

3. Results

3.1. Evaluation method

In both years, the course was evaluated by means of a student questionnaire, filled in after the course. The evaluation took place before students got their grade, so student's results did not affect the answers on the questionnaire. The questionnaire consisted of 32 questions, 23 of which were closed and 9 were open questions. For both years the same questionnaire was used. In the first year, 52 students attended the course and 40 students completed the questionnaire. In the second year, 53 students attended the course of which 41 filled in the questionnaire. This means exactly the same response of 77% in both years. Not all respondents answered all questions; in case of missing values only the unambiguous answers were taken into account.

In order to find out whether there were significant differences in scores between both years we carried out a t-test. Judging by a significance level of 0.025 (p-value) no significant differences were found between the two years of study. Consequently, the data for both years were combined.

Next to the questionnaire, one interview is held with the teaching assistant.

In this section we will focus on the results with respect to time spent on electronic learning environment (3.2); the role of video clips in the concept (3.3); electronic discussions (3.4) and finally, the feedback given during lectures (3.5).

3.2. Time spent on electronic learning environment

In our questionnaire we asked students to estimate the total time they had spent on the course in hours and the time they had spent on working with the electronic learning environment. Students indicated that they spent an average of 30% of the total time on working with the electronic learning environment.

3.3. Video clips

Students are positive about the video clips. 85% said that they had watched half of the video clips or more; 49% had even watched all video fragments. On a scale from 1 to 5 (1 = not useful, 5 = useful) 92,5% considered the video clips useful (27,5%: 4, 65%: 5). In the questionnaire we asked students what role they would prefer for the video clips in this course, i.e. as an addition to lectures, alternate: sometimes lectures, sometimes video clips, or as replacement of the lectures. Figure 3 shows that students have a clear preference for video clips as an addition to lectures. This probably has to do with the fact that the teacher in this course is a charismatic top manager, whose lectures contain practical cases and examples to illustrate management theories. The teaching assistant declared in the interview that the lectures are indeed very appealing for students, but that the core of the lecture was hard to identify. Consequently, when the teacher summarizes the highlights of the lectures on video, video clips have additional value for students.

Quoting from the questionnaire when asked for advantages of the video clips:

- The video clips can be watched as often as you want.
- The video clips contain the most important aspects of the lecture, so they are a good help for preparing the exam
- The video clips present a lively, short and clear summary of the lectures

Some of the disadvantages mentioned were:

- Slow Internet connection at home
- Not possible to ask questions, video clips are not interactive
- Eventually you are going to transfer the video clips into text anyway

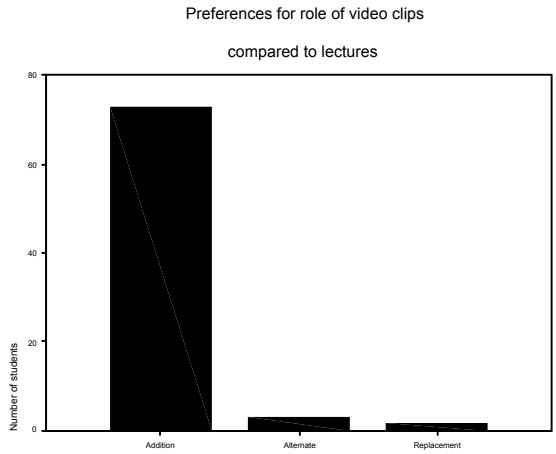

Figure 3: student's opinion on the role of video clips in this course.

Reusability of the video clips

In the first year of the course, the teachers had to put a lot of time and effort in making the video fragments. However, in the second lecture series it turned out that almost all video fragments could be used again. Together with the positive results concerning the video clips, one can conclude that making the video clips can be considered a good investment.

3.4 Electronic discussions

Students reacted positively to questions that are related to electronic discussions. 87,6% of the respondents indicate that they found the electronic discussions useful (4 or 5 on a scale from 1 to 5). Furthermore we asked students whether they considered it useful to get to know the opinion of other

groups and to react on the opinion of other groups. 87,4% appreciated getting acquainted with the opinion of other groups, and 79,8% found it useful to react on the opinion of other groups.

Besides the electronic discussions, the course set-up also provided for face-to-face discussions about the statements and the assignments. 85% of the respondents indicated that they discussed statements as well as assignments face to face within their own group. In our questionnaire we asked students what kind of discussion they consider to fit best in this course, electronic discussions or face-to-face discussions. Results show that 24% consider electronic discussions to fit best in this course and 41% think face-to-face discussions fit best. 32% of the respondents filled in both options, i.e. electronic discussions and face-to-face discussions. Apparently, a large number of students found it difficult to choose, probably because of the fact that both methods have their own advantages.

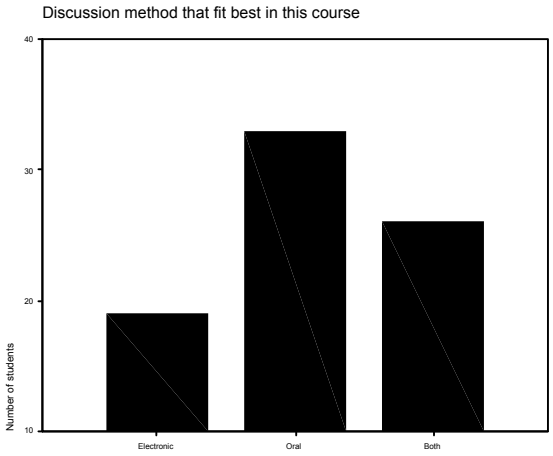

Figure 4: student's opinion about the discussion method that fit best in this course

Students, who had a preference for electronic discussions, explained their answer with quotes like "electronic discussions are time and place flexible; you do not have to be present". Students, who considered the face-to-face discussions to fit best, added an explanation like "face-to-face discussions are more efficient to form a group's opinion, because every body can react right away". Finally, students who have chosen both options stated that they considered both discussion methods to fit well in the course, because they are supplementary. Face-to-face discussions suit for forming a group opinion and electronic discussions fit best for discussions between groups.

3.5. Feedback during lectures

Another important element of the course is the feedback on group work provided by the professor during the lectures. The feedback was the link between the electronic learning environment and the classroom environment. The feedback stimulates students to attend class well prepared, which may have a positive effect on the interactivity of the lectures.

Students really appreciated the feedback on assignments and discussions during the lectures. 79% considered the feedback of the professor on assignments useful (4 or 5 on a scale from 1 to 5). 67% feels the same about the feedback on electronic discussions (4 or 5 on a scale from 1 to 5). A possible explanation is that it can be very motivating for students that their opinion can be discussed in class. They feel that their opinion is taken seriously and they are also brought in touch with other opinions.

Just like the video clips and the electronic discussions, the lectures were also highly appreciated by the students. 95% of the respondents considered the lectures useful (4 or 5 on a scale from 1 to 5), and the most stimulating component of the course (80%, N=66). This probably counts for the fact that the teacher is a good narrator; the lectures were very lively, contained a lot of appealing examples and were really interactive.

4. Conclusions

In this paper we presented a well thought-out learning concept in which ICT played a significant role. The central element of the course set-up consisted of lectures to which the other elements, i.e. video clips, electronic discussions and case based assignments were strongly related. The objective was to really integrate the lectures with new technology.

Results show that students highly appreciated all aspects of the course. The course is well structured and the electronic learning environment is indeed integrated in the course. This is due to the fact that half of the lecture time is used for giving feedback on student's assignments and contributions to electronic discussions. The video clips refer to a real lecture, and were available soon after the lecture. The electronic learning environment is more than just an information medium.

The course set-up seems to be effective to teach managerial knowledge and expertise. We consider the concept to be applicable to subjects other than "Management of ICT oriented organizations". The concept is appropriate for sharing practical knowledge and experiences with students. It would be very interesting to try out the concept in comparable settings. An unknown variable in the success of the course, and more specifically in the success of the video clips is still the teacher. It would be interested to find out whether the video clips would have the same impact with another teacher in another setting.

In the second year of the course, the results were as positive as the first year. Furthermore, the professor and his teacher assistant had to spend far less effort in preparing the course. The most important time-saver was the video clips, because they could be used again in the second year of the course.

References

Brakels, J., C.E. van Daalen, W. Dik, S. Dopper, F. Lohman, A. van Peppen, S.A.G. Peerdeman, D.J. Peet, E. Sjoer, W. van Valkenburg & M. van de Ven (2002). Implementing ICT in Education Faculty Wide, *European Journal on Engineering Education*, Vol. 27, No. 1, pp. 63-76.

Collis, B.A., & Peters, O.(2000). Educational applications of WWW-based asynchronous video. In N. Corrie, T. Chambel, & G. Davenport, (Eds.), Multimedia '99 (pp. 177-186).

Daalen, C.E. van (2001). A case study comparing student appreciation of lectures to computer assisted instruction on the topic of systems modelling, In I. GIBSON (ed.), *Proceedings SEFI seminar on Information and Communication Technologies in Engineering Education*, 2-4 May, Galway, Ireland, pp. 76-82.

Daalen, C.E. van, S.M. Dopper, G.P.J. Dijkema, A.R.C. de Haan, P.M. Herder, M. Kruit & E. Sjoer (2002). DIY in ICT: faculty members develop their own implementations of ICT in education. *Sefi conference proceedings,* Florence, September 2002.

Dillenbourg, P. (Ed.). (1999). *Collaborative Learning. Cognitive and Computational Approaches*. Amsterdam: Elsevier.

Herder, P.M., E. Subrahmanian, S. Talukdar, A.L. Turk & A.W. Westerberg (2002a). The Use of Video Taped Lectures and Web Based Communications in Teaching: A Distance-Teaching and Cross-Atlantic Collaboration Experiment. *European Journal on Engineering Education,* Vol. 27, No. 1, pp. 39-48.

Herder, P.M., E. Subrahmanian, A.L. Turk & A.W. Westerberg (2002b). Communication and Collaborative Learning in a Cross-Atlantic Design Course, *Ed-Media Conference Proceedings*, Denver, Co., June 2002.

Knowlton, D.S. (2000). Promoting Durable Knowledge Construction through Online Discussion. Promoting Durable Knowledge. Presentation at 'Teaching and Learning', 6th Annual Mid-South Instructional Technology Conference, April 8-10, 2001 in Tennessee. http://www.mtsu.edu/~itconf/proceed01/11.html

McCombs, B. L. (2000, July). Learner-centered psychological principles: A framework for technology evaluation. Invited paper presented at the U.S. Department of Education's Regional Conferences on "Evaluating Technology in Education," Atlanta.

Sjoer, E. & J.K. Brakels (2001). Changing writing processes using ICT: electronic peer review in collaborative writing. In I. GIBSON (ed.), *Proceedings SEFI seminar on Information and Communication Technologies in Engineering Education*, 2-4 May, Galway, Ireland, pp. 64-75.

Sjoer, E. & S.M. Dopper (2002). Are the Promises of Online Assessment Being Proved in Practice? A case study into what conditions should be met in order to use online assessment successfully, *Ed-Media Conference Proceedings*, Denver, Co., June 2002.

Verhagen, P.W. (1992). *Length of segments in interactive video programmes*. Dissertation. Enschede: Utwente.

28 Learning Faculty to Teach with an E-Learning Platform: Some Design Principles

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Abstract

The implementation of electronic learning platforms requires new competencies of faculty members. Institutions of higher education are challenged to support their staff to acquire those competencies. Training seems to be an interesting way to do so. This paper includes a brief description of a faculty development programme of the Katholieke Universiteit Leuven (Belgium). The evaluation of the programme - both by the trainers and the participants - clearly pointed at the necessity to carefully analyse the characteristics of the participants, as well as the competencies needed to integrate successfully an e-learning platform in one's teaching practice. This exercise led to the formulation of some design principles for faculty development programmes on e-learning platforms. The change of faculty members' teaching conceptions as well as the attention for their stages of concern can be pointed at as crucial elements of these principles.

Keywords: design, faculty development, e-learning platform

1. Introduction

In July 2001 the Katholieke Universiteit Leuven decided - like many other institutions for higher education - to acquire a commercial e-learning platform for the whole university. This decision was based on several arguments. One of these was that the central support offices could no longer sustain faculty members efficiently as software and languages used to develop platforms by faculty proliferated. On top of that and more importantly, an explicit concern for the students, who risked to be confronted with different platforms motivated the decision.

In order to successfully implement this innovation the Toledo (Toetsen en Leren Doeltreffend Ondersteunen; Effective support of Assessment and Learning) -project and -team were created (Buelens, Roosels, Wils & Van Rentergem, in press). Different support initiatives were set up. A faculty development programme '*The Digital Chalk'* was one of these. The general aim of this training was to help faculty acquire all competencies needed to integrate the electronic platform in their teaching practice in such a way that both they as teachers and the students could benefit most. The introduction of the e-learning platform - in other words - was meant to function as a lever for educational innovation, so that the implementation of the university's student centred teaching concept 'Guided independent learning' (Elen, in press) would gain strength.

2. Format of the training

'The Digital Chalk' consisted of four elective modules: an introductory module, a design module, a module about information delivery and one about communication facilities.

Lack of time between the acquisition of the platform and the announcement of the training initiative forced the trainers to base the design of the initiative on the most obvious and salient goals and assumed characteristics of participants. We assumed for instance that faculty members do not want to spend a lot of time on teacher training courses. We therefore split the training into independent modules, each of them lasting 3 hours (including a coffee break).

With regard to the objectives that were set for the training, the focus lied on the development of particular insights and competencies we considered essential in order to use the two main functionalities of a platform, namely information delivery and communication (modules 3 and 4). More specifically, it was considered important that participants gained insight in the influence of information (its forms and structures) on learning. They should also become aware of the influence of pre-attentive processes (what determines the attention people give to certain elements of information) and of communication between students and teachers and among students on learning. Evidently, the participants also had to learn to use on an instrumental level the different functionalities of the platform regarding information and communication. This stresses the importance of a profound insight in the features of the platform (module 1). Because the different functionalities of the platform need to be integrated into each other and into the global learning environment, the systematic process of decision making faculty members should go through in order to decide if and how to use the platform in their teaching was presumed essential (module 2).

More details about the concrete learning environments that were set up in each of the modules are given below:

Introductory module: This module consisted of a demonstration of the functionalities of the platform and an assignment for the participants. The assignment required the participants to actually use the platform. All questions of the participants regarding this module (received with their registration) were answered in the demonstration or through the assignment.

Design module: During this module participants were guided through a limited analysis of their own teaching practice. Questions they had to answer were 'Give two competencies you want your students to acquire', 'How would you characterise your students?', 'What activities would help those students to acquire the competencies?', 'How will you evaluate whether they acquired the competencies?', 'What problems could students have during their learning process?', 'How could you as a teacher help students with those problems?', 'Which functionalities of the e-learning platform could you use to help your students and how will you use them'?

Module about information: This module consisted of three parts: first the participants had to explore different formats of information put on the platform about a specific topic (lightning). The exploration had to be done from a technical perspective, for example 'What is the size of this file?', and from a didactical perspective, for example 'Is it obvious for you what to do with this information?'. During the second part the technological implications of putting information on the Internet was treated. The third part was focused on the influence of different kinds of information (words, pictures, moving pictures, etc.) on students' learning.

Module about communication: During this module participants were given the chance to explore different communication functionalities of the platform. Most of the time was spent on discussions in different groups via the discussion forum about a question, a comparison and a postulate regarding electronic communication. All questions, comparisons and postulates were inspired by the 'questions' participants submitted when they subscribed for the training . At the end of the module the different discussions were summarised.

All four modules were organised during semester holidays between September and April. Participation in the first module was a prerequisite for participation in the other modules, unless trainees already participated in an information session about the platform, another support initiative of the Toledo-team. There were no preconditions for participation in the other modules, although participation in the second one was recommended for the last two modules. Together with their registration participants were asked to formulate a question regarding the subject of the module.

All faculty members of the university were invited (n=1424). Teaching assistants (n=851) could also participate but they did not receive a personal invitation. Across the four modules 192 subscriptions of 84 different people were received. Twenty-one people only subscribed for the first module, 26 people subscribed for all modules (all four or last three if they already followed an information module). Because the maximum number of participants for module 2, 3 and 4 was set on 25, only 73 people could actually participate. Many of them could not follow all modules they subscribed for.

3. Observations

Evaluation data were collected after each module with an open ended questionnaire. Based on the participants' comments and on the trainers' experiences following observations are worth mentioning:

- With regard to the *participants' characteristics*, it was noticed they all possessed basic computer skills. Trainers only very seldom had to support the mere technical use of the computer.
- Almost all participants' questions were formulated from the perspective of the teacher and on a rather instrumental level. Questions like 'How do I…?', 'What is a solution for problem X that I expect to occur?', 'How do I manage the amount of work the use of the platform implies?', etc. were typical, whereas questions that reflected a concern about the learning of students were rare. Similar observations are made in the literature (e.g. Entwistle, 1999; Fox, 1983; Füller, 1969, 1975; Loucks-Horsley, 1996; Van den Berg & Vandenberghe, 1995) about the evolution of teachers' concerns. When confronted with an educational innovation most faculty members are first concerned about the implications of this innovation for themselves *(self-concern)*. In a second phase faculty become more and more concerned about the implementation of the innovation (*task-concern*). Only after going through these two stages, they finally question how this innovation can help their students to learn (*other-concern).*
- It also became clear - in particular during and after the first module - that some participants were forced by their dean, head of department, or programme co-ordinator to use the e-learning platform in their teaching. The question whether they would use the platform was already answered without even taking into account the goals students have to reach.
- The programme did not always seem to fit the participants' needs. Indeed, some participants dropped out, because of the 'beginner's level of the training programme' (n=2). It is presumed that those participants had other concerns about the use of the platform than the ones that were handled during the training.
- With regard to the *design of the learning environment* created in the modules, assignments and discussions among participants created opportunities to utter doubts and uncertainties. For many participants it was a relief to

observe that other faculty members have similar experiences and questions.

The fact that the training was not a once-only initiative had the side effect that participants began to appreciate that implementing a platform is a long term process.

Both the trainers and trainees were enthusiastic about using the participants' questions as an entry for exercises and discussion. The fact that these questions were taken into account in the different modules clearly responded to the immediate needs of (most) participants.

With regard to *the content of the training*, one can notice that as the university purchased an assessment platform beside the e-learning platform, no attention was given to the concept nor the practice of formative evaluation. Faculty members have to follow another training in order to learn to use that platform.

It was remarkable how positively the focus on the instrumental use of the platform was evaluated. The participants appreciated the fact that they were given assignments during the modules for which they actually had to use the platform. The one module in which less attention was paid to the instrumental use of the platform (information module) and in which the participants consequently were more passive, was evaluated less positively than the others.

The intensive instrumental training did not however hinder more didactical questions to be raised by the participants. Especially the usefulness of the different functionalities for their personal educational practice was questioned. The success of the design module might be related to this. The participants clearly appreciated the relatedness of this module with their own educational practice and the guidance they received by the analysis. As the university acquired an assessment platform beside the e-learning platform no attention was given to the concept nor to the practice of formative evaluation. Faculty members have to follow another training in order to learn to use that platform.

While the participants' educational practice was the starting-point of the second module, those practices were much less taken into account in the last two modules. One could raise the hypothesis that this jeopardises the transfer to their actual teaching practice.

One has to notice that some design and educational aspects of the delivery of information and communication were not dealt with in the second (design) module, because these aspects were supposed to be integrated in de last two modules. However, due to a lack of time and to the necessity to learn the participants to use specific functionalities of the platform, the didactical use of those functionalities of the platform was discussed very briefly. More attention was given to the technological implications of different forms of information, of students' pre-attentive processes when consulting information and of ways of keeping the stream of communication manageable for faculty members.

A quick check of the e-courses set up by the participants after the training raises some doubts about the effectiveness of the training. The check revealed that most of them are still designed from a teacher perspective. Especially the delivery of information (as many as available) seemed to be the main goal of the courses: slides, articles, chapters from handbooks, hand-outs, etc. Furthermore, in many cases these courses are additional for students. They have to take them on top of the usual classes. The participants do not seem to integrate the platform in their regular teaching practice. The impact of the training programme on the participants' teaching conceptions seems to have been minimal.

The above observations illustrate that participants were enthusiastic about some aspects of the training. Yet, at the same time, questions can be raised as to what extent the training functioned as a lever for the (further) implementation of university's teaching concept, Guided independent learning. It remains a difficult task, however, to make statements about the quality of training initiatives such as 'The Digital Chalk', because one cannot refer to a clear set of criteria. In order to judge whether the training has been successful, one should at least be able to verify whether it enabled the participants to acquire the competencies that are essential for an innovative use of the platform. Therefor, a detailed analysis of the starting situation of the participants as well as of the desired outcome is essential. The analyses mentioned will be made in the following two paragraphs.

4. Participants' characteristics

In order to have an idea about the situation at the start an inventory of the characteristics of the participants is necessary. Based on the data received with the subscriptions, the experiences during training and the above observations the following inventory can be made:

- The group of staff members that is interested in an e-learning platform is very heterogeneous and this on different aspects:
  - age (estimated between 25 and 55)
  - gender (24 females, 60 males)
  - teaching experience (beginning versus experienced staff members)
  - educational responsibilities (14 teaching assistants, 67 tenured staff members, 1 programme director and 2 deans)
  - studydomain (24 humanities, 22 exact sciences, 35 biomedical, 3 central services)
- The participants have the basic computer skills needed to learn to work with an e-learning platform.
- Many faculty members are mainly concerned about what this innovation means for themselves (self-concerned). There are indications - that need to be further explored - that these faculty members only register for an introduction to the platform. They are at least at that moment not interested in further training.

- Faculty who have been introduced to the platform already and who are interested in training, are mainly concerned about the performance or the instrumental use of the platform and about the management of problems (with students) they expected (task-concerned).
- Most participants have heard about 'Guided independent learning', the university's educational concept, but only some of them are familiar with the meaning of the concept.
- Although there are no empirical data to sustain it, taken into account the questions received before and during the training, most participants seem to adhere to a teacher centred vision on teaching and learning.

5. Analysis of necessary competencies

The ultimate aim of the training is to enable participants to use an e-learning platform in educational situations in a meaningful manner. Such use requires faculty members to have two main competencies:

- to be able to use the platform in an instrumental way; and
- to be able to reflect systematically upon one's own educational practice.

The first competency implies that the faculty member:

- has to be aware of the different functionalities of the platform;
- is able to use the main functions and bullets of the platform;
- understand the structure and operation of this computer application. This implies that the user can anticipate on how the e-course will look like for students and how it will change over time, depending on if and how he/she put time limits on certain functionalities.

The second competency is more complicated. It encompasses a lot of other competencies. Staff members need:

- to have insight in how learning occurs;
- to know and have insight in the teaching concept of the institution one is teaching at;
- to be able to design different educational learning environments; this implies
    - to know and have insight in the different components of a learning environment: students' characteristics, goals, students' learning activities, content, support material, evaluation, context (Dienst Universitair Onderwijs, 2001; Clement, in press);
    - to understand the interdependency of those components;
    - to have insight on the influence of the structure and different forms (symbol systems) of information on the learning of students;
    - to understand the influence of communication on learning;
    - to understand the influence of formative evaluation on learning;
    - to be able to translate the above insights to one's own educational practice in order to facilitate learning;
    - to be able to analyse and (re)design one's own educational practice.

This second competency implies a student centred vision on teaching and learning. Indeed, both the systematic reflection on and the design of learning environments - as described above - demand from faculty that they acknowledge the central place of the students in learning and teaching.

6. Design principles

The above exercises to make an inventory of the characteristics of the participants (start situation) and an analysis of the necessary competencies to use an e-learning platform in a useful manner (desired situation) accentuates the gap between both situations. A first gap relates to the instrumental use of the functions and functionalities of the platform. Bridging this gap however seemed to be rather succesfull with the present design of 'The Digital Chalk'. The assignments that require an actual use by the participants of the e-learning platform can be taken into account for this. Obvious however is that the instrumental use of the platform is an absolutely necessary but not a satisfactory precondition for a meaningful use of the platform. A meaningful use of the platform requires a student centred approach and the most fundamental difference between the start situation and the desired situation seems to be the teaching conceptions of the participants. To bridge this gap, addressing the participants' teaching conceptions is absolutely necessary. Only then the introduction of the e-learning platform (and the training offered) can be a lever for the implementation of a student centred approach - such as the university's concept 'Guided independent learning'.

Changing conceptions however is not an easy thing to do (Tillema, 2000). Ho's (2000) analysis of the prevailing models with regard to conceptual change, demonstrates that there are four critical elements in all programmes for professional development that pursue conceptual change:

- *self-awareness* of one's own teaching conceptions
- *confrontation* between one's own conceptions and practices and between one's own conceptions and conceptions of others.
- *exposure* to better, alternative conceptions

- *commitment building and refreezing.*

Before faculty members will adopt a new conception, this conception has to be intelligible, plausible and fruitful.

As a whole the models for conceptual change leave a rather rational impression. They evoke the idea that implementing the four critical elements will automatically result in conceptual change. However, the statement that a new conception has to be judged intelligible, plausible and fruitful by faculty before they will adopt it, hints at the fact that not only rationality is at stake in a process of change. Taking this and the observations made with regard to 'The Digital Chalk' into account, we want to stress the importance of the participants' *stages of concern*, a more 'emotional' element (Hargreaves, Earl & Moore, 2001; Van den berg & Vandenberghe, 1999). Research regarding those concerns (e.g. Loucks-Horsley, 1996) demonstrates that people only evolve from one stage of concern to another if questions and needs regarding the previous one (self or task) are answered and fulfilled. We therefor claim that for a training programme such as 'The Digital Chalk', participants' concerns should not only function as an indication of the level one should adjust the (starting) level of the training to. These concerns should also be taken into account in order to attain conceptual change.

Consequently two kinds of design principles can be formulated.

In order to provoke conceptual change in the participants during training it is preferable to:

1. offer participants a model or instrument that enables them to distinguish the different components of a learning environment (and their interdependency) and that they can use to analyse their own teaching practice with. This will grade up the awareness of their own teaching conceptions and - on condition that the analyses are shared among participants - will confront them with other conceptions and practices;
2. integrate the trainees' teaching practice into the training. It will allow participants to confront their conceptions to their own actual practice and that of their colleague trainees. Active exercises with regard to this practice will also add to the transfer of what is learned during training to this practice (Korthagen & Kessels, 1999);
3. elaborate the university's educational concept during the training. Not only its meaning should be explained, the design of the training should also be in accordance with the concept (Laga, Elen & Waeytens, 1999). It offers the participants an example of an alternative or even better teaching conception than the one they adhere to;
4. integrate first realisations of participants. Discussing those realisations with other participants and trainers will allow commitment to change and refreezing to grow.

In order to take into account the participants' stages of concern one can identify next principles:

1. Hands-on experience should be scheduled during training. This fulfills direct self- and task-related concerns on an instrumental level.
2. Participants should get an answer to the questions related to their concerns. The training should be adjusted to their specific needs (see also Laga, et.al., 1999). Nevertheless , they have to be challenged during training by providing them information and assistance regarding the next phase (Loucks-Horsley, 1996; Laga, et.al., 1999). This includes for example questioning how learning occurs, discussing postulates with a teachter centred background, confronting participants' own educational practices with examples of teaching strategies designed from a concern about students' learning.
3. In order to be able to respond 'just-in-time' when staff members move from one stage of concerns to another (and thus start questioning other aspects of the educational innovation) individual support should be available at any time and on request (Laga & Elen, 2001).
4. For the same reason, basic materials regarding graphic material, legal aspects, symbol systems, communication, feedback, interaction, etc. should be made available on the platform. This information also has to be explicitly supplied and discussed when participants ask such questions during a training initiative.

7. Conclusion

The above design principles will determine the design of 'The Digital Chalk' 2002-2003. Taken into account the differences in the target group (with regard to their stages of concern) different modules will be offered. The acquisition of the identified necessary competencies will be the overarching objective for the different initiatives. Every initiative will be focused on a specific part of the group of faculty members, characterised with certain concerns and teaching conceptions and will have specific objectives, all in line with the (sub)-objectives identified above. Change of the participants' teaching conceptions will be combined with attention for their stages of concern.

References

Buelens, H., W. Roosels, A. Wils & L. Van Rentergem (in press). *One year E-learning at the K.U.Leuven: an examination of Log-Files*. (Paper to be presented on the European conference on "The New Educational Benefits of ICT in Higher Education" September 2002, Rotterdam, The Netherlands).

Clement, M. (in press). Analyseren van een opleidings-onderdeel, In J. Elen & E. Laga (Eds), *Muizen in het auditorium: ICT in het hoger onderwijs*. [Mouses in the audience: ICT in higher education] Antwerpen: Garant.

Dienst Universitair Onderwijs (2001). *Begeleide zelfstudie: een brochure voor docenten.* [Guided independent learning: a brochure for faculty members]. Leuven: Katholieke Universiteit Leuven.

Elen, J. (in press), The reality of excellence in higher education: The case of guided independent learning at the K.U.Leuven, In E. Decorte (Ed.), *Excellence in higher education.* London: Portland Press.

Entwistle, N. (1999), 'Expanding awareness of learning, studying and teaching', in M. Lacante, and P. De Boeck (Eds.), *Meer kansen creëren in het hoger onderwijs, [Creating more opportunities in higher education],* (pp. 129-151), Diegem: Kluwer.

Fox, D. (1983), 'Personal theories of teaching', *Studies in Higher Education, 8*(2), 151-163.

Hargreaves, A., L. Earl & S. Moore (2001). *Learning to change: teaching beyond subjects and standards*. San Francisco: Jossey-Bass.

Ho, A. S. P. (2000). A conceptual change approach to staff development: a model for programma design. *The international journal for academic development, 5*(1), 30-41.

Korthagen, F.A.J. & J.P.A.M. Kessels (1999). Linking theory and practice: Changing pedagogy of teacher education. *Educational Researcher, 28*(4), 4-17.

Laga, E. & J. Elen (2001). Characteristics of support initiatives to stimulate professional development on ICT. In J. Price, D. Willis, N. Davis, & J. Willis (Eds), *Proceedings of SITE 2001 - March 5-10, 2001*, 692-697. Norfolk, VA: Association for the Advancement of Computing in Education.

Laga, E., J. Elen, & K. Waeytens (1999). Supporting the use of ICT to improve instruction in higher education. In s.e., *Improving University learning and Teaching, 24th international conference- July 5-8, 1999*, pp. 465-470. Brisbane, Australia : Griffith University.

Loucks-Horsley, S. (1996). Professional development for science education: a citical and immediate challenge. In R. Bybee (Ed.) *National standards & the science curriculum.* Dubuque: Kendall/Hunt Publishing co.

Tillema, H.H. (2000). Belief change towards self-directed learning in student teachers: Immersion in practice of reflection on action. *Teaching and Teacher Education, 16*(5-6), 575-591.

Van den Berg, R. & R. Vandenberghe (1999). *Succesvol leiding geven aan onderwijsinnovaties: Investeren in mensen* [Succesful leadership for educational innovations: Invest to people]. Alphen aan den Rijn: Samsom.

Van den Berg, R. & R. Vandenberghe (Eds) (1995). *Wegen van betrokkenheid: Reflecties op onderwijsvernieuwing* [Ways of concerns: Reflections on educational innovation]. Tilburg: Zwijsen.

29 Strategic Planning for Web-based Learning and Teaching at Tampere University of Technology

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Abstract

The purpose of this paper is to discuss the action to support the development of web-based learning and teaching in higher education. A central question is how web-based learning and teaching should be incorporated into the strategic planning of the University.

Keywords: web-based learning and teaching, strategic planning, organisational change.

1. Introduction

The Finnish Virtual University was founded in 2001. The activities of the Virtual University are based on a shared networking model formed by all the Finnish universities. The Finnish Virtual University is one part in the realisation of the visions, specified in the Information strategy for education and research 2000 - 2004 devised by the Finnish Ministry of Education. (http://www.minedu.fi/julkaisut/pdf/tietostrategia/2002hankesuunnitelmat.pdf).

"There will be a virtual university in Finland, operated jointly by several higher education institutions, businesses and research organisations producing and offering internationally competitive educational services of a high standard."

In the year 2001 work to achieve that goal was started by improving the efficiency of networking between universities, by enlarging the activities of the newly formed network, by maintaining the high quality of education and research, by developing the pedagogical skills needed in web-based education, by supporting innovative uses of information and communication technologies in education, and by making the Virtual University an attractive choice. (http://www.minedu.fi/julkaisut/pdf/tietostrategia/2002hankesuunnitelmat.pdf).

Tampere University of Technology (TUT) participated in the consortium of the Finnish Virtual University when it was founded at the beginning of 2001. At the same time a virtual university project was set up at TUT to fulfill locally the strategy of Finnish Virtual University.

Tampere University of Technology employs approximately 1800 persons, 360 of them are assigned to teaching and 660 to assisting teaching and research. The University has approximately 10 500 students and consists of ten departments including 33 institutes and 8 auxiliary institutes.

It is the mission of TUT to provide the most advanced technical university education and conduct research in the field of technology. In addition to basic research in technology and the natural sciences, the importance of applied research and product development is considerable. TUT is known for its excellent co-operation with industry and business life. The Digital Media Institute at TUT is a research center for information technology of international significance.

The purpose of this paper is to discuss the strategic planning of web based learning and teaching at university level in Finland. We also address the need to organisational change and change in the line of action at Tampere University of Technology. A central question is how web-based learning and teaching should be incorporated into the strategic planning of the University.

1.1. Strategic planning

According to the Murdoch University (Anderson et al. 1999) “Strategic planning aims to direct the activities of an organization towards the attainment of strategic objectives. It is concerned with the setting of objectives, the development of procedures for implementing the objectives and monitoring the extent to which they can be achieved.”

Various approaches and emphases underlie the strategy process for web-based teaching. What strategies have in common, however, is that they pursue better learning for students. Many researchers stress the importance of having a strategy for web-based teaching.

According to Cornford (2001) attempts to build virtual university from bottom-up, course-by-course, without reconstructing the basic structures of the university prone to failure.

Bartolic-Zlomislic & Bates (2002) point out that the economics of online courses require up-front investment, development of business plans, project management, financial and technical support, ... professionalism and a team approach to course development and delivery. Whether or not web-based learning can be considerable successful and worth the investment will largely depend on the value and goals of organisation.

Kaufmann, Watkins and Guerra (2001) note that those that will be successful in making valuable contribution to learners and society will be those that focus on offering useful

learning opportunities. After all, does it really add any value to an organization (or learners) to provide educational opportunities at a time and location convenient to them if the opportunity provides no value in terms of assisting them, their organizations and/or our communities on achieving defined and useful goals. Many organizations are now offering high-tech distance learning, yet few have focused on comparable resources on the basic elements of sound instructional and performance system design.

The ten broad principles below (which are primarily based on Argyris (1990) and Kotter (1996) and presented by Higher Education Funding Council for England, Centre for Higher Education Practice, The Open University (HEFCE 99/95) (1999)) we have found useful in our strategy process.

Principle 1: Develop vision and strategy
Principle 2: Establish a sense of necessity
Principle 3: Create a guiding coalition
Principle 4: Communicate widely and continuously
Principle 5: Be prepared to listen
Principle 6: Develop a shared commitment
Principle 7: Generate some early success
Principle 8: Realize when game playing is going on and deal with it
Principle 9: Consolidate and embed the gains
Principle 10: Do not rest on your laurels

Below we present TUT strategy planning and examine how it reiterates the principles named above.

2. Strategic planning to support web-based learning and teaching at Tampere University of Technology (TUT)

It is eminently appropriate to develop infrastructure at TUT which enhances opportunities for web-based learning and teaching. In addition to infrastructure web-based teaching entails special features with regard to teaching methods and content production. The Ministry of Education and the Finnish Virtual University national strategies moreover set the border conditions for strategies in IT for teaching purposes. The experiences of the first year have shown how much organizational culture determines the focus of strategy work. What is of interest in organizational change is to identify those key areas through which new perspectives and modes of operation can be rooted in the organization.

As a basis for strategy work at TUT a SWOT analysis was conducted on web-based teaching, a survey of the use of IT in teaching and a study was made, one aim of which was to ascertain the valued added generated by web-based learning. In the light of these data a target situation was created and the measures necessary in order to achieve this.

2.1. Virtual University of Tampere University of Technology

The Virtual University of Tampere University of Technology (VUTUT) was founded at the beginning of 2001. The Virtual University of TUT concentrates especially on developing methods and contents for web-based education to meet the demands of the technical sciences. The project`s main goals are to improve the quality of teaching and to facilitate students' and teachers' everyday routines with network-based services. The object is to utilize research findings and technology in the field of web-based teaching.

As Cornford (2002) has pointed out it is important to see the virtual university project as extending across the whole of university. The virtual university is not just a matter of flexible teaching and learning systems but extends into administration, students recruitment, research networks and library systems and so on. In TUT these crucial interest groups have been included in the implementation of the virtual university right from the planning stage. The Rector appointed a steering group for the Virtual University Project composed of experts in data management, teaching services, library and the departments. At TUT there is expertise in web-based teaching from the perspective of their respective disciplines in the Hypermedia Laboratory (Ruokamo & Pohjolainen 2000, 1998), the Computer Science Laboratory and the Virtual Reality Center.

The annual budget of the project is 420,000 Euros, which covers the startup funding of the pilot project and the activities of the support and development team (the VU Team). Since 2001 there have been 47 departmentally implemented pilot projects in web-based teaching in VUTUT. These pilots have concerned research, development and content production.

The activities of VUTUT are web-based. The aim is to include actors from all departments in the development work. To achieve this some 10,000 Euro from the annual budget of the virtual university has been allocated to several pilot projects in order to get them up and running.

2.2. The SWOT analysis

In 2001 as a point of departure for the development of web-based teaching VUTUT considered the strengths, weaknesses, opportunities and threats associated with web-based teaching and learning.

The SWOT analysis was used to give a direction to virtual university activity. It was decided to remedy the threat posed by lack of strategy in such a way that the strategy points traditionally updated at TUT would also take account of the new demands presented by web-based teaching.

STRENGTHS	WEAKNESSES
- High level of technical expertise - Infrastructure: new, innovative technologies, capability and knowhow to develop tools - Interest and activity in the personnel for the production of - Homogeneous web-based course material background of students - Good IT skills of students	- Different practices with accreditation at different universities - Slight experience of utilizing web-based teaching -"Not Invented Here" attitude - Teaching culture: teaching traditionally teacher-centered, not teamwork - Net pedagogy not mastered - Lack of resources, no teacher to be paid - Inability to perceive the value added through the web-based teaching (e.g. diversity in teaching)
OPPORTUNITIES	**THREATS**
- Technical development scope for infrastructure - Electronic personnel identification – development work - Partnership of responsibilities and specialization between universities - Including distance learners to increase group size of small courses - Increasing students' options - Flexible participation in studies, studying more effective - Utilization of material produced elsewhere - Production of high quality material	- Development work lacks sense of purpose, lack of strategy - Demand for web-based teaching and learning partly unknown - Weakness in information transfer may lead to best practices in web-based teaching remaining isolated experiments - Lack of resources, tutoring costs frequently forgotten, enthusiasm at risk of sticking at the first wave - Teachers confronted with totally new and extensive demands

Table 1: SWOT analysis of web-based learning at Tampere University of Technology

2.3. Utilization of information nets and computers in teaching 2001

In 2001 it was the turn of information management strategy work, which included a workgroup composed of experts in TUT web-based teaching. In autumn 2001 this work group took stock of the situation with regard to the use of IT in teaching at TUT. This survey was conducted by means of a net questionnaire sent to all course in all departments of TUT. The response data cover 41% (544 courses) of the total offered in 2001 (Silius et al. 2002).

According to the survey in 2001 computers was used in TUT in teaching principally for functions pertaining to the teaching arrangements (including information dissemination, distribution of teaching material, enrolment, distribution and return of tasks, monitoring points gained, tools for course administration). In approximately one quarter of courses there was a web-based learning environment behind a password. Teaching actually mentored in the web by the teacher was relatively rare in relation to all courses offered.

On the other hand the web was utilised for purposes of collecting feedback with a view to improving teaching and also for providing feedback on practice assignments completed by students. There were no applications in use for. support in learning or knowledge structuring. Throughout the institution the teaching material distributed over the web was mostly lecture handouts in electronic form. There were almost no teaching materials in use which had been specifically designed for use over the web, the exception being those courses implemented specifically as pilots for the Virtual University of TUT.

The following table presents the utilization of the web in the organization of teaching.

Use made of the web	(%) of responses
Information on course homepages	70%
Distribution channel for course material	70%
Submitting assignments to teacher	50%
Course administration applications	60%
Monitoring points for partial completion	50%
Giving feedback for improvement of course or teaching	30%

Table 2: Utilization of web in organizing teaching.

The survey revealed that at TUT there were only under one hundred courses on which the share of web-based learning was over 40% of the studying or teaching mode. Moreover, web-based teaching still contained a small amount of learning discussion connected to the subject area taught. The survey

indicated that TUT was using no much applications supporting learning and knowledge structuring to support net study.

Table 3 presents utilisation of the web in teaching.

Ways of utilizing the web in teaching	(%) of responses
Supervised web discussion	10%
Spontaneous web discussion	20%
Teachers giving students feedback on the web	50%
Web tutoring, verbal feedback on practice assignments	60%

Table 3: Use of the web in teaching .

Teaching material actually designed for use on the web was used by less than one third of respondents. Less than 20% reported using commercially available web material. On the other hand some 60% of respondents reported using free-of-charge material freely available on the web.

2.4. Students in web-based courses at TUT

To obtain more information about good practices on web-based learning in technical sciences various virtual university pilot courses were evaluated. Especially students` background information and their expectations of added value on web-based learning were studied. The majority of the students were at the beginning of their studies and usually they did not have any experiences of web-based learning. In their opinion they had been succeeded quite well in earlier studies. They live near the campus and they were going to study a web-based course at home or in the computer classroom at the University of Technology. Of these students 40% were working while studying and 30% of them studied during the working day at their workplace. Students reported that they could use word processing software, program helps, email, web-browser and install plug-ins but they did not know news and chat as well (Silius 2002b, Forsblom & Silius 2002).

Those students who were working while studying were in special need of flexibility in their study schedules. They mentioned that participation in courses organised only at campus were inconvenient for the most of them. For those students the opportunity to study via the web was the value added. In the situations where course schedules overlapped or courses were full the web-based teaching and learning were reported to be value added.

Access to course material was also mentioned as an added value. In their opinion using the web in learning and teaching students are able to automate their everyday routines and routine tasks (like the delivery of teaching materials, enrolment in exercise groups or courses etc.).

Students expected that web-based teaching and learning would improve the quality of teaching materials. They hoped that teaching materials would be illustrated, for example, by simulation, modelling and visualisation. The students expected that they would get more just-on-time feedback and support for their study in web-based teaching.

The students expected that their learning to learn skills and self-direction skills would improve in web-based learning and also that open learning environment and tutoring practices would support the development of those skills.

2.5. Development of infrastructure

Developing web-based teaching requires sufficient infrastructure: information nets computers, AV equipment software and premises. At TUT the development of infrastructure supporting web teaching is taking a favourable direction.

On the TUT campus staff and students can use TUT information systems and the Internet on TUT computers. The personnel and students also have the option of contact to the TUT campus net from home. The student dormitories have broadband connections to the campus network.

The speed of the campus network is 1GBit/s and it is connected to Finnish university network (Funet) with a 155 Mbit/s ATM connection. In 2003 it is planned to update the connection to 1 GBit/s and to add more wireless local area networks (WLANs) to the campus area. WLANs will be set up to all major lecturing facilities, vestibules and conference rooms. These solutions represent an effort to achieve flexibility for web and computer-based teaching and studying. An effort will be made to ensure flexibility in studies through portable laptop computers to be loaned out from the Library and intended for use on campus.

In addition to these computers students have round the clock access to 295 computers located in nine terminal classrooms maintained by the library and in the library building proper. The computer classrooms are also equipped with additional equipment such as scanners and workstations with recordable CD:s. The classrooms are equipped with software for the needs of the mainstream undergraduate. Several classrooms are to be equipped with the equipment and software needed specifically by distant students. In addition to these generally maintained computer classrooms TUT has a total of 33 microcomputer classrooms maintained by the various departments. These are used for departmental teaching.

TUT is implementing a portal including student and teacher interface. The TUT portal will enhance the functionality of the currently extensive TUT intranet pages which serve as a channel for information dissemination.

The portal includes student and teacher interface. The new student interface includes enrolment at the University of Technology, for courses and examinations, an application for monitoring studies completed, application for providing feedback and for planning studies. Within the limits of the

opportunities available these services will be developed for mobile terminals. The teacher interface includes a calendar, an application for processing feedback, options for compiling students' background information for purposes of course profiling, an application for course management, and application for updating the study guide tools for creating course homepages, an application for reservations and information on teaching equipment in various spaces, management of studies taken and registration application and an application for updating the study guide.

2.6. Developmental goals for web teaching

Web-based teaching is to be developed at TUT in such a way that it both supports teaching given on campus and distance learning by TUT students and students of other universities and educational organizations. Due to work, pace of studies and life situation a considerable proportion of TUT's own students can at time be compared to ODL students proper. The methods developed for them also support such on-campus students for whom there was no room on courses or whose schedules involve timetable clashes.

Effort will be invested in making teaching more diverse by offering more opportunities to participate in multi-disciplinary courses between various organizations. It has been deemed important to offer such courses in the portal of Finnish Virtual University.

According to the information management strategy the target situation for TUT web-based teaching in 2005 is as follows:

Organization of teaching through IT:

All TUT courses will have uniform homepages providing the information necessary for completing the course and access to teaching materials. The courses will further have the use of electronic means of communication such as newsgroups and e-mail programmes. In addition, there will be, in many courses, standardized learning platforms that are tailored to the needs of courses. The web will be used to disseminate information on matters to be updated. The information dissemination practices, course accreditability, practices for approving and registering courses have been designed to serve ODL students, too.

Developing teaching through IT:

Application which support the learning process such as simulation, learning games computer-aided interactive tasks and mind-map applications will be used on numerous courses. Some 50% of courses will utilize the web to promote monitoring of studies while 10% will use the web in a pre-planned qualitative manner to direct learning. Students will be able to utilize the web in some 20% of courses in taking mock examinations and diagnostic questions. Moreover, the tutoring of web-based teaching modules will be designed to direct the progress of ODL students.

Quantitative goal:

The goal is that in 2005 on average every department will offer one course within TUT top expertise through the portal of the Finnish Virtual University. These courses will target some three hundred of TUT's external ODL students. Likewise some three hundred TUT students would complete other universities courses through the portal of Finnish Virtual University. Another type of ODL student at which web-based studies are targeted consists of TUT's own students, Open University students and the personnel of companies.

2.7. Key action points

In addition to development of infrastucture and software it has been desided on the Virtual University of TUT to develop the following measures for web-based learning and teaching:

- Education
- Support
- Courseware production
- Research
- National co-operation

2.7.1. Education and support

Support and training in producing web-based teaching have been organized on the Virtual University Project, which employs four support persons for web-based teaching (so called VU Team). They arrange training in content production and implementation, pedagogy, teaching methods and learning styles, value added in web-based teaching, graphic design, techniques in web-based teaching and matters pertaining to copyright. In addition to providing training these support persons assist the departments in the design and implementation of web-based teaching projects. Once a month some 20 people currently producing web-based courses convene at a meeting where topical questions are addressed.

Producing good quality web-base teaching materials requires a production team. The resources and skills of the individual teacher are not sufficient for the production of good quality and interactive hypermedia material. Thus in 2002 support measures and training were initiated in the departments, likewise the activities of the Virtual University Workshop. This is a working space earmarked for TUT teachers and the digital implementation of web-based teaching content based on "do-it-yourself" activity. The workshop is a low-threshold advice and working point open to all. In the workshop, in addition to equipment and software, supervision is provided by the support persons in digital content production and pedagogy, likewise design assistance in material production, structure and design of graphic appearance, assessment of usability, hints on tools and net publishing and supervision for web-based study.

2.7.2. Courseware production

A considerable part of the TUT virtual university annual budget has been distributed for the implementation of the departments' pilot projects. This constitutes an effort to support above all the departments' content production, when teaching materials are produced and teaching methods using IT and appropriate to the field of technology are developed and tested. This has been in the nature of startup funding in addition to which other funds of the departments have been invested. In the last two years of the project a total of 33 such content production projects have been implemented in various departments.

2.7.3. Research and development

In addition to content production, TUT research and development work on web-based teaching is conducted both in the departments and the VU Team.

The research in the departments focuses on the development and evaluation of learning environment platforms, the evaluation of existing web tools developed in TUT and further development, likewise virtual reality techniques and the use of mobile terminals.

VU-team concentrates to study the best practises and the value added of web based teaching and learning in the field of technical sciences

For instance in order to obtain more information about good web-based learning practices in technical sciences eleven teaching experiments were also evaluated last autumn. All good practices were collected to web site http://www.virtuaaliyliopisto.tut.fi/ verkkopakki (Silius et al. 2002). The evaluation process consists of pedagogical and usability sections (see Albion 1999, Leinonen et al. 2002, Quinn 1996, Soloway et al. 1996, Squires 1997, Squires & Preece 1999, Tergan 1998). The researchers paid attention to how the learning context and pedagogical appropriateness were taken into account in user interface, tools, tasks, quizzes and in planning, designing and implementation of content production.

In order to successfully develop web-based learning and teaching the Hypermedia Laboratory and the VU Team of TUT are doing joint research to clarify the best practces and the conception of added value by investigating the advantages and disadvantages of web-based learning in various contexts. The data will be collected in the pilots of the Hypermedia Laboratory and the Virtual University of TUT.

2.7.4. National co-operation

TUT is coordinating two national network projects in the Finnish Virtual University. The themes of the projects are mathematical modelling and open source courseware, correspondingly. Many universities participate in the national network projects and the teachers of these universities are responsible for certain parts of the courses produced. Studens from different universities can take the courses. Web-based learning methods, content production and administrative measures to support distance learning will be developed in the national network projects.

3. Discussion and Conclusions

We discussed in this paper action needed to support the development of web-based learning and teaching at the Tampere University of Technology in co-operation with the Finnish Virtual University. Special focus were on strategic issues of development of web-based learning and teaching. The experience from the first year, especially that from web-based courses at TUT demonstrates that there is a need for organisational change in the University. The whole organization should participate in the planning and implementation process in order to enable the change.

The experiences have shown how much organizational culture determines the focus of strategy work. What is of interest in organizational change is to identify those key areas through which new perspectives and modes of operation can be rooted in the organization. We therefore take the view that although developing the utilization of IT is included in many TUT strategies, it is necessary to formulate a strategy specifically for the development of IT for the institution.

Of the forgoing the ten principles evinced by Argyris (1990) and Kotter (1996), "Develop vision and strategy" are extremely important from the perspective that the strategy should be a combined effort on the part of various actors in the university. This presents the university with a challenge, as web-based teaching on a wide scale is very new and strategy work has principles of its own. Areas in which traditionally separate strategies have been formulated come very close to ICT strategy for application in teaching, but in these not much emphasis has been given to the utilization of ICT in teaching. The strategy for the utilization of ICT in teaching from the perspective of web-based teaching dovetails with subareas including information management strategy, information strategy and strategy for the development of teaching. In addition to these there is a new area not catered for by the established units and for which no strategic plan has earlier been formulated. This demands new practices and change in the university organization.

The second of the principles evinced by Argyris (1990) and Kotter (1996) "Establish a sense of necessity" is shown to be important especially from the perspective of commitment. It has been found at TUT that commitment to research work as part of the support and development work for web-based teaching helps to yield strategically important information for the organization. It would moreover appear that in such a transitional phase the research communities rely on those units which themselves produce research. Securing a commitment from the departments and teachers of TUT depends on the benefits web-based teaching has to offer. Benefits are seen to include improved efficiency in the operations of the departments, flexibility and diversity in

studies, student satisfaction and automation of study and study routines through IT.

In organizing the Virtual University Project an effort was made to secure the respective commitments of the key units, such as data management, student services, library and departments for the development of web-based teaching. Principle number three "Create a guiding coalition" (Argyris (1990) and Kotter (1996)) was ensured by establishing a steering group composed of expert representatives from the aforementioned areas to delineate the activities of TUT web-based teaching.

Argyris (1990) and Kotter (1996) address the importance of creating interactivity and shared understanding. To enhance dialogue and listening there is a need in the university for different forums at different levels to achieve a shared understanding. It is important that administrative, pedagogical and course production related themes be debated in seminars targeted at the entire personnel, in pilot meetings, meetings of decision-makers and above all at student events.

The principle of "Generate some early success" (Argyris 1990, Kotter 1996) helps new actors to join in the discussion necessary for development. At TUT the courses of several departments selected as pilots for the first year were courses which already had some experience of web-based teaching. During the first year these courses were presented at various meetings intended for the personnel. Furthermore, pages presenting good practices were compiled from these for the homepages of the Virtual University.

In conclusion it may be stated that to strengthen net activity and co-ordinate the development of web-based teaching there is a need for a permanent unit to take care of research, training and support activities pertaining to web-based teaching in co-operation with other actors of the university. Establishing such an organization demands organizational change and a shared vision of the future of web-based teaching.

References

Anderson, D., Johnson, R. & Milligan, B. (1999). Strategic Planning inAustralian Universities. http://www.dest.gov.au/archive/highered/eippubs/99-1/report.pdf (checked up 2.7.2002)

Albion, P.R. (1999). Heuristic evaluation of educational multimedia: from theory to practice. http://www.usq.edu.au/users/albion/papers/ascilite99.html (checked up 2.7.2002)

Bartolic-Zlomislic. S. & Bates, A.W. (2002). Investing in Online Learning: Potential Benefits and Limitations. http://bates.cstudies.ubc.ca/investing.html (checked up 2.7.2002)

Cornford, J. (2001). The Virtual University is… the University Made Concrete? http://www.ncl.ac.uk/curds/vuniv/JCLA.pdf (check up 2.7.2002)

Forsblom, N. & Silius, K. 2002. What is the Added Value of Web-based Learning and Teaching? The Case Tampere University of Technology. The New Educational Benefits of ICT in Higher Education Conference. Rotterdam, the Netherlands, September 2-4-, 2002.

HEFCE 99/95 (1999). Institutional learning and teaching strategies. A guide to good practice. http://www.hefce.ac.uk/pubs/hefce/1999/99_55.htm

Kaufmann, R., Watkins, R. & Querra, I. (2001). The future of distance learning. Finding and sustaining usefull results. Educational Technology, vol 41 (3).

Koulutuksen ja tutkimuksen tietostrategia 2000-2004: Hankesuunnitelmat 2002. Opetusministeriö. Koulutus- ja tiedepolitiikanosasto. http://www.minedu.fi/julkaisut/pdf/tietostrategia/2002hankesuunnitelmat.pdf (checked up 2.7.2002)

Leinonen, T. et al. (2002). Collaborative discovering of key ideas in knowledge building. Computer Support for Collaborative Learning (CSCL 2002) Conference. Boulder, Colorado, USA, January 7-11, 2002.

Quinn, C. N. 1996. Pragmatic Evaluation: Lessons from Usability. http://www.ascilite.org.au/conferences/adelaide96/papers/18.html (checked up 2.7.2002)

Ruokamo H., Pohjolainen S., 2000. Distance learning in a multimedia networks project: main results. British Journal of Educational Technology, Vol 31, No 2, 2000, 117-125.

Ruokamo H., Pohjolainen S.,1998. Pedagogical Principles for Evaluation of Hypermedia Based Learing Environments in Mathematics, Journal for Universal Computer Science, 4 (3), 1988, pp. 292-307, http://www.iicm.edu/jucs.

Silius K. (2002a). Digitaalisen tieto- ja viestintätekniikan hyödyntäminen opetuskäytössä vuonna 2001 TTKK:lla. http://www.virtuaaliyliopisto.tut.fi/verkkopakki/case/opetuksessa01.php

Silius K. (2002b).Verkko-opetuksen hyödyt. http://www.virtuaaliyliopisto.tut.fi/verkkopakki/case/hyodyt.php

Silius, K., Tervakari, A-M. & Kaartokallio, H. (2002). Verkkopakki. http://www.virtuaaliyliopisto.tut.fi/ verkkopakki/

Soloway, E. et al. (1996). Learning theories in Practice: case Studies of Learned-Centered Design. Computer-Human Interaction. CHI'96. Electronic proceedings. http://info.acm.org/sigchi/chi96/proceedings/papers/Soloway/ es-txt.htm (checked up 2.7.2002)

Squires, D. (1997). An heuristic approach to the evaluation of educational multimedia software. Computer Assisted Learning Conference, University of Exeter. http://www.media.uwe.ac.uk/masoud/cal-97/papers/squires.htm (checked up 2.7.2002)

Squires, D. & Preece, J. (1999). Predicting Quality in Educational Software: Evaluating for learning, usability and synenergy between them. http://www.ifsm.umbc.edu/communities/Heur2.html (checked up 2.7.2002)

Tergan, S-O. (1998). Checklists for the evaluation of educational software. Critical review and prosects. Innovations in Education and Training International, 35 (1), 9-20.

30 ICT fans the flames of learning: University of Groningen introduces Nestor

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Abstract

In the spring of 2000, the University of Groningen (RUG) launched a university-wide ICT in Education programme: the electronic classroom (EC). In this case that means a kind of distributed learning in which IT-opportunities were mixed with traditional classroom management. Now the pilot year has ended successfully. In the academic year 2000-2001, more than 8,500 students (roughly half of the total number of students at the RUG), and 500 teaching staff made use of Nestor – as the EC has now been christened. This article describes how the EC was implemented.

The article focusses on the project organisation, choosing the learning platform and the phases in the project.

One of the main conclusions we can draw from the project is that the introduction of new ICT facilities for teachers is more successful if they can be involved in a hands-on capacity at an early stage.

Another main conclusion is that the project is a costly one. Now it is completed almost Euro 1.5 million will have been spent over a period of eighteen months.

The RUG has taken an important first step by introducing Nestor but there is still a great deal to be done:

1. Prelude

On April 28, 2000, the university's Executive Board announced the EC-project to all departments. Prior to this announcement, bilateral discussions had been held with all eleven departments. The department boards, either independently or jointly with other departments, submitted several grant applications for ICT in Education programmes. The outcome of the bilateral discussions was no less than the launch of a university-wide EC project, with total funding of NLG 4 million (appr. USD 1.5 million) provided by the Executive Board and departments, and a project strategy based on the active participation of all departments at management and staff levels. In short, the plan required sufficient management support, people and resources to achieve the desired objective: the implementation of a university-wide electronic classroom as of 1 September 2001. The project organisation was outlined in the project plan, and is shown in Figure 1.

The project organisation is based on the following principles:

- Active involvement of departments at management and staff levels. All proposals relating to the project are only to be submitted to the EC steering group after approval at the regular meetings of departmental contact persons, who then inform their department managers.
- Establishing in advance which expertise, tasks, interests and responsibilities are involved during and after the project, and making maximum use of the knowledge and experience of existing divisions within the university. After all, there is a strong possibility that, in one way or another, these organisations will have to take on these tasks once the project phase has ended. Thus there are two reasons for involving them during the development phase: their expertise and creating a support base within the university for the project – something that should not be underestimated.
- Active involvement of teaching staff and students in the main project decision-making process. Although the organisation and structure of the project are crucial, it is provisional in terms of the ultimate aim: effective use of ICT in education by those teachers and students.

The project is based on an implicit decision to implement a single, university-wide system. This would seem an obvious starting point because it is great fun for teachers and students who do not confine themselves to their own disciplines. It will also lead to greater efficiency with regard to technical infrastructure and exchanging information with other institutions. Nevertheless, many institutions have chosen not to go down this path and, who knows, they may be right!

2. 'Dry run' during the summer

It is obvious that a project must have a sound structure; this is the first step to achieving results. But what is the next step? Two main aspects were realised in the summer of 2000, the project organisation and the selection of the learning platform.

With regard to the first aspect: proposals on training, technology, etc. were put forward by the relevant EC working group (see organizational chart). The proposals were discussed at the regular meetings attended by departmental contact persons, who were also members of the working groups. The EC steering group finally approved the project proposals and allocated the requested budget. This meant that

the departments were actively involved in the project organisation and, on the basis of their overall picture, could help to bite the bullet at various stages in the project. This whole process required active support, which was provided by ECCOO (the Centre of Expertise for Computer-aided Education) with regard to substance and procedures.

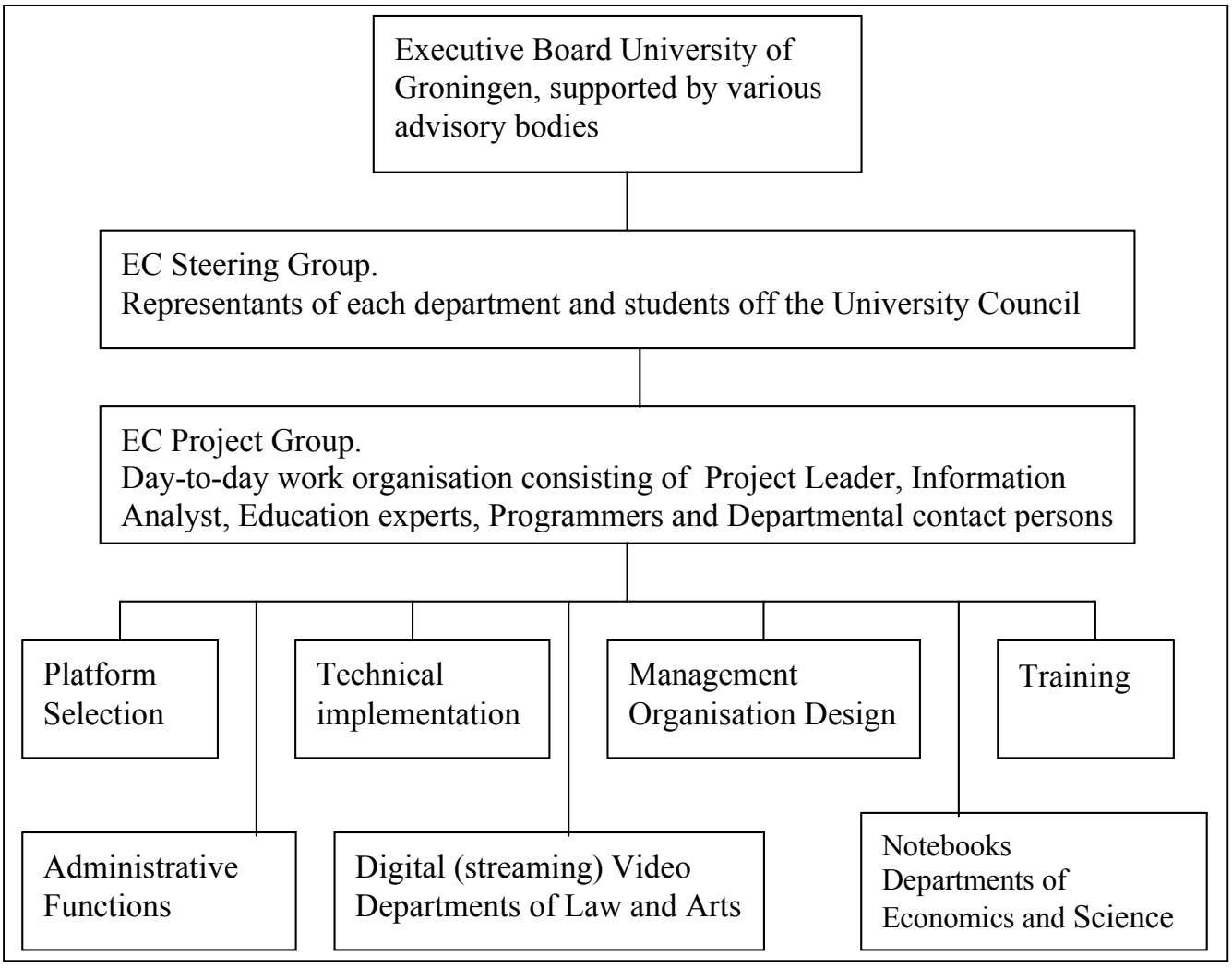

Figure 1. Organizational Chart : RUG electronic classroom

The second aspect was even more interesting: choosing the learning platform for the RUG. To make the selection process easier, a shortlist was compiled from the many alternatives. On the shortlist were Blackboard, Intralearn and WebCT. These three systems fulfilled the requirements for the platform, namely a tangible product already used in education; an education-oriented platform that was compatible with the RUG's technical infrastructure; suitable for use on a large scale, etc. Each shortlisted system was put through an intensive selection procedure. In mid-July 2000, six evaluation sessions were held with teaching staff and students. The suppliers' instructors briefly explained each system, which participants then tested. This produced useful results in terms of learning aspects, user-friendliness, and other aspects relevant for teachers and students. At the end of July, a six-strong project delegation left for the US and Canada, where they visited the system suppliers and universities using the systems. They collected a great deal of information and, on the basis of this, Blackboard 5 level3 was chosen. The EC steering group announced its decision on August 22, 2000 and one week later Simon Kuipers, Chairman of the Executive Board, signed the contract with Blackboard Inc..

3. Term 1: the pioneering phase

After a week of hard work by Computing Centre staff, Blackboard went on-line in the second week of term 1. In the meantime, the department contact persons went in search of 'pioneers': teaching staff who were willing to introduce

Blackboard into their teaching right away. The search was successful. In each department there was at least one person prepared to do this. The electronic classroom was thus launched with a total of 18 participating lecturers and 500 students. The aim was to extend the user group by means of the oil-slick model in the second and third terms to 50 resp. 250 lecturers, and 2,500 resp. 6,000 students. The lecturers were not simply left to fend for themselves with the system; ECCOO provided individual supervision and they received training (provided at that stage by Blackboard). During the first term, an in-house Blackboard course was developed that covered not only the functions of the system, but also didactic aspects such as using the system in a practical learning situation. The main advantage of this approach was that defects could be identified early on and small scale modifications made. For example, it turned out that the software uses a lot of memory. The Computing Centre devised what has now become known among other user groups as the '*Groningen patch'*. The Learning Platform Selection working group was then disbanded as it had completed its task.

4. Term 2: first expansion

The main question was, of course, is Blackboard catching on? Are the pioneers and the students enthusiastic? The answer to both questions was affirmative. This was confirmed by the fact that, in the second term, a total of 70 lecturers and 2,500 students from all departments were using Blackboard. In the second term, the expansion involved other aspects such as designing and purchasing robust hardware (web and file servers), setting up a helpdesk manned by initially four teaching assistants, and setting up support for lecturers within the departments. The hard work had now begun for the Management Organisation Design and Technical Implementation working groups. Whereas in the first term the names of Blackboard users were entered by hand, in the second term this was done by means of a link to ProgRESS-WWW, an Internet application developed and used by the RUG allowing, for example, students to register for courses and exams.

The work of the Administrative Functions working group (objective: integration with other administrative systems) and the Technology working group resulted in a 10-page document listing wishes and requirements, questions and technical defects relating to the Blackboard software. This document was sent to a number of Dutch universities that use Blackboard on an institution-wide basis, or plan to do so. A mini-symposium was held at Groningen with representatives from the University of Amsterdam (UvA), Free University of Amsterdam (VU), University of Nijmegen (KUN), Tilburg University (KUB) and Erasmus University Rotterdam (EUR). The Delft University of Technology was unable to attend. The document referred to above was discussed with Blackboard in Washington. This resulted in a great deal of useful information and contacts. However, this did not mean that all our wishes could be met, e.g. full facilities for working with foreign language fonts or formulas. The program is now so extensive that making modifications is a major undertaking. Within this context, Blackboard's absolute priority is to publish new versions whose content has been decided long ago. In fact, there is no time for interim software modifications. Blackboard release 5.5 is now on the market, and has been in use at the RUG since September 1, 2001. The new release offers teaching staff some useful extra facilities, and links to other administrative systems have been facilitated.

The pilot year was officially launched in December 2000 with an EC conference. The name of the electronic classroom – Nestor – was revealed, and the law student who came up with the name was presented with an electronic notebook. Nestor was an elderly learned counsellor from Greek mythology. Nestor balances the centuries-long history of the University of Groningen against fast, state-of-the-art ICT. The original purpose of Nestor was also emphasized: a student jury awarded Professor Gisela Redekers NLG 5,000 for the most interesting application of Nestor in teaching.

5. Term 3: second expansion

Towards the end of the project year we began to wonder whether the project would really succeed. Is Nestor an ICT & Education development with a future? In the third term we were able to answer these questions with a definite 'yes'. The number of lecturers using Nestor had risen to 500, and the number of users to 8,500 (including approx. 8,000 students) - far exceeding the target of 6,000. In addition, the support department was increased to seven teaching assistants in the third term. The in-house Blackboard training was repeated and adapted to the individual needs of the departments.

The Management Organisation Design working group completed its work. The EC steering group approved of the plan for a Nestor management structure, consisting of a combination of (a) reinforcement of the department support for ICT in Education by means of links to existing facilities, and (b) a Centre of Expertise for matters such as technical management, application management, educational expertise, innovation and institution co-ordination. This involves no less than 20 FTEs!

The RUG has not lost sight of Nestor's original purpose, namely to make a useful contribution to teaching. This was the theme of the second Nestor conference held on June 28, 2001, where Ed d'Hondt, president of the VSNU (Association of Dutch Universities) called for more resources for the irreversible trend of ICT in Education. In the third term, COWOG (Groningen Centre for Research into Higher Education) researched the use of Nestor by students and lecturers for teaching.

6. Epilogue

Nestor is now a household name at the University of Groningen. In itself this is not surprising, since more than

half of the students and a large number of staff at the university have been using Nestor. The number of users is still increasing since September 1, 2001 when approximately 12,000 students and lecturers had been using Nestor. This figure includes first-years students who will use Nestor for standard study purposes, albeit not 100% in all subjects, and the majority of students beyond the first year. The Executive Board, in consultation with the departments, decided to fund the plan for the temporary Nestor Management Structure for the years 2002 and 2003. After these two learning years, the expertise and management structure should be fully embedded in the university.

Does that mean that everything is done and dusted? No, certainly not. The RUG has taken an important first step by introducing Nestor but there is still a great deal to be done:

Nestor's added value for teaching will have to be developed further in co-operation with lecturers and students. The importance of achieving a perfect balance between real and virtual interaction lies not so much in a single ideal solution – which does not really exist – but primarily in achieving pro-active and appropriate use of Nestor's facilities in teaching.

New educational applications need to be found for information and communication technology**.** Nestor comprises more than the central learning platform, Blackboard. In 2002, a pilot project will be launched for Cytrix technology, which enables network software to be launched remotely via the Internet. This means, for example, that a simulation program linked to a specific computer/server can be made available to students in Nestor, without time or location restrictions.

Administrative efficiency needs to be improved. In 2003, the current electronic RUG course catalogue will be incorporated in Nestor. This is only one example of how existing systems will be either incorporated into or linked to Nestor in the near future.

Bottlenecks will have to be removed, e.g. ICT facilities for students, training for large numbers of teaching staff, availability of content and the everlasting problem of intellectual property rights.

7. Final word

In this paper we have outlined the University of Groningen's electronic classroom project. Of course, the project involved much more than this, and readers who are interested in the juicy details are welcome to pay us a visit. The first conclusion we can draw from the project is that the introduction of new ICT facilities for teachers is more successful if they can be involved in a hands-on capacity at an early stage. During the course of the project, it has been proven that Blackboard was the best choice, despite its shortcomings. Information about the software bugs can be found at the Nestor site. Teaching staff are now also familiar with the program's limitations, for example the test facilities. The program nevertheless offers enough facilities to be enthusiastic about, and it is important to communicate honestly with teachers and students about both its benefits and drawbacks.

The second conclusion is that the project is a costly one. When it is completed at the end of this year, almost USD 1.5 million will have been spent over a period of eighteen months. The Nestor management structure was launched on January 1, 2002, and will cost approximately USD 1 million per year – and this only covers the visible costs. The figure does not include invisible costs incurred mainly within the departments by lecturers and support staff who have to adapt their courses, or the cost of training large groups of staff, or the ICT infrastructure for teachers and students. Internet access is not yet fully available to all students. Students who do have Internet access have to bear the costs themselves**.** In contrary to the USA, local calls are not free of charge in Europe**.** Food for thought for the Dutch Ministry of Education, Culture and Science.

31 The Development of Informatics in University of Pécs.

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Abstract

The University of Pécs has 9 faculties, nearly 28 thousand students and 1,500 professors. Its capacity to offer the complete range of domestic higher education possibilities with its 9 faculties provides the unique cultural positions of the University. The development of the IT network that operates at the Pécs premises of the institution began in 1991 and is subject to continuous improvement and expansion. The presentation will introduce the development targets, the quantitative data, the characteristics of Internet and Network use as well as the current and planned future changes of resource stocks in laboratories.

In the year 2000, all Nobel prizes were granted to scientists who excelled in the development of new tools to be used in the digital, so-called ICT systems and the elaboration of new, computerised economic methods. The EU is funding €100 million worth of developments in this field. Inspired by the completion of IDP and efforts made by the Ministry of Education in the field, the leadership of UP decided to deal with the radical restructuring and improvement of the informatics system along with IT courses and applications. The presentation will elaborate on the strategy of IT education, the SWOT analysis, training targets, organisational changes, consolidations of the subject, financial sources and the expected results of the development planned.

Keywords: Informatics,The informatical network

1. Evolving of the University of Pécs

Following the university foundation in Pécs in 1367, the University of Pécs, restarting in 1923, has separated into two independent units, a law and a medical university in 1951. Economic education joined to the Law University in 1970s, then the Teacher Training Faculty was set up in 1980 by integration the local Teacher Training College. In addition, in the beginning of 1990s, through development of this college, the Faculties of Fine Arts, Sciences and Liberal Arts was set up. Establishing of the Faculty of Technology was a significant stage of the integration process of the university in 1995, namely the integration of the College of Technology, which works previously as independent institution. At the medical university, the training college for health workers started in 1990, which became independent faculty by 1995. Till now, the last stage of integration was the joining of the Medical University of Pécs, the Janus Pannonius University with mentioned faculties and the Illyés Gyula Pedagogical College located in Szekszárd as well as the Transferred Branch of Liszt Ferenc College of Music in 2000. At present the University of Pécs has 9 faculty and almost 28 thousand students and 1500 lecturer. The university can present the entire supply of domestic higher education by its 9 faculty underlying its special cultural positions.

2. The informatical network in University of Pécs.

Forming of informatical network of the institution working at headquarters in Pécs have been starting in 1991 and it is being extended and developed continuously. The network can be described with the following numerical data:

Type: ETHERNET network, with bandwidth of 100 Mbit.

Length of optical backbone is 17 km. Length of local access networks within the building is approximately 100 km.

Number of LANs connected to backbone network: 38

Number of LANs connected to network via microwave: 4

Number of NetWare subnetworks: 48

Number of Linux subnetworks: 5

Number of user terminals connected to network: 4700

Bandwidth of HBONE connection: 155 Mbit/sec

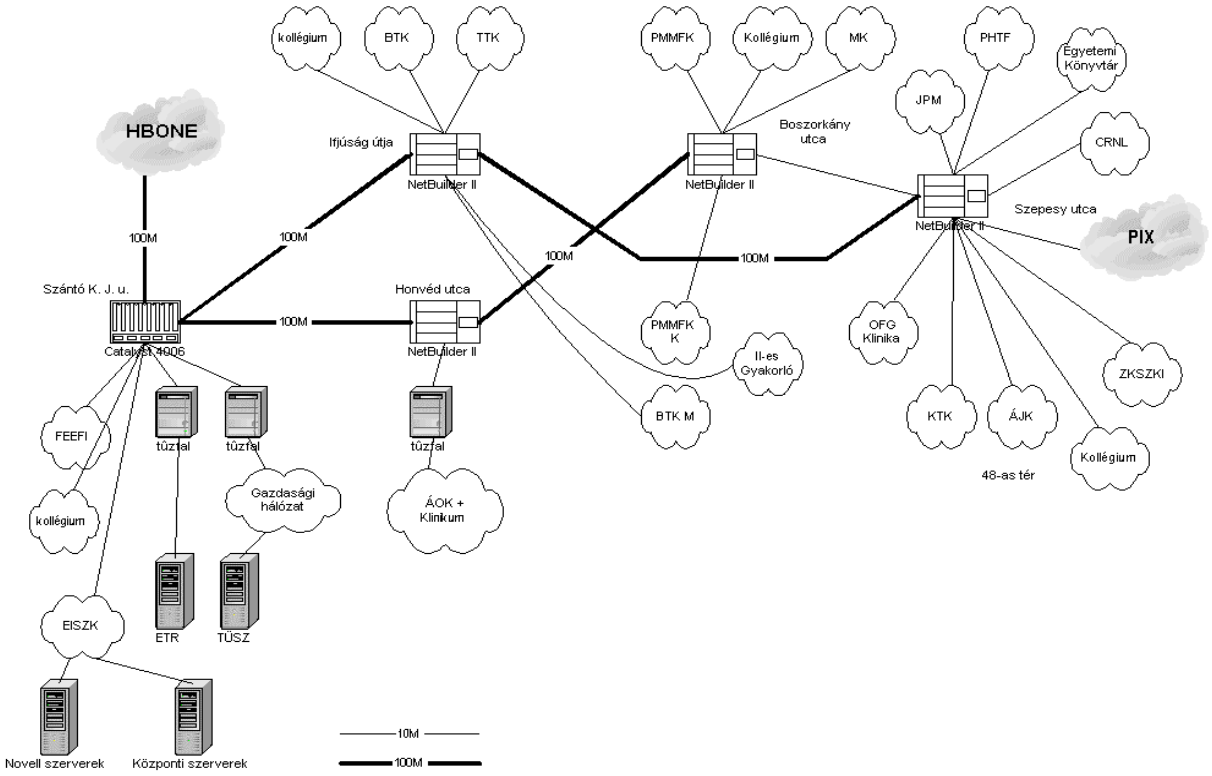
Number of backbone connection routers: 5

Various type and performance of machine tool and characteristic technological difference of local networks built up in various time and colorfulness of applications give rise to complication of the network.

Regrettable circumstances that because of restricted financial means Intranet networks were not built up completely. For similar reason, the building up of the structured networks of a few student hostels and their connection to backbone network are delayed. There is lack in quality informatical connection of the university to its own training schools and teaching hospitals.

Narrow bandwidth not supporting modern applications and running not enough piece of routers that withdrawn from production arise as a special problem in running of optical backbone network. Enlarging of bandwidth is formulated as of primary importance task also for LANs.

Topology of the network is shown in the following Figure:



Each country branch has informatical network, which has not connected yet to domestic academic network, HBONE, directly. Networks of sites are mostly Novell subnetworks but works also Linux and NT networks. The building up levels and services of networks show considerable differences. General features are the lack of complexity and demand for technological development as well as qualitative replacing and quantitative enlarging of network resources.

3.Use of Internet, network service.

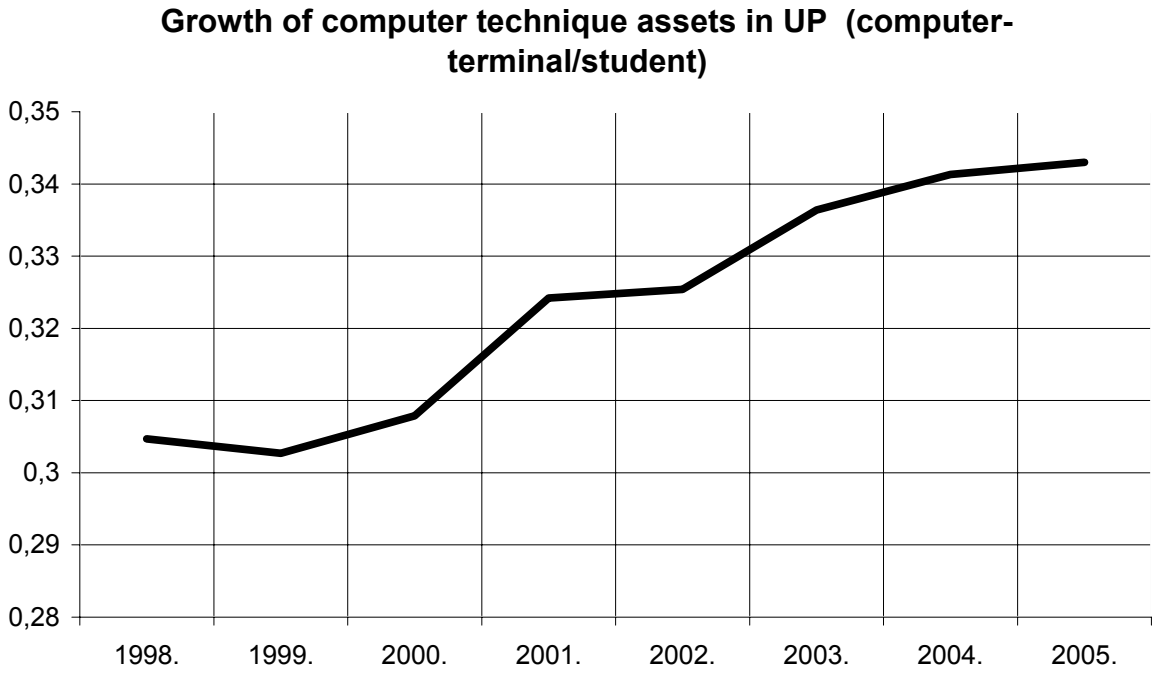
Intensive use of Internet services is almost the only European level grant to the education systems and researchers. The primary reason is the high cost efficiency, wide-range access and existence of state subvention.

Each organizational unit has its own Internet domain and IP address interval according to its current building up level.

Informatical network of organizational units located in various towns are connected to academic network, HBONE, trough which the Internet services can be accessed. University is also a regional center of HBONE, its currently bandwidth to Budapest is 155 Mbit/sec. For country branches, narrow bandwidth (64 Kbit/sec) has considerable effect on quality of connection. This makes such form of communication with basic institution also questionable although this question plays significant role in reasonable use of information system supporting the management, running of institution. This communication connection now realized experimentally on lines rented from MATÁV.

Among network services, the WEB service is of overriding importance. Recognizing the continually increasing significance of the Internet as a medium, coordinated, well-ordered renewal of web sites that represent the institution, becomes important purpose for University of Pécs as a whole.

Technology plays also increasingly dominant role in providing various services. Inner Intranet means tremendous growth in running the information system of UP, while external access represents as powerful marketing channel for regular and part-time student market, scientific life and university management.



Quick growth of computer technique assets is shown in the above Figure.

Use of Intranet and the university network is well described by the following numerical data:

Characteristic features of use of Internet and Intranet in 2000:

Average quantity of incoming data from Internet per day	**Average quantity of outcoming data to Internet per day**	**Average quantity of inner network turnover per day**
32Gbyte	12Gbyte	19Gbyte

Importance of informatics as independent and applied science is well represented in current, and even more in planned, training program of the university. General purpose and special oriented informatical labors provide the acquisition of professional knowledge, till now also organizational units make every efforts in the interest of development and running them. Following table contains current distribution of piece of labors among educational units:

Educational unit	Total number of workstation (piece)
ÁJK Faculty of Law and Political Science	36
ÁOK Faculty of Medical Science	62
BTK Faculty of Liberal Arts	30
EFK Training College Faculty for Health Workers	12
IGYFK Illyés Gyula Pedagogical College	72
MK Faculty of Fine Arts	14
PMMFK Pollack Mihály Tech. College Faculty	243
TTK Faculty of Science	324
Total	**835**

Resource of labors strongly differ, they have typically few number of assets supporting the modern applications (multimedia applications, landinformatics, teleteaching etc.). Because number of expert staff is low, continuous opening of labors is not solved.

Figures in the table clearly show also that our university not possesses continually working informatical centers with large capacity promoting individual learning, professional preparation of students. This question closely related also to provisions of informatical assets of student hostels. We do

not might say that informatical provisions of such complexes are insufficient, nevertheless, it requires significant improvement. Buildings of student hostels are integrated to network system, they bandwidth are narrow, network configuration inside the buildings are not complex and they quality are also objectionable. It provides access to network services only for those students who have they own informatical resources.

In era of globalization and laying the foundation of information society, the informatical infrastructure becomes strategic factor. Its state of development fundamentally determines the working capability, competitiveness of economic, cultural and *educational system* in a country both nowadays and, in increased degree, in the future.

Because of changes, the main direction of educational activity unambiguously determined by **demand of labor market, social requirements.** General tendency in is high education all over the world, the appearance of requirements of **qualitative mass education, lifelong learning**, which can be satisfied, on appropriate standard and level, only by new type education supply with up-to-date structure and methodology. In this process, the application of modern results provided by *information technology, technical modernization of educational process* is essential.

Priority of the latter topic is emphasized by recently accomplished institutional integration, which is destined to form the "UNIVERSITY OF THE FUTURE" and closeness of joining to the European Union only strengthens this process.

Following table contains our purpose in informatical development.

Informatical developments based on IDP
Informatical investments
Informatical network
Network services
Informatical labors, teaching rooms
Software legalization
Telephone system
Information system
Library informatics

4.Development of informatical training.

In 2000, without exception, such researchers have been awarded the Nobel price who shine in development devices that can be applied in digital, so-called "ICT" systems and in working out new computational economic methods respectively. The EU finances developments of hundred millions Euros in this field.

The management of UP, in connection with completion of IDP and in line with expressed purposes of OM, Ministry of Education, has decided to deal with fundamental improving and reshaping informatical ***teachings*** and ***applications***, the state of ***information system***. Reasons for this can be supported as follows

- communication and management information system of organization of the university with increased size and complexity can not be run without significant informatical support,
- schooling environment of UP demands new type of informatical and informatical-applying teachings (courses) so far there is great domestic and foreign manpower shortage in these fields,
- applied researches in informatics in environment of other universities happen in significant cooperation, through new faculties-institutes, with sponsorship of corporations.

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UP can do other than to set the following tasks

- making mass schooling in informatical professions in 4-5 new specialization, in university, college and part-time teaching fields, providing usual resources
- beginning qualitative elite training in one-two specialization (university specialization PhD program) and providing them with excellent resources
- coordination of applied researches, multiplying their volumes according to regional conditions
- providing uniform, consistent information services for education and research on higher level
- and up-to-dating the information system of inner management, development its running to level of country average with support of informatics.

4.1. Possibilities of model variations

In the course of program, we have analyzed several possibilities, as a results of this the following opinion has been formed:

- continuation courses mean important income source for university, faculties, participant in work,
- continuation courses open possibilities to tie alumni to university, who, thorough their role as lobbyist, liquidity, recommendations, increase of the goodwill, number of students and funds of the university,
- postgraduate studies – as one of crucial points of cooperation – are also appropriate for connecting university and the region, the social environment,
- social building function of university is fulfilled through achieving such target groups that did not addressed previously.

We recommend that the organization of continuation courses of integrated universities form such organizational-managerial structure which combine the advantages of "professional" bureaucracy and "divisional" organizing.

The pattern is shown in Figure entitled "System of continuation courses of integrated universities"

It can be seen that certain activity is reasonably assigned to a "center", basically as a service, in demand-following manner with flexible resource allocation, while the others – typically customer-close activity and arrangement of teaching – is mostly assigned to decenters.

Consider that, as all separated economic units, also I-ETR must take part in ***budget planning,*** work out its own plans. For this purpose, running its own, centralized information system, gathering and analysing managerial, financial information are essential. Planning can be done at strategic level where the most significant changes (types of teachings, courses, new markets, new projects, investments) are taken into account, and we attempt to outline the developmental process for long term, 4-5 years. Yearly planning is more specific: planner can move at level of new products, changes inside the portfolio, market organizing projects, changes of organization. In both cases, simple financial models can be prepared trough that the effects of different financial variations can be demonstrated to decision-makers.

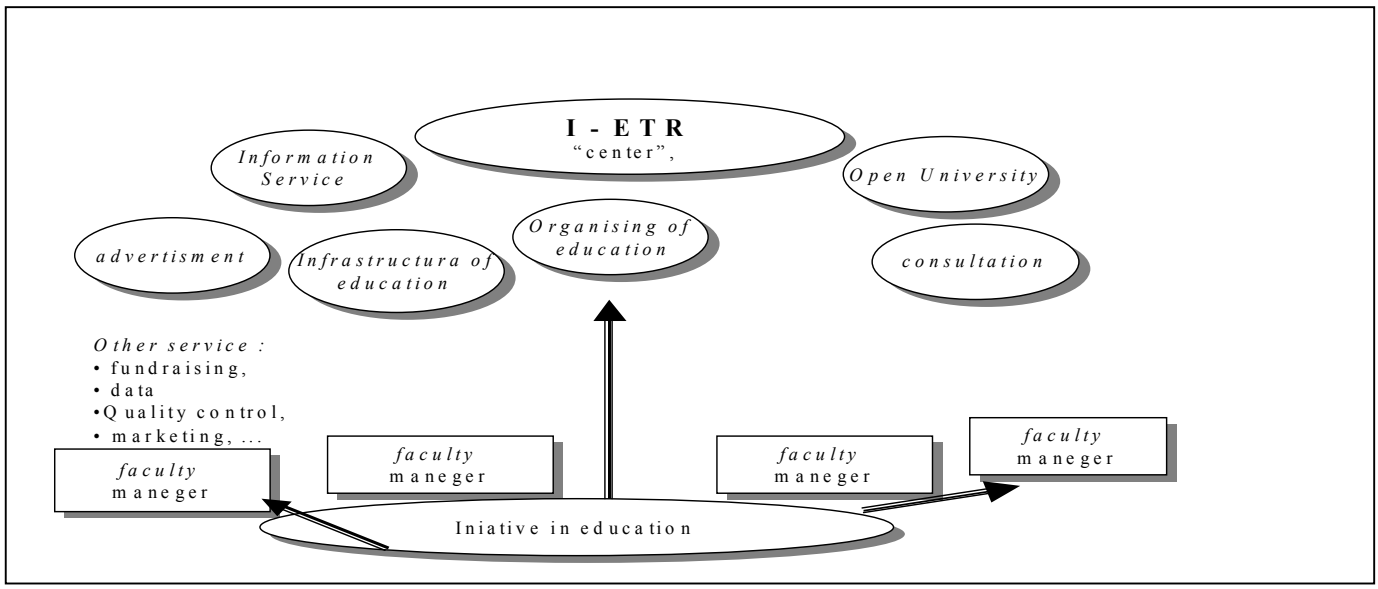
In addition, the Center collects the documentation of relevant laws, orders and inner regulator decrees. Faculty executive officers are in relation to the departments, they forward, analyze regularly ideas, suggestion accumulated here in form team decision making.

The strategy of University of Pécs shall be based on the combined system of external and internal challenges, where external challenges are presented by the society, the economy and the labour market, and while internal challenges are set by the demands of the current citizens of the University. The necessary measurings and surveys to map external and internal challenges have been performed The challenges related to the different functions of the University may be elaborated by building on these results. The main path of the education activities is unambiguously determined by the demand of the labour market and the society. A general tendency in higher education world-wide is the appearance of a demand for quality education of masses. It is a huge challenge for UP to react to this trend. The dramatic increase in quantity (50% of the age group) may only be met on a satisfactory level by offering education of new type and structure and up-to-date methodology. The labour market has restructured significantly in the past decade. Driving professions have developed and, in a parallel path, a significant decrease of demand has taken place for other professions and specialised fields. Hungarian higher education, including the legal predecessor institutions of University of Pécs, has executed the significant output increase by partially preserving the previous programme structure that has become unmarketable by today.

Regarding its education activity, aims to become **market leader in Hungary**, a **decisive player in the Central-Eastern European region**, and a **significant in Europe** in the coming 10 years regarding the number of students and the multi-coloured nature of the training fields. In its education activity, the University aims to retain its multidisciplinary nature, intensifying the interdisciplinary content of the offered fields. In the future, the University aims to perform education activities in the following fields:

Information technology	State administration and law
Economy	Health sciences
Technical sciences	Natural sciences of living and inert things
Arts	Education sciences

Organization chart of suggested "model of Pécs"



IDP SWOT ANALYSIS

UP

Strengths

- Multi-faculty university with a wide spectrum of educational, research and artistic activities
- The largest university and the most significant employer of the region
- Student base reaching over the region, with different educational forms
- Potential in education, science, arts and health care significant even on national level
- Organisationally mostly integrated decision-making and central administration
- Existing traditions of internal co-operation in some fields
- Internationally renowned education programmes in English (FoGM, FoES)
- The only complex education of arts in rural higher-education

Weaknesses

- Divided geographically and locally
- Lack of capitalizing on the opportunities of internal co-operation (education, research, arts, administration)
- Internal mechanisms of distribution not supporting internal co-operation
- Lack of social and economic relations
- Lack of weight-proportionate interest enforcement at national forums
- Lack of unified quality assurance
- Narrow range of internal and external services
- Slowly adapting, inflexible organisation and, occassionaly, education portfolio. Heterogenously developed faculties
- Rivalry between organisational units instead of co-operation
- Lack of clear internal settlement system and resource allocation
- Complex demands against physical limitations (unified library)
- Disregarding existing real values, slow reaction to market interests

Opportunities

- Potential student base with demands for quality mass-education
- Large demand from IT society for professionals
- Opportunities in accession to EU. Demand for EU-experts.
- Utilisation of increasing student mobility (e.g. EU, across-the-border Hungarians). Increasing opportunities for Hungarian professionals to enter international labour markets
- Involvement in R&D activities of multinational companies entering into Hungary and the region, as well as of domestic companies
- Increasing social demand for the services providable by the University
- With nationally improving economic situation, increasing effective demand for market-oriented trainings

Threats

- Economic and industrial development level and infrastructural conditions of the region
- Strengthening of national (Szeged, Debrecen) and regional (Kaposvár) competitors. Appearence of private higher education as a new type of competitor
- State support is uncertain in the long run
- Brain drain by international markets and business sector
- Danger of mass education to quality

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SWOT analysis of informatical training

STARATEGIC NOVELTY, in respect of future important innovative initiative, so far experimental task, "essential investment" must be stimulated	PROMISING STARTING, elaborated program, after the initial innovation, return of investment be expected shortly, activity must be strengthened
FOR EXAMPLE: ❑ short informatical continuation courses ❑ a day manager training, "consultation" in high segment ❑ "professional weekend" in any field ❑ "university week" competence ❑ sandwich courses, practical courses with corporate participation inter-faculty courses in foreign languages for foreigners ❑ new "literacy"-type mixed courses in any topic. "What is the geology?", or "Baroque buildings of Pécs"	FOR EXAMPLE: ❑ certain language continuation courses ❑ certified informatical examinations e. g. ECDL ❑ postgraduate courses in foreign languages with foreign degree ❑ new type economic courses, e. g. MBA ❑ professional training in new techniques ❑ qualifications in new teacher training courses ❑ new administrative training prescribed by authorities or government ❑ building up in training system of large enterprises ❑ all courses in teleteaching form ❑ all courses via Internet
ROUTINE-LIKE, MASS training, with small novelty-value, with big profits: probably must be revaluated, make decide on market position	IT MUST BE CUT DOWN, ORGANIZED OUT, activities yielding non significant profit, with small prestige value

References

Béla Sipos ed. (2002). Institutional development plan of UP. pp. 86.

32 The FernUniversität Hagen - a University in Transition

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Abstract

The University of Hagen (FernUniversität) is the only distance teaching university in Germany. This contribution addresses the university's transition to a fully virtual university. it does not intend to add another paper to the numerous existing ones, but, after some general remarks, to act as a kind of guided tour by presenting links to more detailed descriptions of the addressed components.

Keywords: virtual university, migration, learning elements

1. Universities in Transition

Worldwide, universities are getting more and more involved in a general process of transition:

- Society and economy are changing to a knowledge society/knowledge economy. As a consequence, instead of studying just once a life, students will have to continuously update their knowledge, e.g. by attending state of the art university level education. So far it is not yet clear at all whether lifelong education will be provided solely by universities or by other education providers as well. Universities have to leave their ivory towers and enter a highly competitive market. They should carefully reconsider their programmes and adjust them to this new situation.
- To enter new markets and attract new customers, universities are getting more and more involved in multiple modes of education, e.g. face to face and distance education.
- To meet the demands of a highly competitive market, universities have to sharpen their profiles and become open for co-operation with other universities. Universities that are not open for substantial co-operation will hardly survive the near future. The University of Hagen, e.g., closely co-operates on the one hand with other universities, which leads to international as well as to interdisciplinary programmes; on the other hand it co-operates with industry and professional societies, which leads to industry-specific curricula as well as continuing education programmes.
- There exists a transition from faculty-oriented curricula to inter-faculty curricula. A multimedia expert, e.g., needs knowledge from mathematics, computer science, law, design, psychology, and so on, i.e. from a variety of faculties.
- There is also a transition from curricula-oriented degrees to knowledge certificates. When students re-enrol at a university, at the end of their studies they want to get a certificate about their accumulated knowledge in a specific area, not just about a number of successfully passed courses.
- Instead of just offering semester-oriented programmes, in the future universities will have to offer a broad spectrum of programmes, stretching from traditional programmes to, e.g., continuously available learning on demand programmes.
- Finally, there is a transition from linear programmes, where students enrol for a series of courses, to general learning spaces. Such a learning space provides lectures, courses, seminars, assignments, certification, testing, tutoring, monitoring, etc. A student enters the space, where she can either follow a guided tour through the learning environment, or can individually select the learning materials she is interested in; finally she decides to leave the learning space and asks for an appropriate certificate. After a while, a student will re-enter the learning space for some additional education.

2. Virtual Learning Spaces

The concept of a learning space easily leads to the concept of a virtual learning space, which brings *all* its services via electronic communication, independently of time and distance, to the individual user. It provides and integrates all functions and services of a real learning space, systematically uses new media and technologies, heavily supports all kinds of communication and co-operation, and provides low-cost solutions on broadly-available hardware and software platforms. In a virtual learning space, students use their personal computers as learning environments, information agents and communication centres. Students may learn when and where they want to learn, combine traditional forms of learning with new ones, and can learn with personal, professional and social contacts. There exist various examples of virtual learning spaces:

- virtual universities (e.g. the University of Hagen);
- virtual campuses (e.g. the EUNITE network's European Virtual Campus);
- networks of universities and partners from industry (e.g. EuroPACE);

- even the World Wide Web comprises some properties of a virtual learning space.

3. The University of Hagen

The University of Hagen has been founded in December 1974 by act of parliament of the state of North-Rhine-Westphalia. Being the only distance teaching university in Germany, it forms an integral part of the regular public higher education structure. It is fully in line with conventional universities, fulfils the same tasks, functions and responsibilities, has the same rights, and meets the same standards like any other German university; its students have to meet the standard requirements for enrolling; students from other universities can switch to Hagen and back; instead of living in Hagen, they are spread around Germany, Europe, some of them even around the world.

The university comprises six faculties (computer science; economics; education, social sciences and humanities; electrical engineering, law and mathematics), 68 study centres, about 80 professors, about 1700 courses, and about 60.000 students; 80 % of them are fully employed, i.e. are studying besides their full-time jobs; 40 % of them are holding already a university degree.

The university supports a number of study centres, which provide students with face to face coaching and tutoring, and support social contacts between students. Most of these study centres are located in Germany, some of them in other Western and Eastern European countries; they are essential for the success of distance learning. Though their roles will change, all study centres will be fully integrated into our Virtual University concepts

Like a traditional university, the University of Hagen firstly offers programmes like diploma, bachelor of science, bachelor of arts, master; supplementary programmes, postgraduate programmes as well as single course studies, where students can just enrol in single courses and get certificates; in addition we provide a broad spectrum of further continuing education programmes. From the very beginning new technologies were introduced as soon as they became available and as far as they proved successful for teaching and learning. Besides printed course materials since many years we are offering audio and video tapes, are showing up bi-weekly in the public TV, and are using CD-ROMs, computer conferencing, video conferencing, etc. Consequently, we are now in transition to a Virtual University.

4. The Migration Strategy

Already in the mid nineties, from individual initiatives various research and development projects evolved in the area of virtual teaching and learning, three platform projects became widely known, *Virtual University, ET-Online,* and *WebAssign* (numerous papers about these projects can be found via the homepages of the chairs (Lehrgebiete) Kaderali, Schlageter and Six via the FernUniversität's homepage http://www.fernuni-hagen.de). Despite their pilot character the platforms attracted thousands of students and were heavily used for real teaching and learning processes. As a consequence, the university developed the concept of a virtual university as briefly sketched in section 2. The following decisions proved essential for a successful transition:

- The Virtual University development became a direct strategic task of the university's management board, with a Vice-Rector in charge of the transition.
- A *User Group*, chaired by the Vice-Rector, became responsible for all user-oriented decisions; all institutions of the university, academic, administration and service ones, are represented in the user group, which can ask an expert group for device and support; the user group, through its chair, directly reports to the management board; subgroups of the user group concentrate on specific issues like CSCL and report back to the user group.
- A first university-wide standard platform was assembled from the three pilot platforms; its internal and external interfaces became obligatory for all further platform component developments.
- Two new teams for
    - handling and maintaining the platform
    - further developing the platform

  were established in the university's computer centre.
- The management board sets aside a quite significant amount of university money for
    - developing multimedia learning materials
    - developing new components for the standard platform

Based upon the user group's recommendations its chair submits a proposal for funding directly to the management board, i.e. without passing through other university commissions. For details see Berkel (2001).

It turned out that instead of regulations and stringent standards incentives and good examples are the best way to motivate university members, faculties, administration, service units etc. to get voluntarily and enthusiastically involved in the transition process. Meanwhile the whole university heavily supports the goal of a virtual university.

5. The Platform

In the mid nineties, when individual researchers started virtual university research projects, there were no commercial platforms available which even approximately met their requirements. Thus, as mentioned above, three different

research platforms evolved, were validated with significant numbers of users and successfully made available to other dual-mode universities as well. When in 1999 the universities management board decided to implement a unifying virtual university concept it also decided to assemble a standard operational platform from components of the existing prototype platforms, called *platform 2000*. At the same time, the virtual university development started to develop a new strongly component oriented *platform 2003* project. By now, the number of worldwide commercially available platforms has significantly increased to about 200, and various projects are trying to classify and evaluate them (see for example http://www.virtual-learning.at/evalplattform.htm http://www.izhd.uni-hamburg.de/pdfs/Plattformen.pdf. for details)

Thus we carefully studied whether to use an existing platform or at least integrate components from existing platforms into our platform.

A platform as a whole has to meet several criteria:

- it has to provide a set of services (catalogue of functions)
- it must allow integrating existing components like, e.g., legacy data bases (whose use, e.g., is enforced by the government)
- it must be component oriented with well defined open interfaces
- it must allow the easy integration and exchange of standard open, of the shelf components, e.g. for communication and cooperation services
- its code and detailed documentation must be available
- it must be extendible, taylorable, adaptable to changing needs and requirements

The platform provider must

- be commercially sound (probably only few of the 200 providers will survive the next years)
- provide extensive local or at least national support
- be open to new user demands (e.g. by providing and supporting a user group)
- guarantee sound and stable financial conditions.

It turned out that for our situation no single platform and/or platform provider meets all the above criteria, thus it seems necessary to integrate components from several platforms, including our own one. On the other hand, because of practical and financial reasons, it does not seem feasible to use components from more than two or at most three different platforms. We will finally decide about our platform approach within the next few weeks. For details see Sternberger (2001).

6. Teaching Elements

As mentioned in section 3., the FernUniversität since its foundation is heavily using a broad spectrum of teaching and learning elements, stretching from CBT courses to face to face seminars, from newsgroups and chat rooms to individual oral coaching in study centres. Even in the new century of hightech multimedia, the FernUniversität still believes in using adequate mixes of media, adjusted to the special needs of the corresponding learning event. In the following, some types of teaching/learning components are sketched briefly:

- **Integrated Learning Environments:** courses are presented via Integrated Learning Environments, which, depending on the needs for a specific course, provide access to
  - the – protected - electronic version of the course, which can be downloaded by the student
  - relevant literature references and Internet links
  - news groups and chat rooms
  - self assignment and testing environments

  Via our homepage http://www.fernuni-hagen.de numerous Integrated Learning Environments can be accessed; e.g. http://www.fernuni-hagen.de/LUWIWI/Teilgebiet/BWL_II -> Zugehörige Kurse.
- **Assignments:** *WebAssign* (Brunsmann 1999) is an Internet based tool which supports all tasks as well as various kinds of assignments/corrections:
  - regularly, via the Internet students submit their assignments; which in case of multiple choice as well as more complex forms are automatically corrected and graded by a central computer in Hagen;
  - in case of more complex assignments the solutions may be pre-corrected by a computer in Hagen and subsequently be sent to the remote corresponding corrector;
  - formula and graph editors in form of Java applets support the submission of complex solutions, to be corrected by human correctors only;
  - WebAssign also supports the whole administrative part of the assignments / corrections process.
- **Virtual Seminars:** In a virtual seminar, students can communicate, co-operate, discuss and present their results via online and offline communications means. Though traditional face-to-face seminars can and should not be substituted by virtual ones, virtual seminars form an additional type of learning elements, which are very well accepted by students. For experiences with virtual seminars see Heidbrink 2001.

Laboratories: The faculties of Electrical Engineering and Computer Science provide virtual laboratories. As an example, a real robot at the Institute for Control Systems Engineering and Automation Theory can be booked, programmed, run and controlled via the Internet. For details see Lütticke 2002, and http://prt.fernuni-hagen.de/forschung/pub-de.html (section Multimedia and Internet) and http://prt.fernuni-hagen.de/pro/virtuelle_umgebung/paper.html .

- **Co-operative Computer Supported Learning (CSCL):** The CSCL subgroup is presently discussing a set of different CSCL scenarios ant their functional requirements. Their report will be passed via the user group to the faculties for discussing the scenarios' didactical consequences. Based upon the faculties decisions the platform will be realized accordingly. The decision process can be followed via http://www.fernuni-hagen.de/LVU .
- **Exams:** though most of our oral exams are organized in Hagen, more and more exams are conducted via video conferences between the FernUniversität and its study centres.

7. Co-operation

In the following, from a big number of virtual university related projects some examples for various kinds of co-operations with other universities are given:

Dual Diplomas in Economics

Students with a bachelor degree in economics, who enrol for a full diploma programme at Masaryk University, in addition take selected courses of the diploma programme at the University of Hagen and pass the corresponding exams, get - beside their diploma from Masaryk University - an additional diploma from the University of Hagen. Similar programmes have been established with universities in St. Petersburg and Riga.

European Master in Mediation

The universities of Barcelona, Geneve, Hagen, Leuven, Lyon and Paris, and the Institut Universitaire Kurt Bösch (IUKB) in Sion have established a co-operation for a European Master in Mediation. Students with a university degree in law can study mediation at one of the participating universities for one year and then continue their studies for another year at the IUKB (including joint group meetings, individual study programmes, practical work and thesis) to finally get their master degree in mediation. For details see http://www.fernuni-hagen.de/OERV/Seiten/mediation.html .

EUNITE

The European University Network for Information Technology in Europe (EUNITE) is a good example for co-operations between European universities; it comprises universities from Aalborg, Granada, Hagen, Helsinki, Leuven, Lund and Twente and Strathclyde. Its main strategic goals are:

- to promote the use of information and communication technology as tools for improving teaching and learning in higher education;
- to capture the market for life-long learning at university level;
- to enhance and develop the co-operation of the EUNITE universities in these fields.

Through this co-operation, the partners intend to:

- make available an innovation potential of ICT for on-campus higher education;
- develop and establish new ways for open and distance learning;
- internationalise their learning programmes;
- enhance inter-university networking in the provision of courses and programmes/curricula, and the production of learning materials.

For details see http://www.eunite-online.org .

CUBER

A huge number of traditional and continuing education programmes is flooding the European market and it is hard for the individual customer to find the best programme for his individual demands. The Personal Curriculum Builder in the Federated Virtual University of the Europe of Regions (CUBER) is another example for a successful co-operation between various European universities and university networks. The FernUniversität is the main contractor of the CUBER project, which. in contrast to EUNITE, is heavily funded by the EU. The project aims at

- finding the best match of vocational demands, academic offers, and individual learning conditions;
- broadening the access to learning resources from diverse providers, such as European Distance Teaching Universities;
- building logically coherent course packages.

The CUBER broker middleware decouples search and delivery systems and comprises

- a knowledge base of standardized course descriptions and domain knowledge;
- a forms- and menu-based authoring interface;
- a user-centred customisable, interactive search-engine.

Of course, beside its technical results, the success of CUBER will heavily depend on whether a significant number of European universities will be willing to closely co-operate

and share its potential customers. for details see http://www.cuber.net or

ULI

ULI is a German-Swiss teaching network of 11 universities in the area of computer science; students can enrol at one of the participating universities and can take courses from any university, either face to face lectures or Internet courses. By mutual agreement all credits from any of the universities are accepted for degrees. For details see http://uli-campus.de .

Conclusion

The paper summarized, in form of a guided tour, various aspects and experiences of the FernUniversität's transition to a virtual university. Significant steps have been passed successfully, many others still have to follow.

Acknowledgements

The Virtual University Hagen is a joint effort of a whole university with many actors and active contributors. Only very few of them have been mentioned in this brief overview.

References

Berkel, Th., Haferburg, A., Hoyer, H., Möllers-Oberück, T. (2001). Von der Leitentscheidung zur netzbasierten Universität - Migrationsstrategie E-Learning der FernUniversität Hagen*, Informatik 2001, Band II,* 2001, Österreichische Computer Gesellschaft, Wien

Brunsmann, J., Homringhausen, A., Six, H.-W., Voss, J. Assignments in a Virtual University – The WebAssign-System, *Proceedings of the ICDE World Conference 1999, Vienna*

Heidbrink, H. (2001). Virtuelle Seminare: Erfahrungen, Probleme, Forschungsfragen. *Medienpädagogik-Online-Zeitschrift für Theorie und Praxis der Medienbildung, Ausgabe 1/2001*

Lütticke, R., Carsten, C., Helbig, H.: VILAB - A Virtual Electronic Laboratory for Applied Computer Science**,** *Proceedings of the Conference Networked Learning in a Global Environment*, ICSC Academic Press, Canada/Netherlands 2002

Sternberger, K., Vogeler,B. (2001). Virtual University Platform – Part of the FernUniversity – Infrastructure, *Proceedings of the ICDE World Conference 2001, Düsseldorf*

Various kinds of information and interesting links in the broad field of Virtual Universities can be found via the homepage of our Virtual University office: http://www.fernuni-hagen.de/LVU

33 Underpinning the Learning Environment: Strategic Decisions for ICT Literacy in Higher Education

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Abstract

Student ICT literacy lies at the heart of the ICT-rich learning environment. The learning environment increasingly offers the student a set of ICT tools and access to large amounts of digitally stored information, at institutional, national and global level. For the student, the abilities not only to confidently use these tools, but to critically evaluate the most effective use to which they can be put, are crucial, and will impact upon the effectiveness of study. Additionally, such generic skills are preparatory both in the lifelong learning context, and in the transition to employment. The strategic address to student ICT literacy is thus an important element of policy-making in higher education institutions. In discussing the response which institutions are making, we will draw upon two sources of evidence, the CITSCAPES Project, which carried out in 2001 a survey of current provision for student ICT literacy throughout the UK, complementing this with a series of case studies illustrating the variety of practice in this area. And second, we will reflect upon developments at the Universities of Glasgow and Gloucestershire, which are very different types of institution, but have both placed strategic priority upon student ICT literacy. Each has approached the delivery and assurance of student ICT literacy in a different manner: Glasgow has over the past seven years developed a compulsory ICT literacy programme for all students, whilst Gloucestershire have developed a set of modules which integrate ICT literacy into the curriculum.

Keywords: ICT Literacy

1. Introduction

Student ICT literacy lies at the heart of the ICT-rich learning environment. The learning environment increasingly offers the student a set of ICT tools (which may or may not be built around a so-called "Virtual Learning Environment"), and access to large amounts of digitally stored information, at institutional, national and global level. For the student, the abilities not only to confidently use these tools, but also to critically evaluate the most effective use to which they can be put, are crucial, and will impact upon the effectiveness of study. Additionally, such generic skills are preparatory both in the lifelong learning context, and in the transition to employment. The strategic address to student ICT literacy is thus an important element of policy-making in higher education institutions.

2. The Evolving Situation in the UK – the Citscapes project

ICT Literacy is a crucial element in the student's ability to study effectively in an information-rich and ICT supported learning environment. The UK Joint Information Systems Committee (JISC) recognised this in its *Circular 4/99* of November 1999, inviting proposals for a project which would *"find out how students' C&IT skills development will affect Higher Education and whether, in light of these different skills, Higher Education Institutions will need to change the nature of their training provision."* The outcome of this call was the CITSCAPES project, which has been running since May 2000, led by the University of Glasgow (other partners are the Universities of Gloucestershire and Stirling, Glasgow Caledonian University, Gloucestershire College of Arts and Technology, Lauder College, Dunfermline, and the Learning Skills Development Agency). The project team carried out detailed surveys of student ICT Literacy provision in higher education, and compiled a series of detailed case studies. The project has now extended its work into the further education sector, covering colleges offering courses to 16-year-olds and over; this work is still under way, and this paper therefore reflects the higher education results. The higher education survey involved three questionnaires, A, focused on strategic and policy issues, B, focused on the character of ICT skills provision across the institution, and C, focused on the characteristics of the actual programmes of delivery of ICT skills. We used the term "C&IT induction" to refer to any process of engendering ICT literacy in students. Note that the terms "ICT" and "C&IT" are synonymous, "C&IT" being used officially in UK higher education in preference to the more widely used "ICT" (in Europe) or "IT" (in the USA).

3. Strategic Recognition

It is clear from our data that student ICT literacy is now becoming recognised as an important issue by most HEIs. Almost two thirds of the HEIs responding to the CITSCAPES survey considered Student C&IT induction "highly important" (Table 1.).

Question A2. What level of priority is given to student C&IT induction?	Number	%
Highly important	56	60
Fairly important	30	32
Not considered as major priority	4	4
Any combination	3	3
Total	93	100.

Table 1. Level of priority given to student C&IT induction

As an additional comment on its response, a pre-1992 university wrote, "Recently assumed much more importance - we are beginning to tackle this whole area more consistently - neglected in the past."

A circumstantial indication of the increasing strategic importance of induction in ICT skills is the seniority of managers admitting to a strategic role for this area who were willing to complete CITSCAPES Questionnaire A (Table 2.).

Status of person responding to Questionnaire A	Number	% of returns	% of respondents to this question
Principal	1	1	1
Vice-principal/pro-vice-chancellor	19	21	22
Director of Information Service/Dean of Faculty	15	17	17
Head of Department (including IT Service)	35	39	41
Service manager or equivalent	12	13	14
Training Officer/Lecturer	4	4	5
Did not complete this question	3	3	
Total	89	100	100

Table 2. Level of person responding to Questionnaire A

Of these persons, 35 out of the 86 who answered the question (40%) ranked at Director of converged service/Dean of Faculty or above. Heads of Computing or IT Services were included in the next group, Heads of Department, which provided another 39 persons (41%). Managers or officers and lecturers only contributed 16 (19%).

Looking at the place of student ICT literacy in the institution's strategic intentions is more difficult, since strategic documents can vary from fantasy lists or public relations exercises through realistic goal-focused plans to lists of current activities with very little future orientation. Such documentation is not always the best guide to what is taking place or may be planned. However, in the context of increasing accountability to stakeholders, policy documentation is a more serious requirement than may have been the case in the past. Over two thirds of institutions responding to Questionnaire A were able to assert that student C&IT induction was incorporated in strategic documents (Table 3.)

Question A3. Is student C&IT induction incorporated in strategic documents?	Number	% of returns	% of those who responded to this question
Yes	64	69	70
No	27	29	30
Did not respond to this question	2	2	
Total	93	100	100

Table 3. Incorporation of student C&IT induction in strategic documents

The details of policy documentation may be more difficult to evaluate, since they may reflect the styles and topical concerns of senior managers, and may focus on problems to be solved, rather than those which may be felt to have already been solved. We did not consider the level of priority accorded to student ICT literacy in strategic plans, or the level within strategic documentation at which reference to it appears.

In terms of the relationship of policy and action, responses to survey question A9 provide institutional perspectives on the current situation (Table 4.). That fewer than half the institutions responding characterise their present situation as stable, underlines the status of student ICT literacy as a live issue in higher education.

Question A9. How could the current position regarding student C&IT induction at your institution be best described?	Number	%
Stable	51	55
Transitional	30	32
Tentative	9	10
Any combination	3	3
Total	93	100

Table 4. Current position regarding student C&IT induction

This table also suggests that action is being taken in respect of this issue in the majority of institutions. We may presume that all institutions characterised by themselves as other than stable are moving towards implementation of student ICT literacy measures (rather than being in the process of dismantling them); and that several (at least) of those who characterise themselves as stable have already implemented such measures, and do not at present wish to change them.

The quotations below from some respondents illustrate the situation. Some institutions have identified a satisfactory approach:

> We are a large research-led university and Information Services do not have the resources to [provide] all u/g students with IT training (e.g. word processing, spreadsheets, databases etc.). We do provide this for staff and taught & research postgraduates. … We provide induction training to u/g and are looking to ECDL as a way of introducing IT training to u/g. (Pre-1992 university)
>
> What we term "induction" for undergraduates is simply an introductory talk on the facilities available and how to get the best from them, it is not hands-on training. Some academic departments provide the latter on their own initiative. A central hands-on training program is considered a priority for research students and is provided centrally. (Pre-1992 university) is a relatively small institution (c6000 FTE students) and it is also a single-faculty. This simplifies C&IT provision because the range of hardware and software platforms is not great. All students are encouraged to attend the regular induction sessions (throughout the year) and a majority do. Staff can also attend regular sessions for them and we also do one-to-one training for them on request. All backed up by a helpdesk service for students, dedicated small support team for staff, and self-help documentation. (Pre-1992 university)
>
> The idea of generic C&IT induction is now rather outdated, given the diverse (and often advanced) range of skills many students have on entry. Embedded C&IT induction within general study-skills customised for each subject is the way forward. (Post-1992 university)
>
> The induction provision stems naturally from the process of planning, validation and operating a course. Key skills are an embedded feature of course provision at this University. (Post-1992 university)
>
> The Central University Computing Services run a full programme of IT training modules which are available to all staff and students of the University. Anyone can attend; they must have the pre-requisite knowledge. (Pre-1992 university)
>
> All students at the start of the Academic year are given specific C&IT Induction which is followed by weekly Key Skills Sessions. (Monotechnic institution)

Others are still feeling their way towards addressing the issue:

> The demands of 18 year olds joining the University in this area is continually changing. Much more support is needed for mature/part-time students than the traditional intake. (Post-1992 university)
>
> The College realises it should be providing C&IT skills training as part of a wider provision including report writing, presentation skills, statistics, study skills etc. i.e. NOT as a separate entity. It has been raised at various committees but no structured way forward has yet been determined. (College of Higher Education)
>
> We are moving to a more centralised model involving computer-based diagnosis and development of student IT skills, alongside voluntary development/accreditation opportunities. (Post-1992 university)
>
> A new post, IT Training officer, has recently been filled. The remit includes co-ordination of all student IS training. But no work has started yet, as the initial focus is on putting a staff training programme in place. (Post-1992 university)
>
> A University wide Group has recently been created to look centrally at the whole issue of C&IT skills training for all University members - staff and students. (Pre-1992 university)
>
> New division of Learning and Teaching established May 2000 with newly appointed Director. (College of Higher Education)
>
> At present there is no SYSTEMATIC C&IT induction for students. Library staff and IT support staff provide ad hoc induction, and C&IT issues are referred to in more general library induction sessions. The situation is acknowledged as a priority area. This year, data has been collected on student PC ownership and C&IT competence. It is planned to target future, more systematic, induction through use of this data. (Monotechnic institution)
>
> Identified as area for potential change in Learning and Teaching Strategy for College, but fraught with difficulty. (College of Higher Education)

4 Nature of Provision

The overview of development of ICT literacy provision suggests a model of piecemeal growth in devolved areas (faculties, departments or services), overlain first by central initiatives and later by consolidation. An example is the University of Glasgow, considered below, where disparate provision developing in a range of departments was

complemented by a centrally funded programme, which then enabled a consolidation of provision by departmental incorporation of the centrally supported structures. Our data supports this model, and suggests that higher education institutions lie somewhere on the “piecemeal growth – central initiative – consolidation” trajectory.

A result of this development would be a multiplicity of providers in each institution, and responses to Question A6 (Table 5.) are consistent with this pattern.

Question A6. Who provides student C&IT Induction?	Number	%
One unit or department	19	20
More than one	72	77
No provision	0	0
Any combination	2	2
Total	93	100

Table 5. Number of providers of student C&IT induction

Very few institutions suggest that student ICT literacy is offered by only one agency. Of the 19 offering this response, 8 are monotechnic institutions, where numbers are smaller and opportunities for diversity in provision limited, 5 are institutions with a limited range of faculties only, and only 6 can be described as comprehensive in their range of provision, and 4 of these could be described as smallish (c.12, 000 students). We should expect then to see in most institutions a more or less complicated picture of to some extent overlapping provision offered by a number of agencies, some central, some devolved.

Question B5 requested a listing of departments involved in student ICT skills provision; the mean number per institution (with 86 responses to this question) was 2.7, with numbers ranging from 0 to 8 (Table 6 and Figure 1.)

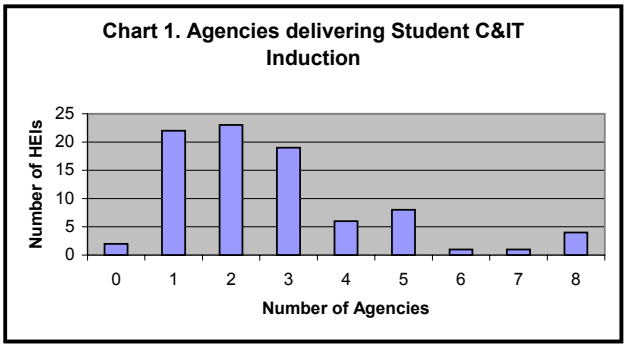

Figure 1: Number of agencies delivering student C&IT induction

Thus we have an average of almost three agencies per institution involved in student ICT literacy provision, and the most likely number is between two and four.

Question B5 Units	HEIs
0	2
1	22
2	23
3	19
4	6
5	8
6	1
7	1
8	4
no response	6

Table 6. Number of agencies delivering student C&IT induction

The names of agencies quoted in response to Question B5 indicates the range of directions from which student ICT skills are being provided (Table 7). Taking central departments, computing and information services have the largest numbers, but by no means dominate the table, with a substantial minority from agencies concerned with student support. Considering provision from academic departments, the range is very wide, with computing departments not being particularly heavily involved.

Question B5	Type of Agency	Number
Central Agencies	Information service	24
	IT/Computing service	28
	Library	13
	Student support	21
	Teaching & Learning	13
	Other	13
	Total central agencies	112
Academic departments	Computing	11
	Other	95
	Total academic departments	106
	Total	218

Table 7. Type of agencies delivering student C&IT induction

We should be careful in interpreting table 7, since some of the central departments quoted are involved in academic course provision, and whilst unspecified numbers of some responses refer to academic departments or faculties, others list those which are known to be involved in delivery of student ICT literacy. Nevertheless, it is clear that there is no

obvious direction from which student ICT skills should be expected to come, and academic areas are as involved in delivery as central ones.

If we consider what is being provided (see Table 8.), a picture emerges of a variety of routes through which student ICT skills may be delivered. Although provision by a service department and within academic courses are the most likely routes, stand-alone programmes, student skills programmes or provision through student support programmes are sufficiently well-supported for them to be considered normal routes for delivery.

Question B5.		
Student C&IT induction provision types	No. of HEIs indicating presence of each type	% of total HEIs responding to this question
Stand alone C&IT skills programme	33	39%
C&IT course as part of a student skills programme	36	42%
C&IT skills as part of an academic course	65	76%
C&IT course provided by a service department/unit	63	74%
Element of student special needs & support services	31	36%
Number of responses = 85		

Table 8. Types of student C&IT induction provision

In terms of what is offered, there is some variation in emphasis, as indicated by responses to Question C5, requesting goals of student C&IT induction:

i. Support academic work:

> To equip students with core C&IT skills that will underpin their course of academic study, enabling them to take full advantage of IT & electronic resources provided by the University. (Post-1992 university, Information Service department)
>
> To provide essential IT skills to enable the student to complete academic study. (Pre-1992 university, IT service)
>
> To provide training to enable students to complete IT tasks required by their academic course. (College of HE, IT service)
>
> A range of basic skills integrated into the respective programme of study and dependent upon student needs, in order to equip students with the skills necessary for their course. (College of HE, Maths/IT dept.)
>
> To enable the students to obtain the competence on the PC to support their studies. (Post-1992 university, Computer Centre)
>
> To provide basic training in IT for students to be able to use the facilities available in order to produce their academic work. (Pre-1992 university, IT Services)

ii. Support study of a particular subject:

> To develop basic skills to use and apply (Windows 2000, Internet Explorer, MS Exchange, PowerPoint, FrontPage, Excel and Access) to future business school modules. (Post-1992 university, Business School)
>
> Fill gaps in UG provision, and provide underpinning base for research skills at MA level. (Post-1992 university, postgraduate History course)

iii. Preparation for employment:

> ITT Students: To raise C&IT skills of trainee students in line with the Government's standards (Circular 4/98) in order to satisfy QTS. Joint Hons: To provide C&IT skills as part of a Core Skills programme to increase preparedness for a professional working life after graduation. (College of Higher Education)
>
> To develop a range of transferable skills…to prepare students, through the development of an appropriate range of knowledge and skills, for careers in media and communication. (College of HE, Faculty of Media)
>
> To provide students with the necessary tools to function in the current technological situation, also to encourage communication skills vital for success as a practicing engineer. (Post-1992 university, Faculty of Engineering)
>
> To prepare students with the skills required for a modern workplace. (Post-1992 university, School of Sport)

iv. General benefits to both study and employment.

> To equip students with basic IT skills for study and employment. (Post-1992 university, Learning and Teaching Centre)
>
> To develop personal competence in generic skills, and an ability to selectively use software in the classroom/place of work (College of Higher Education, Maths & IT dept.)

v. Focus on particular applications:

> To provide taught sessions on range of Microsoft packages for postgraduates - through standard training sessions. To provide self-teach material for undergraduates. (Pre-1992 university, Information Service department)
>
> To ensure students can access the network (e-mail, internet) and can use the main components of the MS Office suite (word, excel, PowerPoint) (Post-1992 university, Business School)
>
> To introduce email and word-processing to all newly enrolled students, (Monotechnic, Learning Resources dept.)

To give basic IT skills in Word, PowerPoint, Excel, Access (Office 2000 packages), file management, scanning. (Monotechnic, Learning Resources Centre)

vi. Focus on an IT qualification:

A pilot scheme to assess the effectiveness of the ECDL as a basic IT skills qualification. (College of Higher Education, Library and Information Services)

vii. Future orientation

To give students the opportunity to discover ways of exploiting the digital technology they can expect to meet in future years. (Monotechnic, Computing Service)

5. Two Case Studies

5.1. University of Glasgow

The University of Glasgow was founded in 1451, when James II, King of Scots, persuaded Pope Nicholas V to issue a bull authorising Bishop Turnbull of Glasgow to set up a university. Modelled on the University of Bologna, Glasgow was Scotland's second university, and is one of the four "ancient" Scottish universities (the others are St. Andrew's, Aberdeen and Edinburgh). The university was based first in the Cathedral, then in buildings not far from it, and finally moved to its present campus in the West End of the city in 1870. There are two sub-campuses in the north-western suburb of Bearsden, housing the Education and Veterinary Medicine Faculties, and the university also has a stake in the Crichton Campus, Dumfries, a regional higher education facility for the South West of Scotland. It is the largest university in Scotland, with, in the 2000-2001 session, 16,847 full time students (14,794 undergraduate, 2,053 postgraduate) and a further 2,459 part-time students (507 undergraduate, 1,952 postgraduate). There are nine faculties: Arts, Divinity, Education, Engineering, Law & Financial Studies, Medicine, Science, Social Sciences, and Veterinary Medicine. 57.5% of students are women, 11% of students are from outwith the UK, and 12.5% of undergraduates are mature students (i.e. over 21 when they began their studies). Glasgow has established itself over many years as a university serving the West of Scotland, but it has also developed, again over a period of centuries, an international reputation which draws students from throughout the world.

As an old university, Glasgow possesses a traditional structure, with a Senate supervising academic matters and a Court administrative ones. The University Principal is influential in both bodies, but normally requires the support of faculties in carrying matters through the Senate (although on occasions of urgency opposition can be overridden). However, because of his role in resource distribution and liaison with the Funding Council, his role as determinator of policy has grown over recent decades.

The University made a clear commitment to supporting an IT-rich student learning environment in its IT Strategy, which was launched in 1992, and presented a clear vision of the well-supported IT-empowered student of the 1990s. The strategy envisioned measures to bring this to reality, including login IDs for all students, large numbers of PCs available in the University library building, fast networking available to all, the "Common Student Computing Environment" (a set of generic applications available across the whole university network, and a "University-wide Introductory Course in IT". The University is now in the process of reformulating its strategy in a number of areas, and the Information Strategy which is emerging will maintain the commitment to an IT-rich learning environment. Consideration is now being given to a Virtual Learning Environment (VLE) to be adopted across the university, as well as the use of more advanced digital facilities. However, student IT literacy is still seen as lying at the core of provision for students. The IT Baseline has evolved over time, and will continue to do so, in order to best prepare students for IT-rich learning experiences. Work with staff parallels these developments, with the involvement of staff in the IT-rich learning environment seen as a complementary objective to that of effective student IT empowerment.

The University has had, since 1994, a major centrally-funded programme to deliver student IT literacy. Passing through the programme is a requirement for all students in their first year of study. The programme is built around the notion of a minimum IT competency expectation for all students, the "IT Baseline" (the IT Baseline is now shared with both the other universities in Glasgow). A series of routes enables students to achieve the baseline competences, and a needs analysis procedure (now on-line) advises students of the route appropriate to their level of IT competence. The routes vary from a 12-14 hour Beginners course (tutor-led) through a Standard course of 8 hours (available in taught and on-line modes) and a fast-track course consisting of a 2-hour session coupled with on-line topping-up of skills, to a one-off test for those who already possess the skills and merely need to demonstrate them. There is also a procedure, which allows those who already have proof of their skills or are receiving the skills through courses within their subject departments to be exempted from the course requirement. All who successfully pass through the programme receive a Certificate of Basic IT Competence, which is recorded on their academic transcript. About 5,200 students pass through the programme annually. The programme is run by the IT Education Unit, located in the Information Services area. The unit also offers a programme of non-compulsory courses beyond the baseline, focused on student tasks such as laying out a thesis, preparing a CV, delivering a PowerPoint presentation, or creating a web page. The IT Induction Programme is operated in close co-operation with subject departments, and is delivered for the majority of students in departmental computer clusters by research students from that or cognate subject areas. For a minority of students, individual registration is required, and central clusters are used for delivery. For post-graduate students, there are also courses offered by the University Computing Service, focused mainly

on specific applications. The Computing Service directs its main training activity towards staff.

For the future, a number of developments are anticipated. After two years of development work, this year the IT Education Unit launched the on-line element of the student IT Induction Programme. This involves a series of integrated on-line applications: a needs analysis procedure which advises students of the most appropriate route for them through the programme; a linked registration system which allows students to sign on to an appropriate course; and on-line materials delivery system; and a three-stage system of on-line feedback questionnaires, one at the beginning of the course, one at the end, and a third four to six months after the course has been completed. Now that the Induction programme is running at its target level (all students in their first year of study – c. 5,200 per annum), further attention is now being focused on course provision beyond the IT Baseline. Whilst the Baseline programme is intended to prepare student to use IT effectively as students, consideration also needs to be given to preparing students for more advanced academic work, and for passage into employment. This may involve the development of further baselines or benchmarks, in which there will be more of a subject focus than with the IT Baseline programme. This work is being carried out during the present academic session. As mentioned above, the university is moving toward the adoption of a particular VLE to be made available to all students and staff, and when this choice has been made, IT Induction provision will evolve to ensure that students are prepared for confident VLE-usage.

The University of Glasgow is fully committed to maintaining its leading position as a provider, not only of student IT literacy, but of an IT environment in which students and staff can deploy the tools of the Information Age in the interests of learning. An IT guide issued to all students makes this point: "IT is an important tool which can be employed to make study more effective. For this reason a programme of courses offering general IT competence to all students has been developed since 1994. The courses making up the programme are open to all students of Glasgow University, and are free of change." (*IT for Effective Study*, 2001-2002 edition p. 21)

5.2. University of Gloucestershire

Cheltenham & Gloucester College of Higher Education (CGCHE), now the University of Gloucestershire, was formed in 1990. Located on three campuses in Cheltenham, the University will open a fourth new campus in Gloucester in 2002, responding to the need to widen access and participation in higher education in Gloucester. It supports over 9000 full-time and part-time students and approximately 1000 members of staff. Teaching faculties include Arts and Humanities, Education and Social Sciences, Environment and Leisure and the Gloucestershire Business School. The Uinversity offers a large variety of professional and vocational courses in areas such as Art and Design, Teacher Training, Management, Social Work and Community Studies. A number of modular undergraduate and postgraduate courses are also career orientated; they include Business Studies, Media Studies, Hospitality and Tourism, but more traditional subjects such as English and History are offered too. Of the diverse student population 80% originate from Gloucestershire and neighbouring counties, 25% are mature students, 5% are from ethnic minorities. The total population of international students is 280 (ca 3%).

The University's ICT skills provision is categorised as either programme/subject specific or generic. These categories are further divided into compulsory and voluntary. Programme specific compulsory and voluntary training consists of academic modules, which are available to all students irrespective of their final award. For example, the 'Learning Development' module, 'SF121', focuses on skills development relevant to the students' current academic and future professional careers. A further module, 'SF122', 'Transferable Skills', covers key C&IT skills necessary for the students' progression through their major and minor subject routes in levels two and three. This module is supported by a centrally produced workbook and must be successfully completed during level one. These skills based modules have been designed to introduce undergraduate students to some of the basic ICT skills necessary for the successful completion of their academic study and address a range of skills, both subject specific and generic. Voluntary generic training includes credit bearing academic modules, externally certified awards including the ECDL and non-credit bearing skills training. Beyond these courses, a Skills Support Team operates within the Learning Technology Support Department to provide specific advice according to student requirements.

There is a commitment to maximising the use of ICT to support and enhance student learning. Institutional responsibility for student ICT induction resides with several University committees. An ICT Steering Group considers the ICT strategy for the whole institution, The Teaching, Learning and Assessment Committee is concerned with how ICT is applied and integrated to support learning. Faculty Academic Standards Committees approve changes to existing modules and new module additions; Field Boards evaluate modules, which are subject to internal and external review. The Faculty of Learning and Information Services, through the Department of Learning Technology Support leads generic ICT skills training for both students and staff, offering an information skills programme, as well as CLAIT and ECDL. The LIS Faculty Management Team plans change for the future, responds to feedback from Field Boards and recommends good practice. Specific policies related to ICT development include an ICT policy, which has been developed to use ICT to enhance and support the development of learning, teaching, research, administration, and management processes.

The University is witnessing rapid development of modules delivered using on-line methods. On-line learning will play an increasingly important role in the academic environment.

In order to accomplish quality on-line training the development of on-line courses is under way. The changing student profile may result in the inclusion of more advanced and technically demanding ICT training sessions. Experience suggests that some students are arriving with more ICT experience and knowledge, which demands a continuous innovative adjustment of the ICT syllabus. Future directions include the incorporation of WebCT, the learning management system into the Learning Development modules. Through on-line training materials developments it is intended to integrate generic ICT training for staff and students. With regard to the important issue of 'graduateness', a project is in progress to develop student profiles for their skills development and participation in career management through the compilation of a personal development portfolio or 'personal profile'.

The University recognises student ICT as necessary graduate skill and Learning Technology Support promotes the benefit of acquiring a recognised ICT qualification, in order to provide evidence of competency. The notion of 'graduateness' deserves serious attention and there is pressure on graduates from employers to prove their transferable skills. The University recognises this and identifies and defines skills in module descriptors, indeed, the Teaching, Learning and Assessment Policy seeks to promote students' skills for lifelong learning and employability.

6. Conclusion

It seems clear that in terms of developmental patterns there is a growing maturity of consideration of student ICT literacy issues and provision. In strategic terms there is an acknowledgement that preparing students for effectiveness in the ICT-rich learning environment of twenty-first century higher education is a responsibility which institutions cannot ignore, and to which some institutional resource must be devoted. In organisational terms the vast majority of institutions have moved beyond a situation of piecemeal local provision into one where strategic initiatives at central or devolved level are leading to more comprehensive provision, whilst some institutions have reached a stage of consolidation in which a variety of structures is brought within a more holistic pattern. In terms of the way in which provision is perceived, there is increasing concern to give student ICT literacy provision a clear aim; whilst many concepts of ICT literacy are still application-focused, a growing number of programmes are based on a reflective model of appropriate usage of ICT tools to address study-related tasks.

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34 Developing a Strategic Approach to Using Online Learning in Vocational Higher Education: Using Action Research to Identify Factors Affecting its Adoption by Lecturers

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Abstract

This paper presents a case study of a strategic approach to developing online learning in a vocational university in the United Kingdom. Bournemouth University is no different to many other post-92 universities in the UK in the challenges it faces, which may be described as 'having to do more with less'. A significant example of this is having to support an increasingly diverse student population with shrinking resources. Learning technologies are being promoted to address some of these challenges and their increased use is a key priority within the University's Learning and Teaching Strategy. For the past three years, funding has been made available to support small-scale ICT projects, but their impact has been local rather than university-wide, and the lecturers involved are mainly the technology enthusiasts. The University is now considering how to encourage the majority of its lecturers to move towards adopting online learning. Research suggests that successful and widespread implementation of online learning in higher education, as with any technological innovation, depends on a number of factors. The introduction of a Managed Learning Environment (MLE) at Bournemouth happened concurrently with the re-focusing of the University's Learning and Teaching Strategy, so the opportunity was taken to meet with lecturers to discuss issues surrounding the adoption of online learning. The findings informed the revisions to the strategy. The investigation was situated within the author's research for a Doctor in Business Administration (DBA). The research methodology used was action research and the rationale for adopting this approach for the investigation is explored briefly, identifying some of the issues faced by the researcher in conducting research in her own organisation.

Keywords: online learning; strategic implementation; faculty views

1. The challenges facing higher education

1.1. Introduction

The context for extending the use of online learning in universities is often discussed with reference to a number of external, shaping forces.

The first of these is the broad political drive by governments to harness higher education to the needs of the economy. Through widening access to higher education and by promoting the concept of lifelong learning, more people are being attracted into higher education who would not traditionally have considered going to university. This changing concept of seeing a degree as a route to a job has led to many changes to the curriculum, including the incorporation of vocational and transferable skills (Coaldrake and Steadman, 1999).

The resulting increase in student numbers and growth in the diversity of the student population are additional factors encouraging universities to consider new patterns of curriculum design and more flexible strategies for learning and teaching. These are aimed at increasing access to learning from locations other than the traditional campus, for example, from home and from the work-place, and at times that are convenient to the individual student, not the lecturer. This greater diversity of student background is also resulting in the need to make changes to student support and guidance structures and processes. Students enter university with less well-developed study habits, needing a wider range of study and language support.

However, as the number of students entering higher education has risen, so have the costs, while the corresponding per capita funding from government has fallen consistently for two decades. Universities are forced to seek more efficient ways to deliver education and to generate income from a wider range of sources, for example, from business enterprise. The higher fees contributed by international students, either on campus or in their home location, have become an important source of income, but this, together with home students contributing more to their fees, is resulting in a growing emphasis on customer orientation in universities. Students are one group among a rising number of stakeholders demanding greater accountability from universities (Coaldrake and Steadman, 1999; Watson, 2000).

Many universities are looking towards an increased use of ICT to address these challenges, and Bournemouth is no exception.

1.2. The growth of Bournemouth University

The specific ways in which these challenges are being addressed by Bournemouth University are a reflection of its history and educational philosophy. Bournemouth University is a vocational university on the South coast of England. It aims to be "a pre-eminent vocational university well founded in terms of educational equality and student appeal;" (Bournemouth University, 2001, p.5). It currently has around 8,000 thousand full time students and 4,000 part time students and about 1000 full time staff. Approximately half are lecturers within seven Schools that reflect vocational areas rather than traditional academic disciplines. The other half constitute management and support staff. One of the largest Support Services is Academic Services, in which the author is located.

The University was originally an institute of higher education, administered until 1988 by a Local Education Authority. Following incorporation it obtained polytechnic status in 1990, and was awarded its charter as a university in 1992**.** During this time the organisation underwent a period of rapid growth and change, experiencing a highly centralised system of management. For the last seven years, however, following the appointment of a new Vice-Chancellor in 1995, there has been a gradual shift towards a more open and collaborative style of management. The lengthy process of seeking staff views on the development of strategic plans is a reflection of this changed approach.

Since 1995 a process of financial devolution has also been taking place, as budgetary control of resources has transferred from the centre to each School. Schools are credited with income from which they pay their staffing and other direct costs, and contribute to the University's overhead, including the Support Service costs. This has placed an increased responsibility on Schools and Support Services to provide a sound rationale for their activities and financial allocations.

1.3. Meeting the challenges at Bournemouth

The challenges for universities outlined in 1.1 are being addressed by Bournemouth in a distinctive way with reference to its mission.

In response to the widening participation agenda, Bournemouth has committed to developing higher education through partnerships with local further education colleges. The innovative way in which this is being undertaken has been recognised through substantial funding from the Higher Education Funding Council for England for a project to develop a common learning infrastructure across the partnership.

Attracting funding through diversifying income streams is resulting in more staff being encouraged and enabled to engage in income generating research or consultancy, which has implications for the way in which learning and teaching activities are structured.

Bournemouth has a well-deserved reputation for innovative approaches to providing student support which recognise the diverse needs of students with disabilities, international students and those returning to study (Capstick and Fleming, 2002; Durkin and Main, 2002. A key element of its vocational approach is to provide students with the opportunity of developing their employment skills and competence to a high level.

1.4. Strategic development of the use of ICT

Learning technologies are being promoted to address some of these challenges and their increased use is a key priority for senior managers at Bournemouth, so attention is being paid to ways in which lecturers may be motivated and supported to use them. It is recognised that strategies for enabling change to occur in encouraging the greater use of technology should take into account issues including organisational structure (Bates, 1997) and the individual preferences and motivations of those affected by the changes (Moore, 1991; Collis, Peters and Pals, 2000). The complex influence of the decentralised nature of academic culture should also be taken into account (Bottomley et al, 1999; Coaldrake and Steadman, 1999; Taylor, 1999)

Two key aspects relevant at the organisation level are the vision and support of the senior management, both at the executive level and within faculties, and appropriate deliberative structures, again at university level and faculty level, where issues relating to online learning may be discussed and policies agreed. The Pro Vice Chancellor Academic, and Heads of Learning and Teaching in the seven Schools in senior posts all act as 'champions' of online learning. The Learning and Teaching Development Committee has been constituted as sub-committee of Senate.

Another key contributing factor to developing online learning is the allocation of sufficient funds, both at a central level and in faculties. Initiative funds for past three years has been made available for learning and teaching projects of up to £20,000. These projects must be approved by the Schools and show clear links to their Learning and Teaching Plan.

1.5. Central support from Academic Services

As well as having the vision and the structure to promote change, and a dedicated budget, another key feature to enable innovation to become embedded with the university is the need to provide support through organisational structures that can respond quickly (Bates, 1997). The location of this educational development support can be provided either through a central unit which services the whole university, through devolved support units established in faculties, or through a combination of both. It has been recognised that the organisational culture of universities leads to very decentralised institutions, yet the very nature of technological innovation demands a whole institution approach to its implementation. This has the potential to cause tension

between the faculties and the central units established to implement the change, if not carefully managed (McMurray, 2001).

At Bournemouth a central facility within Academic Services, the Learning Design Studio, was established to provide central support for online learning developments, but Schools also have been provided with funds to support lecturers' innovations. The support staff in the Schools are linked through a communication network facilitated by the Learning Design Studio.

The initial approach to encouraging lecturers to use ICT was to see the various elements of online learning as a set of building blocks from which they could select elements to try, depending on their pedagogical need. These elements included the development of subject web sites, the use of computer conferencing and computer assisted assessment. The impact of this approach has been largely local rather than university-wide, and the lecturers involved are mainly the technology enthusiasts, so the issue of scaling up is being addressed. The vehicle which is being proposed to achieve this is an in-house managed learning environment (MLE) known as BUBBLE.

2. Factors affecting lecturers' adoption or rejection of online learning

2.1. Introduction

The successful and widespread implementation of online learning in a university, as with any technological innovation in an organisation, depends on a number of factors. It takes time to achieve, the technology must be practical to use and supportive professional development must be provided (Somekh, 1998). Other factors influencing the adoption of online learning, identified with reference to research findings from the UK, USA and Australia, include knowing the motivation of your audiences and how the innovators differ from the mainstream majority (Johnston and McCormack, 1996; Steel and Hudson, 2001; Spotts, 1999; Collis et al., 2000).

Changing academic practice is always a complex process, especially at a time when perceptions of academic work are changing (Martin, 1999; Coaldrake and Steadman, 1999; Taylor, 1999). In order to promote change at the individual level, appropriate staff development for new teaching methods should be in place (Bates, 1997; Cox et al. 1999). Since academics are being encouraged to learn to use the technology and develop appropriate pedagogical approaches, in the face of uncertainty or scepticism about its value to student learning and its impact on the academic workload, development opportunities should concentrate on changing conceptions of learning and learners, and then demonstrate how technology may be used to promote learning. (Taylor, Lopez and Quadrelli, 1996, pxiii). But even if an appropriate staff development programme is in place, academics need to see that putting effort into changing their teaching practice is valued and that the effort is rewarded.

2.2. Context at Bournemouth

The introduction of the MLE, BUBBLE, happened concurrently with the re-focusing of the University's Learning and Teaching Strategy, so the opportunity was taken to meet with lecturers and their managers to discuss issues surrounding the adoption of online learning. Information gained from these interviews was used to inform the revisions to the strategy, both in its written form and in its implementation.

This paper presents the findings from that investigation and includes an examination of the role of online learning as viewed by lecturers in a vocational university.

2.3. Identifying lecturers' views about online learning

The aim of the study was to explore lecturers' views about online learning and how Bournemouth, particularly in the context of its vocational curriculum, might encourage its further use. Within the overall strategy of an action research approach, a range of methods was used to collect data from different sources. These including a group interview with lecturers from different subject backgrounds, individual interviews with senior managers and observations of meetings during which a pilot version of an in-house MLE was demonstrated. This papers covers the analysis of the group interview and the BUBBLE meetings to provides the information. The eight lecturers who took part taught vocational subjects underpinned by science, social science and humanities disciplines from six of the seven academic schools. They taught on undergraduate and postgraduate programmes. Four were female and four were male. They were invited to take part on the basis of their use of online learning, as known to the author. Their experience and motivations covered explorers, non-explorers, transferers and non-transferers (Collis, Peters and Pals, 2000).

2.4. Approaches to the use of online learning

When asked what the term 'online learning' meant to them, the lecturers gave a range of examples which revealed, initially, that they conceived of it predominantly as a tool for knowledge acquisition. One suggested that "learning on the web is no different to learning from a book". However, as the discussion continued, they began to suggest that they also perceived it to be an important tool for developing students' skills, both cognitive and transferable. More examples were given which related to the ways in which students could develop communication and collaborative skills, a well as enhance their IT skills.

Two lecturers had used computer conferencing with their students. Initially, both had used it as a means of providing

their lecture notes to students, but one admitted that although all her notes were on the web, she was "not quite sure that this was an advantage". This was because "all I am doing is replicating what I am telling them, and its taking me double the time to put them on the web". The second agreed with her and reported that she had decided not to make her lecture notes available next year but to use the conferencing tool as a vehicle for discussion and debate, not as a 'depository'. Another lecturer described how her students had set up their own web site and shared resources through it. Online learning was viewed as one among many tools for teaching. It was referred to several times by the lecturers as 'complementary', and 'a tool'. The primary task for the lecturers was seen to be identifying the learning outcomes that had to be achieved and then making use of different teaching strategies to help students achieve those outcomes. One summarised this view when he suggested that "It (online learning) is a parallel and not a replacement mechanism and it doesn't suit all subjects, lecturers, learning outcomes or students."

They also suggested that online learning could benefit certain groups of students. Apart from recognising that online learning can support distance learning generally, it was acknowledged that it can also provide access to resources for students who find it difficult to get to the campus, for example, mature and part-time students, and that it could also be used to support students on work placement. There was also some recognition that other individual preferences might be met. Online learning was seen both as providing an opportunity for those who found it difficult to voice their opinions in seminars, but also possibly as a limitation for those who were good at face to face debate.

However, the lecturers were concerned that students, who came to university for the social experience, would start to question the value of a course at Bournemouth if they came to a campus university and found much of the learning undertaken online. The concept of the student as paying customer of the university was also evident, one lecturer reported that "I have noticed over the past three to four years an increase in students demanding one to one relationships. If they don't get it in the seminars, they will go and stand outside your door until they do get it."

2.5. How to encourage the use of online learning – views from the lecturers

The lecturers were then asked what factors encouraged or hindered greater use of online learning at Bournemouth. The ones they identified included the need to see the University's overall strategy for online learning, having the time and resources to engage with it and feeling supported in their attempts to use it. These were similar to those identified in other studies (Bottomley et al., 1999; Collis and Moonen, 2001).

The strategic direction for online learning at Bournemouth was questioned several times during the interview. There was a suggestion that the strategy was neither clearly articulated, nor was there an obvious rationale for its use. Furthermore, some existing online developments were criticised because they appeared to have been introduced without thought for how they should be used.

2.6. Support for developing online learning

None of the lecturers suggested that online learning should not be part of the university strategy at all, but there was a strong feeling among them that its use should be regarded as complementary to face to face teaching. The choice of when and how to use it should be left to the individual lecturer. They did recognise that perhaps they did not know enough about how it might be used most effectively and that it was difficult to find out what was going on in the rest of the university. There was strong agreement from the group with the lecturer who said that she had never been in such an isolating job.

They recognised that there was a need for more support to help them use online learning. A specific kind of support was referred to, in which technical expertise was combined with the ability to design curriculum support materials. The term 'consultant' was used, implying someone to whom you could hand over your subject content and who would not only turn it into an online resource but also give you guidance on the best way of using online learning to achieve your goals. This was linked to the idea of recognising that lecturers should be valued as specialists in teaching and was contrasted with the recognition given to those undertaking research, "That's important in terms of how you feel valued. There is a tendency, certainly in my School, if you are not doing research you are looked on as if you are something on the bottom of someone else's shoe, but actually, there are people doing research who really shouldn't teach."

2.7. Ease of use of the technologies

There were relatively few concerns expressed about actually using the technology itself. The more technically knowledgeable innovators expressed concern about narrow bandwidth and the need to accommodate of a range of web browsers, which prevented easy access to online resources by students from off-campus in the short term. The scale of facilities currently on-campus was also recognised as a limiting factor. One lecturer recognised that just putting lots of material on the web was resulting in students printing it out, but he could see that his ideal of being directly online with students in a classroom required more terminals in more seminar rooms than available at present. The cost of continually updating IT equipment was also recognised as a constraint. The need for students to be able to upload their own web-sites to show-case their work was considered critical in several Schools.

2.8. Pedagogy of online learning

As the discussion above indicates, given the commonality of conceptions of learning and teaching afforded by the vocational nature of the disciplines taught at Bournemouth, there appear to be few subject areas where online learning would be regarded as totally inappropriate. Lecturers would seem to support its use, providing it complemented more traditional approaches in a balanced approach. It was recognised that it could contribute to knowledge acquisition and concept formation and that it could facilitate collaboration among students, as suggested by Coomey and Stephenson (2001).

The principle negative pedagogic factor attached to online learning appeared to be that it could lead to the reduction in face to face contact between lecturers and students, which might be detrimental to the development of students' vocational skills and might alienate students looking for the campus experience.

The findings from the interview were augmented with notes taken at meetings between Academic Services and each of the seven School executives at which at pilot version of BUBBLE was demonstrated. An even clearer expression of the underpinning value of a constructivist approach to learning emerged. Lecturers suggested that BUBBLE seemed to present a very transmission focused model of teaching. They asked "Is it just an electronic notice-board and "Where does the learning come into it?" or "How can interaction in the learning and teaching process be made more evident?" and commented that "It looks very content driven". In the light of this, they sought reassurance from the BUBBLE developers that they would consider how to design in opportunities for interaction to take place, and include spaces where collaborative activity could take place, and where students could display their best work on their own web-sites.

3. Using the findings to inform the development of an appropriate learning and teaching strategy and its implementation

The analysis of this data provided some key insights to inform the revision to the learning and teaching strategy. It suggested the four themes for the Learning and Teaching Strategy and it indicated some appropriate terminology to use. The analysis also suggested implications for the implementation of the strategy to promote the further use of online learning. The first of these was to re-schedule the development of various components of the MLE and the second was to look for ways in which engaging with online learning could be made more rewarding for lecturers. This led to the development of Bournemouth's first Learning and Teaching Fellowships scheme.

As a result of this research study, the revised Learning and Teaching Strategy was shortened to just four key priorities that could be explained more readily to academic staff as follows:

1. Emphasise the need to increase flexibility, with online learning as a component of that
2. Focus on enhancing collaborative learning and working practices, to develop employability skills
3. Encourage a supportive, student centred approach
4. Acting to maintain the highest quality of learning and teaching underpinned by an evidence-based approach

The findings also identified that, to be acceptable to lecturers at Bournemouth, online learning has to be seen as complementary to a range of other learning and teaching approaches. Within the strategy this was emphasised in the context of extending flexible learning opportunities, which could include online learning but was not synonymous with it.

The need for greater flexibility in learning and teaching as a way of securing greater efficiency in teaching delivery was also emphasised, but it was not suggested that online learning alone would achieve this, but that it could be achieved through a broad approach to curriculum redesign.

As Sfard suggests: "It takes a common language to make one's position acceptable, or even comprehensible, to another person." (Sfard, 1998, p9)

The study also highlighted some implications for Academic Services in the continuing development of the MLE project. Greater priority was given to developing a conferencing facility rather than concentrating solely on document publishing, in order to facilitate the creation of a learning environment that facilitated participation and collaboration, as well as knowledge acquisition.

Many UK universities have begun to address the issue of recognising and rewarding lecturers for the effort of engaging with the agenda, and the funding recently received from HEFCE for implementing human resources strategies has often been used to establish fellowships or prizes. Criteria were development for Bournemouth's Learning and teaching Fellowship scheme which draws on this funding.

4. The value of action research as a method of inquiry

The study reported in this paper is part of on-going research undertaken by the author for a Doctorate in Business Administration at Bournemouth University. Action research was adopted because the starting point for the research was grounded in a real-world issue, it was attempting to identify the factors influencing the adoption of online learning in a vocational university. If the findings were going to be useful in improving practice, they had to be derived from a collaborative approach involving the author not as neutral observer but as participant in the research. Action research takes it strength and value in researching professional practice because theory is generated from practice (Coghlan

and Brannick, 2001; Ellis and Kiely, 2000; Greenwood and Levin, 1998). It is also a cyclical process of planning, acting and evaluating. This paper considers findings from the first cycle of the research activity.

The tensions arising from undertaking research in my own organisation were similar to those identified by Coghlan and Brannick (2001). All the way through the study it was often difficult to define the research question separately from the management task of revising the learning and teaching strategy. This led to the strong possibility that that bias influenced the findings. In the data collection, lecturers may well have told me what they thought I wanted to hear, and in the analysis, I may not have been sufficiently objective. There was also the tension between the need to present findings in the public domain while respecting the confidentiality of those involved. The process of undertaking the research did lead to greater insight into relationships with colleagues and an understanding of the differing perceptions about the nature of work in a vocational university from the standpoint of academic staff and support staff. This insight has led the development of work in the second cycle of the research to investigate further the nature of the academic culture and the climate for change at Bournemouth.

References

Bates, A.W., 1997. *Restructuring the university for technological change*. Paper presented to the Carnegie Foundation for the Advancement of Teaching, 18-20 June, London. Available at: http://bates.cstudies.ubc.ca/

Bournemouth University, 2002. Strategic Plan 2002/3-2005/6.

Bottomley, J., Spratt, C., Rice, M., 1999. Strategies for effecting strategic change in teaching practices: Case studies at Deakin University. *Interactive Learning Environments*, 7 (2-3) 227-247.

Capstick, S. and Fleming, H., 2002. Peer assisted learning in an undergraduate hospitality course: second year students supporting first year students in group learning. *Journal of Hospitality, Leisure, Sport and Tourism Education,* 1 (1) 69-75 (available online at http://www.hlst.ltsn.ac.uk/johlste)

Coaldrake, P. and Steadman, L., 1999. *Academic work in the Twenty-first Century: Changing roles and policies.* Canberra: Higher Education Division, Department of Education, Training and Youth Affairs. http://www.dest.gov.au/archive/highered/occpaper/99H/academic.pdf. Last accessed 28th January 2002

Coghlan, D. and Brannick, T., 2001. *Doing action research in your own organisation*. London: Sage.

Collis, B., Peters, O., and Pals, N., 2000. Influences on the educational use of the WWW, Email and videoconferencing. *Innovations in Education and Teaching International,* 37(2) 108-119.

Coomey, and Stephenson, J., 2000. In Stephenson, J. ed. 2000. *Teaching and learning online: pedagogies for new technologies*. London: Kogan Page.

Cox, M., Preston, C. and Cox, K., 1999. *What motivates teachers to use ICT?* British Educational Research Association Annual Conference, University of Sussex at Brighton, September 2-5 1999.

Durkin, K and Main, A., 2002. Discipline-based study skills suport for first-year undergraduate students. *Active Learning in Higher Education*, 3 (1) 24-39.

Ellis, J. H.H M. and Kielly.J.A., 2000. Action inquiry strategies: taking stock and moving forward. *Journal of Applied Management Studies*, 9 (1) 83-94.

Greenwood, D. J. and Levin, M., 1998. *Introduction to action research: social research for social change*. Thousand Oaks, Cal.: Sage.

Johnston, S. and McCormack, C., 1996. Integrating information technology into university teaching: identifying the needs and providing the support. I*nternational Journal of Educational Management,* 10 (5) 36-42.

Littlejohn, A. and Cameron, S., 1999. Supporting strategic change and cultural change: the Strathclyde learning technology initiative as a model. *Association for Learning Technology Journal,* 7 (3) 64-74.

Martin, E., 1999. *Changing academic work: developing the learning university.* Buckingham: SRHE & Open University Press.

McMurray, D.W., 2001. The importance of 'goodness of fit' between organisational culture and climate in the management of change: a case study in the development of online learning. *Association for Learning Technology Journal*, 9 (1), 73-83.

Moore, G.A., 1991. *Crossing the chasm*. New York: Harper Business.

Sfard, A., 1998. On two metaphors for learning and the dangers of choosing just one. *Educational Researcher*, 27(2) 4-13.

Somekh, B., 1998. Supporting information and communication technology innovations in higher education. *Journal of Information Technology for Teacher Education*, 7(1) 11-31.

Spotts, T.H., 1999. Discrimination factors in faculty use of instructional technology in learning and teaching: the perceptions and experiences of teaching staff. *Educational Technology and Society*, 2(4) 92-99.

Steel, J., and Hudson, A., 2001. Educational technology in learning and teaching: the perceptions and experiences of teaching staff. *Innovations in education and Teaching International,* 38 (2) 103-111.

Taylor, P., 1999. *Making sense of academic life: academics, universities and change*. Buckingham: SRHE & Open University Press

Taylor, P. G., Lopez, L. and Quafrelli, C., 1996. *Flexibility, technology and academics' perspectives: Tantalising tales and muddy maps*. Canberra: Higher Education Division, Evaluation and Investigation Program, Department of Employment, Education and Youth Affairs,: Australian Government Publishing Service.

Watson, D., 2000. *Managing strategy*. Buckingham: Open University Press.

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35 Virtual Campus – Trends and Perspectives in Germany

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Abstract

In the last few years in Germany virtual campus initiatives have been funded considerably. In our paper we will give a review of comments and recommendations of the advisory boards in higher education policy and of the various funding schemes on the level of the federal states and the federal government. An analysis of the current program „New Media in Education" indicates trends of possible developments as well as hindrances in the virtualization of higher education.

Keywords: virtual campus, higher education policy, evaluation

1. Introduction

The possibilities of the new information and communication technologies for information, learning, communication, and cooperation are manifold. Since several years, this is a challenge for the whole educational area, and especially for higher education (HE). In the mid nineties there was a first survey on the organisation of media based teaching in German higher education. This survey (Lewin et al., 1996) documented 979 projects using new media for teaching. The authors state only singular activities of enthusiastic people with very few cooperations between institutions. In most cases the media were used as add ons to traditional forms of teaching, not using the full potential of the media.

It is assumed that this is a crucial backlag compared to international competitors (especially in the anglo-saxon area) in a global education market (Encarnação, Leidhold, & Reuter, p. 14, 2000). Not least to considerable public investments for the development and the utilization of virtual components in higher education, this situation has changed.

Today the challenge in higher education consists mainly of the necessity to find ways to integrate technological innovations in a highly differentiated educational system and to adapt them into the inherent logic of the system. Thus we deal with processes of change for the organisation as a whole. German institutions of higher education at present pass through such processes of adaptation and further development.

Germany has a highly differentiated higher education system, with about 90 universities, more than 100 Fachhochschulen (universities of applied sciences), and a number of teacher training colleges and academies for vocational training. Distance teaching is offered by the Fernuniversität Hagen and some dual mode universities. Compared to activities in other countries, these institutions did not take increased initiatives in introducing new media for teaching and learning.

Ultimately it is not astonishing, that respected advisory boards have commented on the possibilities and consequences of the use of information and communications technologies in higher education, like the Science Council (Wissenschaftsrat, 1998), the „Bund-Länder" Commission for Educational Planning and Research Promotion (BLK, 1998, 1999, 2000) and the Association of Universities and other Higher Education Institutions in Germany (HRK, 1997). They all agree that use of the new media will become a structural and competitive factor for institutions of higher education. It can be stated that in the last four years political decisions took these recommendations into consideration and the situation has changed completely.

They emphasize the necessity to expand the infrastructure in higher education, and to coordinate the activities of central service institutions (like libraries, computer centres, media labs) in order to offer new services

- to develop multimedia material,
- and to use (and reuse) the materials at various locations.

Two aspects have to be mentioned as they can be found throughout the recommendations. Unanimously it is stated, that there is a good chance to improve the classical face-to-face situation by virtual components. As the central idea guided self-study is mentioned. On the other hand it is stated, that the realization requires an appropriate level of media competence of the teachers.

Both aspects also can be found in the current discussion on reforming HE in the anglo-saxon area. The Dearing-report (NCIHE, 1997) in Great Britain deals among other things thoroughly with the role of new media. Again there is mentioned first of all the improvement of the quality of teaching, greater flexibility for students, and better efficiency of teaching. On the short range considerable costs for investments are expected and only on the long range possible cost reductions are seen. Even in the United States, where virtual universities already act on the market, the necessity is seen to develop media competence of the teaching staff with public support (see WEBC, 2000, with the demanding subtitle "Moving from Promise to Practice").

In our paper we will try to map out the emerging landscape of virtual teaching and learning in higher education in Germany, which is one result of our work in the project 'kevih'.

2. The 'kevih'-project

The use of multimedia and telemedia at German universities and colleges is linked with high expectations. With a national funding scheme and corresponding federal activities a rather developed and differentiated scenery is observable. In order to get an actual and precise picture of this scenery, a horizontal project was established within our national funding scheme: kevih - concepts and elements of virtual higher education (http://www.iwm-kmrc.de/kevih).

The aim of the project is to survey, describe and analyze the current situation with reference to pedagogical, curricular and technical aspects, and to show prospects for potential developments:

- recording, investigating and presenting the state of the art, as far as 'virtual' institutions of higher education in Germany are concerned,
- analyzing existing models of organisation, proposing a framework for 'virtual' teaching in higher education in the German context,
- instituting a forum for information exchange and setting up networks of experts.

To achieve these goals we work on the following tasks:

- develop a system of relevant categories and criteria, based on international standards,
- describe and analyse existing developments, projects and initiatives on the basis of these categories,
- compile a database of relevant project informations, developments, and applications,
- evaluate the data, using curricular, pedagogical and technical criteria,
- identify those forms of organisation, concepts and elements of 'virtual' teaching which support innovative changes in the practice of training and further education, especially in pedagogical and technical terms and in the field of evaluation,
- analyse the concepts and existing forms of organisation of 'virtual' teaching in higher education, based on relevant literature and project applications on the background of existing (infra-)structural conditions in the Federal Republic of Germany.

Our analysis is based on the material of 546 proposals with more than 2000 project partners. It was assumed thus to have a nearly complete coverage of all activities in teaching and learning with multimedia and telemedia in German higher education, as only few institutions, persons, and initiatives have not bidded for funding in this scheme.

3. New Media in HE in the Federal States

In the last few years in German institutions of higher education many attempts have been made to introduce multimedia and telemedia. The resulting funding schemes have been shaped by the recommendations and predictions on the virtualization of teaching and learning in HE, given by the boards mentioned above. Due to the responsibility of the sixteen federal states, at first there was not one national program to coordinate these activities, but a number of funding schemes in most of the sixteen federal states. Here we will just mention the three largest. A comprehensive outline of the situation in the federal states is given in a very recent report (Kleimann & Berben, 2002).

3.1. Universitätsverbund Multimedia Nordrhein-Westfalen

The Higher Education Association Multimedia (www.uvm-nrw.de) is a competence network within which the cooperative development of software for teaching and learning is initiated. About 60 projects have been supported in a wide range of subjects as a result of five calls for projects. The resulting products are used in more or less traditional teaching settings. Nevertheless these projects have had already a catalytic effect, now leading to strategic decisions on the use of multimedia in several of the participating universities.

3.2. Virtuelle Hochschule Bayern

The Virtual Campus Bavaria (www.vhb.org) is a joint effort of the Bavarian universities and technical colleges. It bundles all their virtual courses and gives free access to all bavarian students as well as interested persons in continuing education. This offer helps to expand the range of courses at a local institution. A scientific board and project managers, supporting the participating institutions in the development of their courses, guarantee quality control. In semester 2001/2002 41 courses have been available in computer science, engineering, medicine, economics, and key qualifications. Other subjects are under development. Whole courses of study are not yet available.

3.3. Virtuelle Hochschule Baden-Württemberg

The Virtual Campus Baden-Württemberg (www.virtuelle-hochschule.de) is not a new university, but under this umbrella new organizational, didactical and technical aspects to virtualize higher education are developed and tested. Six large cooperative projects are funded to develop virtual components. Represented are all types of HE institutions (universities, technical colleges, pedagogical colleges, academies for vocational training) covering a broad spectrum of topics. It is intended to use the emerging final products in new contexts. With „Campus Online" a non-profit-making institution will be established in the near future to make

available the range of online courses for continuing education.

4. New Media in HE – The National Program

As a consequence of the recommendations mentioned above and in addition to the federal efforts, the German national government (BMBF) has set up some large new funding schemes – the flagship projects („Leitprojekte“) as well as the funding schemes „New Media in Education“ (with three areas of funding: school education, higher education, vocational education and training) and „Notebook University“. Thus in 2000/2001 the situation changed considerably. In total, the BMBF will invest about 430 million € over a period of five years (2000 – 2004).

4.1. Virtuelle Fachhochschule

In a federal flagship project twelve universities of applied sciences, two universities, federal employers association, unions, and businesses are working on the development of a Virtual University of Applied Sciences (http://www.oncampus.de). In the future it will offer programmes of study to students that are tailored both to their personal and career needs following a modularised study plan that combines courses which are available globally. It is intended that degrees of the universities of applied sciences will be internationally recognised. A second aim of the flagship project is to investigate the technical, organisational, pedagogical, psychological, social, economical and legal conditions of building a virtual university. In October 2001 started the programme in computer sciences (bachelor/master).

4.2. Vernetztes Studium Chemie

In a second flagship project on networked chemistry studies (http://www.vs-c.de/) interactive modules are prepared to support problem-based and inquiry-oriented types of learning. The project aims to cover the basic studies in chemistry, following the model of a reformed curriculum for chemistry („Würzburger Modell“). Addressees are students in chemistry, postgraduates in chemistry and related subjects, and interested persons in continuing education. A number of modules have been made available with free access (http://www.vs-c.de/beispiele/index.html).

4.3. Neue Medien in der Bildung

In 2000 the BMBF set up the funding scheme „New Media in Higher Education“. About 450 proposals have been submitted in 2000, 100 projects have started in 2001 (for a complete list of projects and partners see http://www.medien-bildung.net/). According to the political aim to support the use of teaching and learning software at German institutions of higher education until 2005, all of the 100 projects are networks, consisting of 546 individual projects. The average volume of funding is 1,86 million € (data provided by the Project Management Agency for New Media in Education, PT-NMB; December 2001). The establishment of networks as well as the integration of scientific associations as partners should help to avoid the “not invented here syndrome” and guarantee the long-lasting use of the products when the funding is dropped.

The challenge for higher education policy in this program was seen to design the content and develop concepts for use, rather than to support and channel the development of technical prerequisites, as the developments in Germany can be characterized as follows: Whereas information and communications technologies have for years been regularly used in academic research, the new media are now being integrated at a different pace into academic teaching where they are to serve as additional infrastructure or as an additional information and communication option.

A prerequisite for offering web-based multimedia education programmes is the willingness and ability of students and teachers to make optimum use of multimedia technologies. In order to achive this, some fundamental criteria were formulated (BMBF, 2000, p. 19), which should be fulfilled by all projects applying for funds, i.e.

- The concept must include processing of relevant content for presentation by the new media, and methods for media-based teaching.
- The concept must include the organization of the learning environment and communication elements, and it must integrate internal and external information systems.
- The projects must be part of a comprehensive concept (at the level of the federal states, inter-university collaboration, the institution or department concerned) for multimedia support of teaching, in particular when they refer only to parts of a study course.
- Quality assurance and evaluation must be an integral part of the project concept.
- In order to ensure sustainability, measures securing long-term maintenance of the product and its distribution must be planned right from the start, and there must be a clear intention to pay for use on a permanent basis from the institution's basic funding.
- Care should always be taken to ensure that these measures can be certified and/or reviewed.
- In order to avoid funding of software that cannot be broadly applied, for example, because it requires sophisticated technical equipment that may not be available everywhere, only those projects should be considered which, on submission of relevant proposals, promise potential for implementation in academic teaching.

5. The 'kevih'-analysis - First Results

Our analysis is based on the utilization of all project papers, which were available at the beginning of the funding period. Thus it mainly reflects the plannings of the projects involved. The central question of our project 'kevih' is the innovative potential of the funding scheme concerning didactical aspects.

Percentages, given in the following paragraphs, refer to the total number of 100 cooperative projects. Multiple mentionings were possible.

5.1. Changes of general conditions

Range: According to the criteria of the ministry, nearly all funded projects (92%) cooperate across boundaries of the federal states. It is striking that only few projects plan to act on a European level (4%) or even worlwide level (4%). Nevertheless about one third of all projects are developing their content in two languages and seven of them are producing it only in English. It turns out that international networks (at least with german partners) are not sufficiently established, even though a global perspective can be assumed.

Distribution of subjects: The distribution of subjects within the funded projects is as follows: mathematics/computer science 26%, engineering sciences 23%, medicine 20% are in the leading position. Social sciences and the humanities (14%) are clearly underrepresented and in the case of teacher training it is even worse (2%). Incidently this distribution is quite similar to the situation in Switzerland and Austria. Compared to a former analysis (Lewin et al., 1996) there is no significant change and the dominance of the technically oriented subjects could not be reduced. A possible explanation could be the missing media competence in the subjects in question. Though some projects try to compensate these deficiencies by outsourcing technical work packages to external partners (33%), mainly from industry. Another way to better involve these subjects is shown by the University of Basel (Switzerland). There a central service is offered (see http://www.unibas.ch/lehre/) giving advice and training, as well as support for the development of media based teaching materials.

For the German higher education system it is remarkable that only in 5% of the projects universities of applied sciences are involved (in total numbers there are twice as much of them as universities). This is unexpected, as in the past they were much more open to innovations in teaching.

Target groups: The funding scheme is addressing students in basic courses and main courses of studies as the main target group of (76%). Flexibilisation by the independence of time and space indicates a general reaction on the changing circumstances of living. Thus two thirds of all students nowadays are forced to practise a regular gainful activity to earn their living (Schnitzer et al., 2000).

In addition to basic and main studies there are also master studies on the offer (8%) and other graduate studies (6%). So far the sector of scientific continuing professional development was rather neglected by the German universities and colleges. Since several years therefore commissions of higher education demand from the institutions a stronger focus on this target group as a part of life long learning. After all more than half of the projects (52%) indicate, that in addition they will develop offers for continuing professional development.

Sustainability: To ensure sustainability a set of preparatives are advised. Thus 72 projects embed their products in the degree course schemes.

For the most part the virtual teaching materials cover standards in a particular field (56%). In many cases they are designed for further utilization. They are either relevant for other fields and subjects (42%) or they can be used within further education activities (52%).

More than half of the projects (55%) support technical sustainability with open source developments. Thus their products will be available free of charge after the end of funding and as a rule they are open for an ongoing support, as well as for changes and extensions.

Compared to that 48% of the projects are planning a marketing of their products in cooperation with industrial partners after ending of the funding period. Some projects expect that commercialization and charges of utilization partly will enable to finance the maintenance of the products. The return flow of money is expected to serve the long-term embedding of the virtual components in the regular teaching and learning context. Industrial partners in the ongoing development process are named only by five projects, that is industry is less involved in the development than in the commercial exploitation.

5.2. Changes in Teaching

Products: There is less a lack of technical tools for virtual education than rather of content and didactical concepts. One main aim of the funding program is to extend the availability of learning software, thus the projects put their main emphasis on the development of content (100%) and transferable didactical concepts (38%).

Size of products: most projects (83%) are producing teaching and learning elements, which can serve as independent modules for self-study or can be added to traditional lectures or classes. Compared to that the percentage of cooperative projects, intending to develop a complete virtual course of study is rather low (11%). It can be stated, that especially the development of integral modules, which can enrich traditional courses of study in a very flexible manner, open a high potential for changes in teaching. They can be used in different scenarios, ranging from self-organised learning to guided studies or cooperative learning.

Types of usage: The high potential of multimedia seems to be used on an elaborated level, when transfering the content to media. In many projects the content is visualized and made interactive by multimedia applications like simulations (57%), animations (51%), or hypermedia (48%). Concerning telemedia in most cases text-based applications are mentioned, like chat (38%), newsgroups (35%), or e-mail (29%), whereas technical more ambitious applications are mentioned more rarely, like video-conferencing (17%), video-lectures (12%), or application sharing (11%). Altogether the area of telemedia seems more technology-driven; only in a few cases the didactical integration of these applications were described. In contrast to the use of multimedia applications, there are fewer experiences with such examples of good practice, to which it would be possible to refer to.

Functions for teaching and learning: It is of special importance, how innovative techniques are used and which effects these have on the quality of learning. With the provision of multimedia and telemedia components the projects aim to enhance the availability of contents (85%), to make teaching objects more illustrative by using visualizations and animations (82%), and to improve the motivation of the students (74%). In total 74% of the projects expect an improvement of quality by using multimedia and telemedia materials. This is one consequence of the funding scheme, if we compare the concepts with those mentioned in the earlier report (Lewin et al., 1996): There it was stated, that most projects were limited to supply students with informations, like the download of lecture notes, hints for literature, appointments etc. Thus in most cases text based materials were made available in the internet. At that time only in the last place interactive courseware and cooperative work were mentioned.

Scenarios for teaching and learning: The analysis of the project materials has shown, that new media are not used as mere add-ons to traditional teaching and learning contexts, but can also induce structural changes. Thus hybrid scenarios are described, in which students learn as well in real sessions as in the "cyberspace", thus overcoming constraints in time and space. Thereof as a consequence changes concerning the methodological concepts of lectures become apparent. In the funding scheme not only expository teaching/learning media will be introduced (85%), but also teaching/learning media enabling the students a discovery (82%) or exploratory (71%) ways to proceed and to acquire knowledge. It has to be pointed out as a positive trend that to a growing extent (61%) group work will be built into the teaching/learning processes.

Course management systems: For the implementation of their teaching scenarios 50% of the projects go back to the help of course management systems. As recent workshops on this topic have shown, there is a great insecurity about these tools within the projects. This concerns the capabilities of these systems in general and also aspects of compatibility and reusability. In this area is a great demand for knowledge transfer, exchange of experiences and aids for decision-making.

Evaluation: In the proposals of the projects different preparatives for quality assurance are described. 66% of the projects will implement procedures for internal evaluation. 39% will charge in addition or exclusively external partners. Both formative (87%) and summative (66%) designs for analysis will be performed.

5.3. Promotion of Media Competence

For us the term media competence comprises – in addition to more technical oriented aspects of usage and operating new media – especially didactical and presentational aspects (Bett, Rinn & Wedekind, 2000).

About one third of the projects explicitly plan to introduce activities to support the development of media competence for the students (36%). A bit less it is planned for lecturers (30%) and for the developers (28%). About a quarter of the projects (26%) are planning internal advanced training courses for their staff – mostly as workshops, in order to transfer and to discuss specialist knowledge, i.e. that of computer scientists to educationalist or vice versa. Only particular projects describe far reaching concepts, like interdisciplinary working groups or the involvement of companies – those to which part of the developments are outsourced – to offer advanced courses for the staff. These concepts are steps in the right direction and should be extended even more.

For successful developments, for the gainful operation and usage of virtual or partial virtual teaching and learning scenarios it is a central or even indispensable prerequisite on the part of the developers, the lecturers, and the students.

6. Conclusions

The analysis of the project papers has yielded a number of further results, which cannot be reported here. Our complete report will be downloadable at http://www.iwm-kmrc.de/kevih/.

The first results of our analysis of the German situation show a diversified situation. The large number of projects indicates a variety of approaches, as well as different types of materials and teaching concepts. This variety seems adequate for the highly different topics in various subjects and for addressees with varying needs and learning styles.

As our investigation is based mainly on project papers applying for funds, we will follow the developments with tense interest. As an overall effect there is a chance that didactical concepts, the didactical functions of multimedia and telemedia components, and their integration in conclusive curricular concepts, which have been neglected in German higher education institutions far too long, make progress thanks to the incentives of this funding scheme.

Considering the statements and recommendations in German higher education policy as well as the funded initiatives on the national level and in the federal states, one can speak of a vehement effort to join or to keep up respectively with international standards in this area. There is a large degree of consensus, that information and communication technologies can enrich and improve the quality of teaching and that at least parts of the courses of studies can – and should be – virtualized.

Nevertheless, based on our analysis we come to a cautious conclusion: Concerning virtual campus Germany remains in an exploratory phase, and it is not yet clear, if the integration of ICT becomes established exhaustively in higher education. For three areas we want to provide further arguments to support this thesis: quality of teaching, media competence, and continuing education.

Teaching: Most engagement concerning Virtual Campus at present flows into the development of innovative teaching concepts and learning arrangements on the basis of ICT. It is striking that within the projects funded within the "New Media in Education" initiative the focus so far is more on the technical realization than on the didactical design. For us this indicates, that in the higher education institutions and their faculties there is a lack in technical infrastructure and services, which guarantee a trouble-free embedding of virtual components into the everyday routine of teaching. Furthermore there are positive basic approaches of networks, at least due to the fact that the projects all have a cooperative approach and thus are forced to work based on the division of labour. We have to admit though that we have found few clues, that with the actual activities really sustainable new organizational concepts for the faculties and the HE institutions as a whole are used as a basis. On the other side very often it is stated with reference to successful implementations, that it is just a knowledgeable technical concept and a well thought out organizational development plan, which are indispensable prerequisites for a long lasting success of virtual teaching (Pedró, 2001).

Media competence: Many of the current projects and initiatives to virtualize teaching also try to improve the media competence of the teaching staff. This is the only way that the teachers will have enough preparation to use the new elements in an innovative and meaningful manner, and to transform their own ideas and interests. At the moment the average competence is considered to be too low (Bertelsmann Stiftung, 2000). It is also very problematic that students do not necessarily have enough media competence to use the new offers adequately and without problems (Baacke et al., 2000). Of course it is an open question, if Germany can afford to wait for a new generation of teachers, as innovation cycles are getting faster. If virtual components for teaching and learning should have a broad acceptance in HE, a continuing education offensive is necessary for the staff in HE institutions, and not only within the funded projects. The corresponding efforts in the competitive economy can be a good example. As the necessary decisions and steps to taken for a whole organisation have to be based on a solid knowledge, especially the decision makers in the boards should have a good media competence.

Continuing education: Pedró (2001) gives an overview on the development of virtual campuses in Europe. He points out, that the most innovative concepts originate from HE institutions with a professional structure for continuing education. The development in Germany seems to be on a good way, as about half of the projects plan to offer courses for continuing education. Nevertheless the situation remains problematic, as continuing education is rated lower-level compared to basic study courses. The teaching staff first of all is obliged to ensure the basic studies. As workable legal fundamentals are missing for the payment of continuing education courses given within the HE institutions, to a growing extent the offers are organized off-site under conditions of the free market economy. In our opinion it is to follow the recommendation of the "Kultusministerkonferenz" (2001) and to find new regulations in this area, in order to use synergetic effects of the new media both in the basic studies and in continuing education. Without these regulations continuing education in HE institutions are in danger to remain in a shadowy existence.

As our stat-of-the-art analysis shows, german HE institutions are on the way, to integrate virtual elements in the studies. To ensure sustainability of these efforts and to give these actions a clear structure, there is an intensified need for strategic concepts within the HE institutions themselves. In addition more initiatives of the federal government are necessary to coordinate the process as a whole by cooperations. The comments and recommendations of the various expert groups and advisory boards remain trendsetting.

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References

Baacke D., K.-U. Hugger & W. Schweins (2002). *Neue Medien im Lehramtsstudium.* Bielefeld: Hochschulnetzwerk Lehrerausbildung neue Medien. (www.big-internet.de/download/Ergebnistelegramm.rtf, last checked: 20.3.2002)

Bertelsmann Stiftung, Heinz Nixdorf Stiftung (Ed.) (2000): *Studium online – Hochschulentwicklung durch neue Medien*. Gütersloh: Verlag Bertelsmann Stiftung.

Bett, K., U. Rinn & J. Wedekind (2000). Förderung von Medienkompetenz im Bereich der Hochschulen. In: Wunden, Klingler, Zerfaß, Hoffmann (Hrsg.): Medienkompetenz in der Informationsgesellschaft. Stuttgart, 2000.

BMBF (Bundesministerium für Bildung und Forschung (2000): *Bekanntmachung von Richtlinien über die Förderung von Vorhaben zur Förderung des Einsatzes Neuer Medien in der Hochschullehre im Förderprogramm "Neue Medien in der Bildung"*. Bonn: BMBF. (http://www.gmd.de/PT-NMB/, last checked: 20.3.2002)

BLK (Bund-Länder-Kommission) (1998): *Multimedia im Hochschulbereich - Erster Bericht der Staatssekretärs-Arbeitsgruppe*, Heft 63. Bonn: BLK.

BLK (Bund-Länder-Kommission) (1999): *Multimedia im Hochschulbereich - Zweiter Bericht der BLK-Staatssekretärs-Arbeitsgruppe,* Heft 76, Bonn: BLK.

BLK (Bund-Länder-Kommission) (2000): *Multimedia in der Hochschule,* Heft 85, Bonn: BLK.

Encarnação, J. L., W. Leidhold, & A. Reuter (2000). *Hochschulentwicklung durch Neue Medien - Vision 2005*. Gütersloh: Verlag Bertelsmann Stiftung. (http://www.big-internet.de/download/Szenario2005.doc last checked: 17.062002).

HRK (Hochschulrektorenkonferenz) (1997). *Neue Medien in Lehre und Studium.* Beiträge zur Hochschulpolitik 6/1997. Bonn: HRK.

KMK (Ständige Konferenz der Kultusminister der Länder) (2001). Sachstands- und Problembericht zur Wahrnehmung wissenschaftlicher Weiterbildung an den Hochschulen. *AUE-Nachrichten*, 2/2001, pp. 101-106.

Kleimann, B. & T. Berben (2002). *Neue Medien im Hochschulbereich – Eine Situationsskizze zur Situation in den Bundesländern.* HIS Kurzinformation B3/2002. Hannover: HIS.

Lewin, K., U. Heublein, M. Kindt & A. Föge (1996). *Bestandsaufnahme zur Organisation medienunterstützter Lehre an Hochschulen*. HIS Kurzinformation A7/96. Hannover: HIS.

NCIHE (National Committee of Inquiry into Higher Education) (1997). *Higher Education in the Learning Society (Dearing-Report).* Middlesex, UK. (http://www.leeds.ac.uk/educol/ncihe/, last checked: 20.3.2002).

Pedró, F. (2001). Transforming On-campus Education: promise and peril of information technology in traditional universities, *European Journal of Education*, Vol. 36, No. 2, pp. 175-188.

Schnitzer, K., W. Isserstedt & E.. Middendorff (2001). *Die wirtschaftliche und soziale Lage der Studierenden in der Bundesrepublik Deutschland 2000.* Hannover: HIS (www.his.de/soz16, last checked: 20.3.2002).

WBEC (Web-Based Education Commission) (2000). *The Power of the Internet for Learning: Final Report of Web-Based Education Commission – moving from Promise to Practice*. Washington: WBEC (http://www.ed.gov/offices/AC/WBEC/FinalReport/, last checked: 20.3.2002).

Wissenschaftsrat (1998). *Empfehlungen zur Hochschulentwicklung durch Multimedia in Studium und Lehre*. Köln: Wissenschaftsrat

5. Papers Track 4: Infrastructure

36 Developing ICT based Learningware for Physics

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Abstract

As part of an ongoing investigation into digital learning environments and into organizing higher education for the knowledge society, a learning environment has been developed. The learningware has been specifically implemented for an introductory Quantum Physics course in a traditional large university classroom setting. It is however conceived as a generic instrument, suitable for all science courses. The WEB component of the learningware, called "Phys4All" (http://physics.rug.ac.be/Fysica), has been designed using generally available software, thus creating an inexpensive generic tool. A flexible database structure allows for easy adaptation to specific needs of both instructors and students. As instructors can upload the appropriate materials for each specific student group, or can select different learning paths as required, the technology is disconnected from the learning environment.

Keywords: e-learning, multimedia, learning environment

1. Introduction

The trend toward life long learning coupled with demands for more flexibility in when, how and where learning occurs is increasingly pressurizing the traditional higher education institutions into changing their methods and delivery of instruction. While adopting commercially available learning platforms may seem a straightforward solution, introducing new technologies is not sufficient. More conceptually there is also pressure on higher education to renew and refresh its vision of teaching and learning in view of the latest learning theories. At Ghent University, the Centre for Research and Innovation in Physics Education (CRIPE) has been established with the aim of finding the best ways of adapting the new ICT inspired technological capabilities to modern insights in these learning theories.

The choice of physics has not been fortuitous. While physics is recognized as relevant to all science and engineering related curricula, it is perceived by most students as conceptually difficult. At the same time, the overall knowledge explosion is being used worldwide as a pretext to reduce the time allotted to the traditional "Introductory Physics" course in curricula such as engineering, medicine, chemistry and life sciences. Moreover, physics teaching is increasingly being blamed to be inefficient. Indeed, while traditional lectures in introductory physics contain all the ingredients required for knowledge transmission, Physics Education Research (PER) instigated and conducted over the last decade by front-ranking physicists themselves has abundantly demonstrated that such lectures provide few ingredients to support knowledge reception, use, and creation [McDermott, 1991; Redish, 1999; Lenaerts, 1997; Lenaerts, 1998]. Much of the current curricular reform effort in physics is therefore based on the idea of interactive engagement of students in heads-on and sometimes hands-on activities which yield immediate feedback through discussion with peers and /or instructors. [Hake, 1998; Mazur, 1997]. One of the authors (W. W.) obtained very encouraging results by introducing (in 1997) Mazur's Peer Instruction as a more interactive teaching style for an electromagnetism course. Perhaps surprisingly, this approach failed completely for the Quantum Physics course taught by the same instructor to the same students. These somewhat contradictory results provided the main motivation to search for a combination of traditional but nevertheless successful low-tech lecturing methods with the use of technologically advanced network delivered immersion learning materials.

2. ICT assisted Instruction

Physics as a discipline requires learners to employ a variety of methods of understanding and to translate from one to the other - words, tables of numbers, graphs, equations, diagrams, maps. Multimedia are particularly suitable for this role. Physics requires the ability to use algebra and geometry and to switch from the specific to the general and back. This makes learning physics particularly difficult for many students. It is however clear that some unique capabilities of computers can be used to implement hitherto inaccessible and possibly better instructional strategies: the graphic capabilities of computers almost demand to be exploited to present powerful symbolic representations, including dynamic representations of time-dependent processes and to enhance spatial thinking. With careful design, computers can provide powerful environments where students can explore new concepts actively on their own.

From the beginning of the computer age, physicists have been quick to adopt this new technology both for research and educational purposes, and a large body of physics learning software is now available. However valuable, most of this is "stand-alone", not integrated into a specific learning environment. On the other hand, existing learning environments are primarily text-oriented and while commercial authoring tools for producing Web-based learning environments have been available for some time, they were deemed unsuitable for our purpose. To begin with, commercial tools are expensive, being aimed at complete universities or at least at very large departments, and they often seem to be more concerned with administrative niceties rather than with sound pedagogical concepts. We wanted a tool that would allow easy inclusion of existing content, requiring minimal maintenance work for the lecturer and producing Web-deliverable materials for the students. We opted for a flexible database backbone for the instructor's input with an html output for the student's benefit. The database contains all "learning objects", which are very generally defined as digital or non-digital entities that can be used, re-used or referenced to during technology-supported learning [Wiley, 2000]. This allowed us to start up almost immediately, while fully exploiting the vast amount of legacy documents (lecture notes, exam papers, assignments from previous years, documentary slides, simulations etc) available in our physics department. By using all this material as learning objects a continuous and smooth transition from a paper-based towards a Web-based course was made easy. Requiring only a browser at the client side means no additional cost is involved for the students. The familiarity of our students with a browser environment is all the more important, as we had learned from previous experiences that many of them only reluctantly use course-specific software, however well designed. Although the WEB component could equally well be used for distance education we consider that coming to the campus in person remains important.

The flexibility provided by our instructional model allows for motivating the brightest students, while at the same time taking care of the less well-prepared students. The attention for these very best students is intentional, as we feel very strongly that pedagogical innovations often fail to take into account their specific requirements.

One of the most robust observations of cognitive research is that attentional focus is crucial to learning. Students often fail to learn in an educationally rich environment, because they fail to attend to the right things. Therefore the interface display of a learning environment should be optimized to direct the user's attention to the more essential features. The content is subdivided in small portions to prevent cognitive overload. We provide students with a learning path that represents a hierarchical structure; however students can bookmark their own path if they so prefer. The amount of material on the web gives the students the opportunity to create their own organization. Throughout the material questions and small assignments are provided that can be used either during the lectures or, alternatively, for Just-in-Time Teaching (JITT) [Novak, 1999]. JITT is a pedagogical strategy that successfully exploits a fusion of high-tech and low-tech elements. The WWW is used to deliver multimedia curricular materials and to manage electronic communications while the interactive classroom environment is maintained. The JITT system is built around Web-based preparatory assignments. The students complete these assignments individually, at their own pace and submit them electronically. The (traditional) lecture can subsequently be targeted to remedy the specific problems of that student group, thereby increasing its efficiency.

3. Physlets and simulations

One aspect of learning where computer technology has a major advantage involves Web-based interactive problems and animations. To be an effective tool they must foster an interactive-engagement approach so task setting becomes a very important element of the instructional design.

Browser technology now readily supports JAVA applets, small programs written in Java and embedded in HTML documents allowing interaction with the user. Such applets are ideally suited for physics instruction, allowing animation, changing of parameters, taking measurements etc. Combined with a scripting language like JavaScript JAVA applets provide us with very flexible interactive programs that can be adapted to various pedagogical activities. To emphasize the physics content of such script enhanced "physics applets", Wolfgang Christian [Christian, 1998] coined the term *Physlets*. Physlets are easy to use since they are based on standard non-proprietary Internet technologies. Depending on the degree of sophistication, they are also fairly easy to develop. Moreover, many physics instructors are making available downloadable versions, free for non-commercial purposes, so even those without JAVA skills can benefit. Using Physlets allows for better insight in the theory and creates opportunities for presenting to our students new types of problems that would have been awkward to formulate in printed versions. The use of JavaScript allows one to adapt a Physlet to the desired learning model and to the appropriate learning environment. This way the technology is disconnected from the learning environment and can be used by different instructors, creating a generic instrument. Physlet problems can be programmed is such a way that students must determine what they need to know in order to solve the problem before they even attempt a solution. This prevents students from fall back on the often successful but pedagogically counterproductive "guessing" strategy. Physlets can also be programmed to allow students to take readings of different instruments, thus simulating "real" measurements. As in real labs, students can be instructed to arrange and structure these measurements in tables and graphs and to produce lab reports. These traditionally important skills can therefore be trained outside a laboratory setting. Used in this way Physlets present a very cost-effective way of training laboratory skills. We found these virtual instruments to have another benefit: contrary to real

instruments, students do not find them "intimidating" and seem to be more willing to experiment freely, probably because they cannot do anything wrong with them. Moreover, while Physlets can simulate experiences from the real world, a number of real life annoyances, e.g. all kind of noise signals, can be left out, thereby allowing a more focused approach and allowing to create the exact experience the teacher requires. By manipulating the model through changing parameter values, the learner can control step by step how the Physlet is indeed a model for a real situation. Specifically, the option to choose non-significant values for the parameters, which cannot be done in real experiments, often contributes to a much better insight. The animation possibilities of Physlets allow a degree of insight in real problems that is unattainable with static texts or graphics, certainly not for inexperienced learners. less worried about making mistakes they seem more willing to experiment. Many interesting physical processes can't be properly visualized in printed form, e.g. many time dependent phenomena. For others the three dimensional world has to be reduced to a number of two-dimensional cross sections from which only the more gifted students can reconstruct the whole picture. Physlets allow us to give far more realistic representations, which can be manipulated in space at will. Since we first introduced Physlets to our students we had only very positive reactions, and we consider this aspect of our project to be highly successful.

As a cautionary note, we would like to stress here that Physlets can never displace real-life laboratories, and students should eventually be allowed to use real instruments. Familiarity with the appropriate Physlets will then smoothen the learning curve and increase the effective use of prime-time laboratory work.

4. Technical aspects and production tools

4.1. Database structure

Taking into account the pedagogical issues discussed above, a fully-fledged learning environment has been created and baptised Phys4All [Lenaerts 2001]. While all elements are accessible over the internet, for some of them the access is restricted by password or other protection systems. The core element is the database, therefore a lot of effort went into the choice of the most appropriate software. We finally selected FileMaker Pro, now in version 5.5, because it works very intuitively and it produces excellent html material without further user intervention. This last aspect was crucial for our choice and at the start of this project (in 1998) it was not easily available with other database software. In fact, Filemaker Pro contains a Web server so that setting up a dynamic database on the Web is an easy process. It also has a very powerful scripting language that allows communication from the Web between different databases.

The learning environment itself consists of a number of separate but related database files for course material, students, instructors and evaluation. These databases can be connected to the other existing databases like the departmental library and applet database. At any moment new databases can be added by simply setting them up and linking them to the existing ones. E.g. we recently added a "physics lab" database which allows the student to prepare the laboratories at home more efficiently. Filemaker Pro can produce XML output or be linked with other databases through ODBC making it an open tool for future evolution.

Access to the data is governed by both a user profile and an access mode, the main access modes being the "instructor mode", "student mode" and "general user mode".

4.1.1 Instructor mode

Instructors can access all databases, the most important one being the course database which contains the actual learning objects. For security reasons, the "instructor mode" is not only password protected but uses IP control to restrict access to specific computers. The opening screen of the course database, as shown in Figure 1, allows for a number of hierarchical choices ranging from adding a "new course", a "new chapter", a "new paragraph" or a "new file". Additionally, the learning objects can be attributed to one of three "levels". The main or course level corresponds broadly to the curriculum requirements of a specific student group, while the advanced level includes introductions to more difficult and rapidly developing topics (e.g. quantum computing, Bose Einstein condensation) and makes liberal use of advanced mathematics, e.g. Maple worksheets. The introductory level (not yet fully implemented) could be used for a non-science course, and also provides inadequately prepared students with the necessary background knowledge. Clicking the "add new file" button creates the link to the Web site where the document should be transferred to. The Web address is automatically generated and if so desired a preview of the Web page can be copy-pasted in the right half of the screen. Simultaneously the database updates a text file providing the necessary parameters to create a (collapsible) tree view of the course content on all Web pages. This procedure results in a neatly ordered Web site.

In instructor mode, any kind of material can be added or changed quickly and efficiently. Several authors can easily collaborate on the same course and there is no need for a prospective author to acquire any knowledge about the database software.

To allow for reliable updating and easy "recycling" of the learning objects, e.g. using the same file for different courses or different student groups at different levels, the learning objects themselves are not stored in the database, only pointers to the place holding the actual Web pages are generated. Instructors have also access to a special section of the database where announcements can be posted about important physics related topical matters and current events, e.g. background information about the Nobel prizes, new technological breakthroughs, historical and philosophical

perspectives on the ideas of physics, social and economical aspects.

4.1.2.Student mode

Basically the student database keeps all records about a student, i.e. personal data, study path and problem solving performance. A question database linked to the student database is available for surveys and for evaluations or, with the right feedback, for self-evaluation. The question database can accommodate all conceivable kinds of problems: simple multiple choice, multiple choice-multiple answer, multiple choice-open ended answer etc. Questions can be randomized and the database can generate series of questions to fit a certain student profile. Questions can also be interactively related to Physlets, and by generating some random numbers Physlet assisted problem scan be individualized. Every evaluation of the student is stored in a separate evaluation database. A FAQ database based on student's e-mail questions is also available. Recently we introduced the possibility for students to compose questions containing mathematical constructs using simple TeX commands. While students can still avoid TeX by typing e.g. "sqrt x", most prefer using it to produce $\sqrt{x}$, especially after we added an on-line TeX-command help file.

Using the problem solving environment instructors can introduce questions and students can provide answers via the Web. As instructors can monitor the results at all times, this is an excellent instrument to assist lecturers using "Just In Time Teaching" as explained before.

At the start of each semester a password is issued to every student allowing him or her access to the relevant parts of the databases as the course progresses.

4.1.3. General user mode

The Web page http://physics.rug.ac.be/fysica is the entry point to the freely accessible general user mode. In this mode most of the learning objects are available for viewing or downloading. Although all materials were produced with the traditional browsers Netscape Navigator and MS Internet Explorer in mind, we do not have the resources to guarantee 100% compatibility or to keep abreast with all browser developments. Therefore Netscape 4.7 or IE 6.0 are recommended. While Netscape 6.0 gives poor results the recently released Netscape 7.0, preview release 1, seems promising. Presently course material is available covering Thermodynamics, Electromagnetism, Quantum Mechanics and Statistical Physics. A search tool covering the whole Web site is also available. At the start of the semester, students can purchase both a course text and a Cd-Rom. The Cd-Rom is an image of the website at that particular moment, of course without the surveys and the test bank. Most students still find it important to have a "traditional" printed copy of the course text and they appreciate the Cd-Rom because at the moment many of them have only a slow (and expensive) telephone line to access the internet.

Some typical Web pages are reproduced in Figure 2. The tree view at the left of these figures gives an overview of the content of each chapter and can be made floating or minimized to allow a more efficient use of the screen. This tree view applet helps students to keep an overview on the course at all time, since in contrast to the fundamentally linear character of a traditional book, hypertext learning objects are non-linear, requiring users to make choices in searching for information. Pictograms reproduced at the bottom of each Web page assist an easy navigation through the Web site. All figures can be expanded separately to full page format. Icons indicate the availability of Java applets and advanced (level 3) material.

4.1.4. Production of learning objects

Mathematical symbols and equations present a particular problem in a html based environment. Converting them into pictures, e.g. in gif format, may be acceptable in short documents but rapidly becomes unwieldy for an extensive project. We therefore decided to adopt another approach, using the IBM TechExplorer software based on Latex and also adopted by symbolic programs such as Maple and MathCad. At the client side, this software, now in version 3.3, is freely available as a browser plug-in allowing easy viewing of mathematical symbols in Web documents [TechExplorer, 2002]. The use of TechExplorer guarantees beautiful mathematical typesetting as illustrated in Figure 2. Because TechExplorer is based on MathML, an xml implementation, the mathematical symbols load just as quickly as regular html text

While some instructors involved in this project produce documents directly in Latex, most prefer to use MS Word for text and MathType for equations. To facilitate the translation of these Word files into Latex a Visual Basic script has been written. As this procedure still required frequent interventions by a skilled technician the excellent commercial translator package Word2Tex has recently been adopted [Word2Tex, 2002]. For audio and video files any format accepted by standard browsers can be used.

Learning physics at an advanced level requires considerable mathematical expertise. Ghent University has a campus-wide license for Maple and our engineering students get introduced to Maple during their Calculus and Algebra courses, therefore we also adopted this package for the advanced level of the course. Maple allows exporting complete worksheets in HTML format, and can therefore be easily integrated in our project. An example of such a Maple worksheet is given in Figure 3. Students are issued a free copy of Maple, so they can use these worksheet to study the influence of different parameters. Such worksheets allow even users without any knowledge of Maple programming to produce parameter-defined graphical representations.

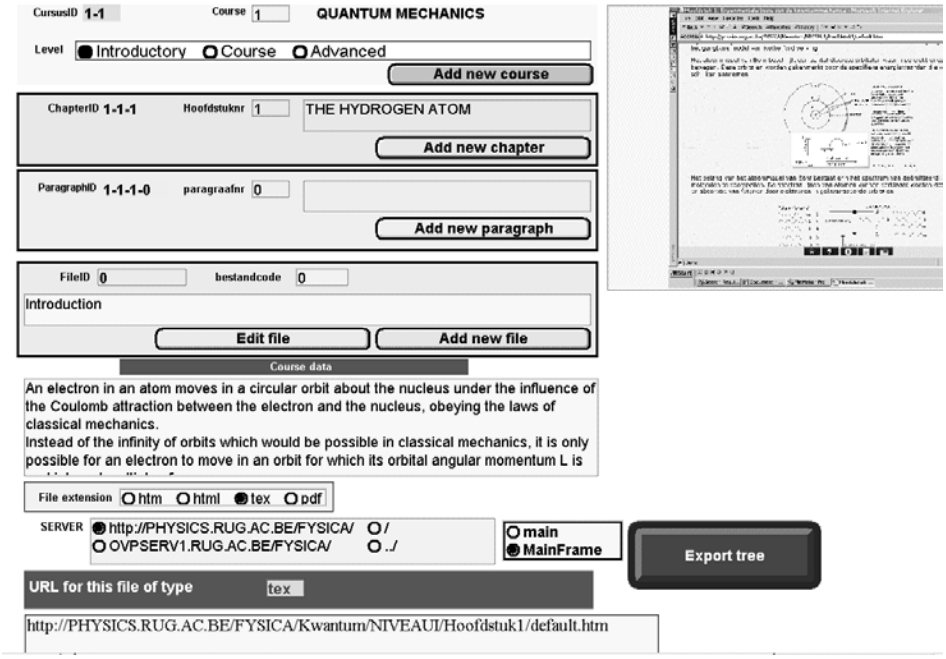

Figure 1: Opening screen of the Phys4All Quantum Physics course in instructor mode

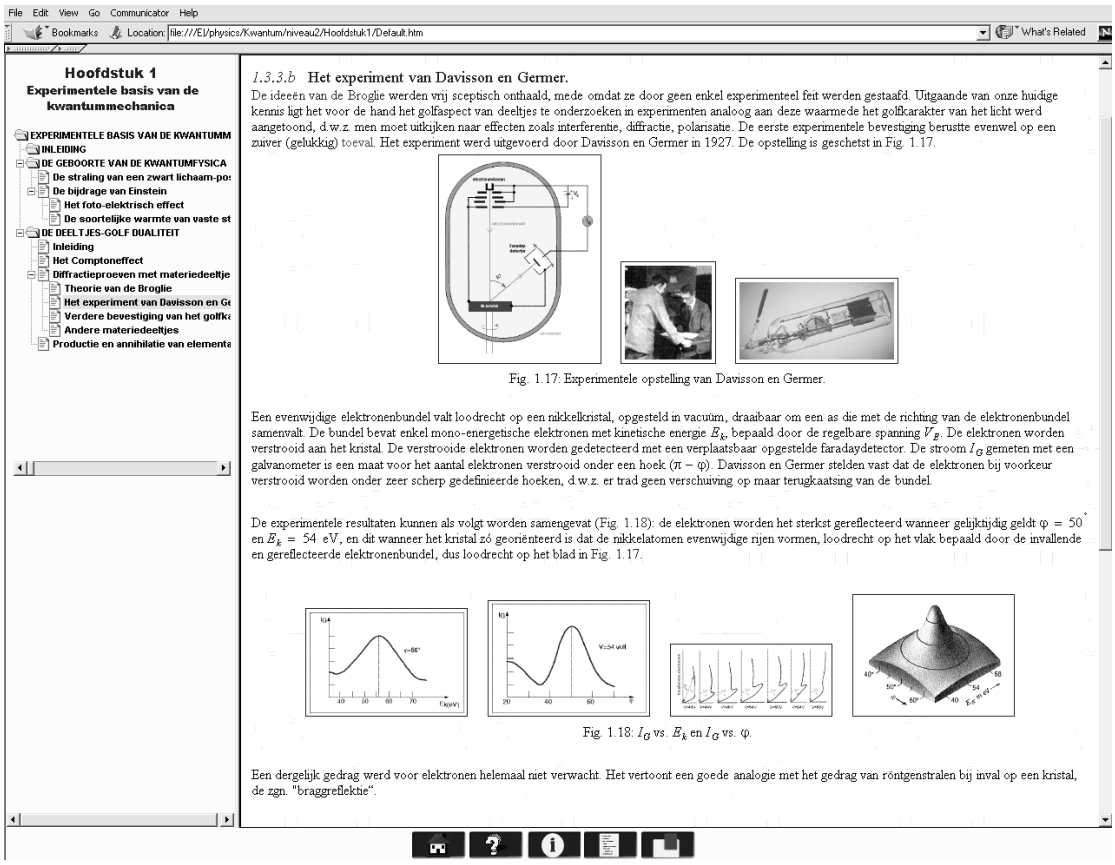

Figure 2a: Screenshot of a typical Phys4All Web page, with the (collapsible) navigational tree at the left

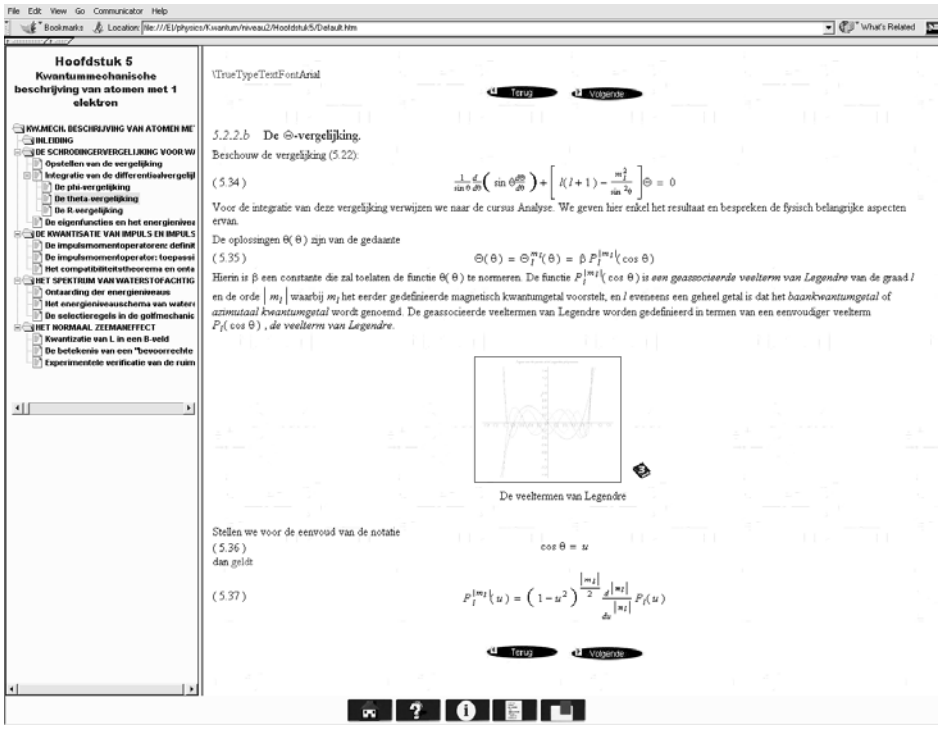

Figure 2b: Screenshot of a typical Phys4All Web page, with the (collapsible) navigational tree at the left

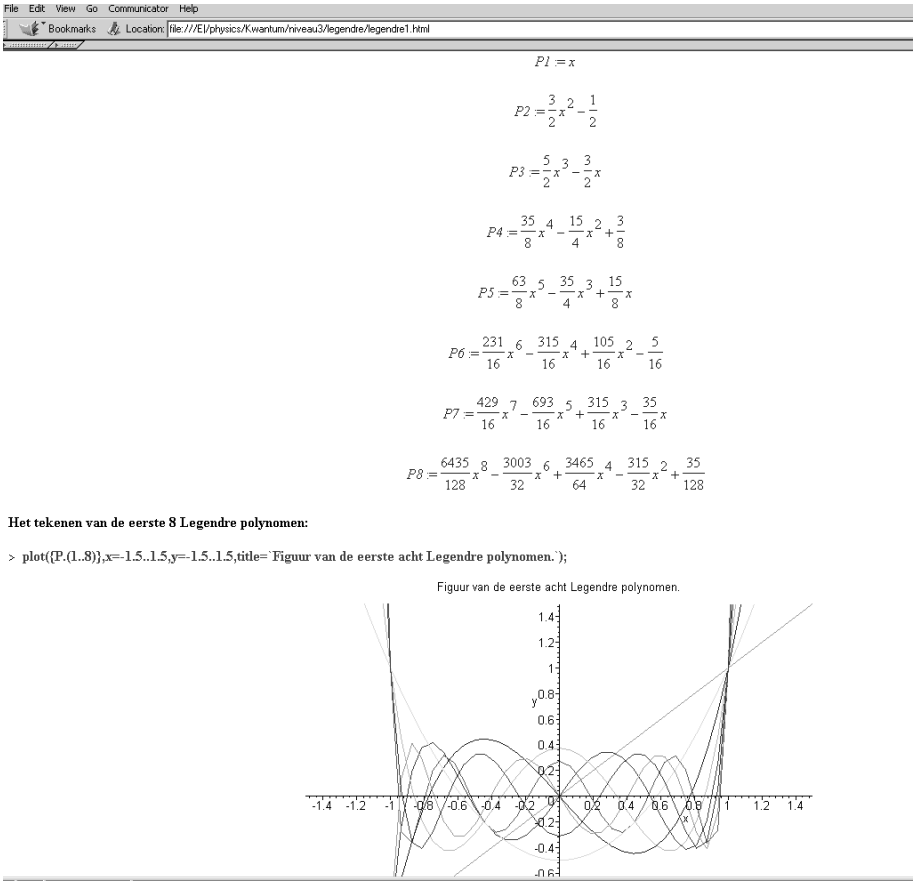

Figure 3: Maple worksheet (Phys4All advanced level 3) for calculating the Legendre polynomials mentioned in Figure 2b

5. Conclusion

In today's technology-driven world, more students than ever before should become familiar with the basic concepts, reasoning, and critical thinking of science. Unfortunately, all evidence points to the fact that students learn less than we intend them to and that bringing about conceptual change requires the introduction of new teaching (and learning) habits. We therefore developed Phys4All, a learning model and learningware based on the judicious use of ICT. Great emphasis has been put on the design and development of ICT-based media consisting of non-linear hypertext, Physlets, laboratory simulations, tests, FAQ and e-mail communication as a solid basis for research on student's understanding of physics and the use of new technologies for teaching and learning. Phys4All has been in development for three academic years and has been extensively tested in a large classroom setting and evaluated through a number of surveys. While most of the data have been collected using the authors' students as a test group, Phys4All is also being used by lecturers at other universities, not connected in any way with the development of the Phys4All project.

Students' use of Phys4All has been monitored and analyzed using Web server log data [Burton, 2001]. These data, together with results from surveys and interviews show that students clearly realize Phys4All offers a lot more than just "another course on a website" or a collection of tools, and they appreciate the added value. Test and examination results for the Quantum Physics course have significantly improved since the introduction of Phys4All. The overall outlook is therefore very positive, indicating that a judicious explicit integration of the use of new technologies can greatly benefit students as well as lecturers.

The database structure set up for Phys4All provides a generic instrument, adaptable to all physics courses, or even all science courses and to each lecturer's preference. As a learning environment tool, it is easily transferable as proven recently by colleagues from the Department of Mathematics who used our Phys4All learningware template to produce a new Web-based course for discrete mathematics in a very short time (http://cage.rug.ac.be/~vo/DiscreteWiskunde/NIVEAU2). Moreover, recently this mathematics course has been smoothly integrated into a Blackboard (http://www.blackboard.com/) environment, proving its is future proof.

Because by law the teaching language of Ghent University is Dutch, most of the material is - perhaps unfortunately for wider distribution - in that language. Nevertheless, anybody interested in using this material for educational purposes is invited to contact the authors for further information.

References

Burton M.C. & J.B. Walther (2001). The value of Web log data in use-based design and testing, *J. Comput. Mediated Commun.*, 6 (3) available online at http://www.ascusc.org/jcmc/vol6/issue3/burton.html

Christian W. & A. Titus (1998). Developing Web-based Curricula Using Java Applets, *Computers in Physics* 12 117-123

Hake R.R. (1998). Evaluating conceptual gains in mechanics: a six-thousand student survey of test data, *Am.J. Phys*., 66,64-74, 1998

Lenaerts J. & W. Wieme (1997). New trends in introductory physics education: an overview*, Physicalia Magazine*, 19 (2), 87-114.

Lenaerts J. & E. Van Zele (1998). Testing science and engineering students: the force concept inventory, *Physicalia Magazine*, 20(1), 49-68.

Lenaerts J., W. Wieme, F. Janssens & T. Van Hoecke (2001). Designing digital resources for a physics course, *Eur. J. Physics*, 23,175-182.

Mazur E. (1997). *Peer Instruction: a user's manual*, Upper Saddle River NJ, Prentice Hall

McDermott L.C. (1991). Millikan lecture 1990: What we teach and what is learned – Closing the gap, *American Journal of Physics*, 59(4), 301-315.

Novak G.M. E.T. Patterson, A.D. Gavrin & W. Christian (1999). *Just-in-Time Teaching: Blending Active Learning with Web Technology* Upper Saddle River NJ,: Prentice Hall

Redish, E.F. & R.N. Steinberg (1999). Teaching physics: figuring out what works, *Physics Today*, 52,(1), 24-30.

Techexplorer (2002). Free reader downloadable at http://www-4.ibm.com/software/network/techexplorer/

Wiley D.A. (2000) *Learning object design and sequencing theory*, PhD dissertation, Brigham Young University. On-line version available at http://reusability.org/read/

Word2Tex (2002). Version 2.4 available from Chikrii Softlab, http://www.word2tex.com

37 Dschola – a Regional School Network

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Abstract

Dschola is a regional project (set up in Piedmont, Italy) aimed at stimulating greater attention to ICT, by involving students, teachers and families in partnership with schools. It involves 2.828 educational structures and 50.000 teachers.

The Dschola school network consists at the moment in 18 excellence technical secondary schools and 5 excellence didactical schools, reference points for technological issues in their regional area and with proven experience within the ICT area.

Dschola aims to:

- Create and stimulate a virtual community of schools through the official Web site http://www.dschola.it
- Improve the excellence of the Centres of Service, Animation and Experimentation through experimentation activities
- Stimulate and sustain the training between teachers
- Enhance and improve the cooperation between the Centres and their territorial schools, as suggested by the slogan of the project: "Schools for schools"
- Stimulate and enhance schools' business skills and capacities in order to co-fund their own projects.

Keywords: network, ICT skills dissemination, cooperative work.

1. Introduction

Dschola is a regional project (set up in Piedmont, in the North West of Italy) started in January, 2001. It is aimed at stimulating greater attention to ICT, by involving students, teachers and families in partnership with schools.

The Dschola network consists of a selected group of primary and secondary schools, with proven technical and didactical excellence at regional level. Those schools disseminate their experiences and expertise towards all the schools in the region.

It is part of an experimentation directed towards the creation of the Regional Network of Piedmont School. It was set up by the Italian Education Ministry, Local Public Administrations and Universities. It involves 2.828 educational structures and about 50.000 teachers.

This three-year project (2000-2003) is totally financed by Fondazione Cassa di Risparmio di Torino, a Bank foundation that invested 21 millions of Euro and made the project possible.

The experimentation for the Regional Network of Piedmont Schools is articulated on three main action lines, that are coordinated with each other, in order to stimulate school and citizens to take part and understand the changes caused by the development of the Information Society.

CO-FINANCING OF ICT-BASED PROJECTS A "Call for proposal" was published in 2001 and a second call was published in spring 2002.

CONNECTIVITY WITHIN THE PIEDMONT GOVERNMENT NETWORK (The so-called "Universal Access"). Services are provided for every public and private school in Piedmont and include: safe and certified network communications, mail boxes, high speed Internet access for management, administrative and educational purposes, information systems and hosting for school web sites (free of charge for maintenance and connectivity), community resources, long-distance support and training activities.

CREATION OF SERVICE, ANIMATION AND EXPERIMENTATION CENTRES (The so-called Dschola project). Starting from their proven experience in ICT, a group of 18 secondary schools set up the required technical and organizational structures in order to become technological reference points in their local area. They are working hand-in-hand with the new school organization and process of gradual school-autonomy. Besides of these, 5 primary schools, with proven experience in didactics and educational methodologies, are in charge of organizing and fostering workshops, seminaries and conferences, in order to disseminate their own competencies.

More specifically, Dschola will support the gradual autonomy process within schools. It is geared to improve educational and organizational flexibility, to increase the responsibility of those who live and work in the school environment, and finally, to assure compatibility and integration between all didactic choices and initiatives.

The project is in continuous evolution and the number of involved schools could increase in time.

2. Project objectives and operational model

The Dschola project is developed through a collaborative work structure among different players, all working at distance in a shared, cooperative and interactive use of ICT and multimedia, and sharing the aim of improving educational, training and experimental services through ICT. The Dschola project key actors are:

- teachers with ICT, technical and administrative skills
- schools with a good technical background and infrastructure interested in improving and enhancing their competencies and skills towards ICT use in educational field and in new economy.

Dschola policy concern is directed towards building and expanding opportunities for skill acquisition, and applying technological innovation towards didactics or organizational management. Such strategies include:

- The creation of closer synergies between ICT and education
- The creation of closer synergies between schools, and between schools and their territory
- The wider distribution of educational opportunities over the Internet
- The transferability and reproducibility of the model in other regions

The project has followed an innovative operational model that merges a top-down with a bottom-up approach. The top-down approach sets up a very general objective: overcoming digital divide in schools and in the educational field as a whole and promoting a conscious use of ICT.

Nevertheless, the project provides to schools a framework to promote and enhance bottom-up initiatives, idea, expertise. In fact, Dschola wants not only to stimulate and accelerate the use of ICT amongst the educational community, but also to increase flexible learning and distance working and cooperation activities. On the other hand, and for the most, Dschola aims to:

- Stimulate, sustain and improve the cooperation between the Centres of Service, Animation and Experimentation and their territorial schools, as suggested by the slogan of the project: “Schools for schools”
- Create and stimulate a virtual community of schools through the official Web site http://www.dschola.it
- Improve the excellence of the Centres of Service, Animation and Experimentation
- Stimulate, sustain and improve the training between teachers
- Stimulate and enhance schools’ business skills and capacities in order to co-fund their projects.

The different topics (namely Learning and training, Innovation and technology transfer policies, Regional aspects and ICT) and actors (namely, Technical and administration secondary school teachers, Educational establishments, local Centres of expertise, Public bodies) involved in the project propose a model for the implementation of the ICT use in the educational field, founded on highlighting best practice experiences, customizing the use of ICT knowledge and technical innovation, providing a training model in which teachers’ skills and competencies are used and improved, considering these three features of professional practice:

- an already presence of good quality technical infrastructure
- human and technical resources that are available for generating new knowledge
- the context in which skills are deployed

3. Key-actors and key-actions

The Dschola school network consists in:

- 18 excellence technical secondary schools, having proven experience within the ICT area.
- 5 primary excellence schools, with proven experience in didactics and educational methodologies.

Furthermore, those schools are reference points for the analysis and production of innovation in education and schooling and can contribute to the development of innovative methods, systems and content.

Schools are connected with a broadband network allowing high level multimedia, cooperative activities and good quality videoconferences.

3.1. Services provided by the Centres

a. Training activities

Each Service, Animation and Experimentation Centre provides both direct and indirect training, consultation and support for schools within its own territory. In particular, the first experience of training involved about 1700 people (principals and their assistants) in a short time, between September and December 2001.

The training activities consist of courses for principals and assistants concerning:

- Surfing the Internet
- Using electronic mail and digital certificates
- Connection to the Piedmont Government Network

b. Support activities for projects co-financed by Fondazione Cassa di Risparmio di Torino

Service, Animation and Experimentation Centres are committed to providing general support for these projects. This support is qualified and detailed following the approval of the presented projects and based on the technical aspects of each project.

In particular, in the period July - December 2001 the Centres supported 145 actions to schools running ICT-based projects, for a total amount of more than 2570 hours of consulting.

c. Support and demonstration activities

The Service, Animation and Experimentation Centres, in conjunction with the activities of the schools in any given territory, are dedicated to providing the tools to enable:

Video conferencing services

Activity and event distribution services in real time

3.2. Animation activities promoted by the Centres

Service, Animation and Experimentation Centres arrange the planning and setting up of meetings and conferences concerning the main aspects of the introduction and use of ICT. These training meetings will supply a comprehensive reference framework for both organization and technology. For example, the sessions will include conferences and meetings based on the following themes:

- Designing and running a website
- Running and maintaining the school's equipment
- Designing and running security solutions
- Designing and developing multimedia services.

Animation Centres arrange the planning and setting up of meetings and conferences concerning the best practices developed by each Centre. The sessions will include conferences and meetings based on the following themes:

- Disability
- Language
- Microrobotics
- Didactics and network technologies
- Hypermedia

In particular, the Centres provided 50 animation activities (namely training meetings, conferences and seminaries) for a total participation of more than 1730 people.

3.3. Experimentation activities provided by the Centres

The setting up of testing activities as innovative services is planned in each Centre (based on past experience, commitment and projects). These include organizational procedures and services made possible by ICT technology. For example, the experimentation projects consist of the following:

- Production of multimedia educational material
- Multimedia educational material for disadvantaged students
- Video-conference training
- Web-based applications for administrative and educational management
- Wireless connection between schools and Local Bodies

4. Web site of the project

www.dschola.it is the official Web site of the Centres of Service, Animation and Experimentation community. The Web site is the virtual meeting point of the Dschola community, interested in the topics regarding the relation between school and ICT. In particular, the Web site intends to

- disseminate and promote the community activities (Animation, Service and Experimentation) and initiatives
- to exchange within the community material, experiences, acquaintance, information.

The Web site is in fact organized in thematic sections, not only focused on the Dschola Project, the Centres of Service, Animation and Experimentation and their activities, but also in order to provide information on school and ICT and community services.

The web site provides community services, as forums, mail hosting, download area, mailing lists. Furthermore, the community receives a selection of newsletters concerning press release on ICT topics, focus on European Commission initiatives and projects, news about the Dschola project and actors.

The Italian version of Dschola is managed by all the members of the community. They can enrich the Web site publishing news, comments, events, upload of material.

At the present time the web site is available in Italian, English and Spanish. Soon the web site will be available also in French.

Moreover, the site in based upon an open source platform (PHP Nuke) that allows direct contribution by the readers and the community members.

In order to make the community wider, the web site is developed according to the rules of the accessibility, and has passed the Bobby and the 508 validation.

The official web site of the project, published in April 2001, has raised its access fivefold in one year and the accesses and community members are constantly increasing in number.

5. Future developments

In its first running period, the project has focused on the service, animation and experimentation activities of the Centres, with particular attention on teacher training and on the optimisation of the technical infrastructure of the network.

For the next running period, the project activities will more incisively focus on the active participation of students in all the managed activities.

Furthermore, for the next year will be followed an action line based upon the creation of thematic regional labs, organised in networks of schools, on e-learning topics. Those consortiums will also attend to the experimentation of technological solutions towards other schools, aiming to support them and enhance their infrastructure and skills.

To conclude, as didactical and technological reference points for all the schools in the region, the Centres are more and more asserting themselves in the regional territory, being acknowledged as institutional service structures for the Italian Education Ministry

38 CLIX®*Campus* and the imc Higher Education E-Learning Network: A Private Public Partnership-Approach to Creating New Educational Benefits

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Abstract

The imc Higher Education eLearning Network is a Private Public Partnership in standard e-learning software development. Its goal is to provide universities with a standard platform that fits their specific needs. The paper presents the approach adopted by imc AG and its higher education partners and discusses some of the lessons learned.

Keywords: Learning Management System, Private Public Partnership

1. ICT in Higher Education: Innovation and Sustainability

In the past, media and technology in university teaching have mainly been discussed from a perspective that attributes to new media the role of a catalyst for university reform in the above-mentioned sense; new media is considered the engine, the enabler and the facilitator of a modernization of higher education institutions as well as the higher education system as a whole.

This view is far from incorrect. There can be no doubt about the innovative potential of new media with regard to the organizational forms and institutional structures of a university – but also with regard to contents and their mode of delivery. And yet it has become increasingly clear that the potential, inherent in new media, for structural reforms cannot be fully utilized within institutions devoid of adequate steering capacity and with only rudimentary management power. We also need institutions that are able to take on responsibility, to act independently, and to decide about their own course of action.

In other words, although new media's potential to foster institutional change is beyond any doubt, technological innovation and innovation by technological means as yet lack the sustainability we need in order to make full use of new media in higher education.

And yet, the use of media for instructional purposes is hardly ever part of an institution's goals and mission. Only in rare cases is it integrated in a process of strategic planning and priority-setting. And the link, so important for a sustainable media development, still needs to be developed between media projects, i.e., innovation, on the one hand, and on the other internal modes of allocating funds according to institutional priorities. Media projects, for the most part, are still in a stage in which they are funded according to the modes and criteria of research funding, i.e., on the basis of third party (research) grants without much institutional back-up and without the necessary ties to an overall institutional policy.

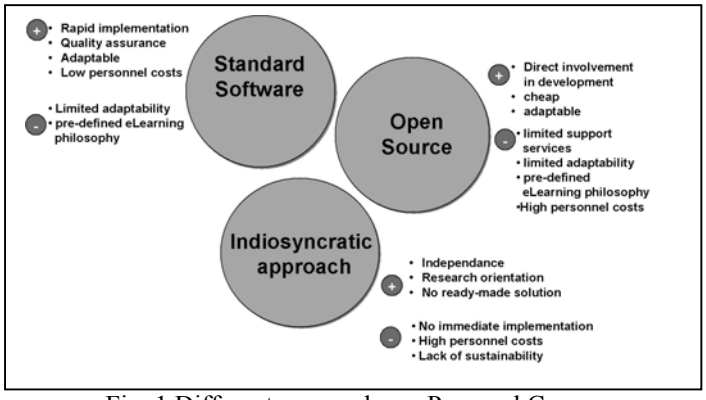

Fig. 1 Different approaches – Pros and Cons

As a result, there is an as yet unresolved conflict of interests in the higher education sector: The search for (technological) innovation and the claim for (academic) independence to some extent oppose the (institutional) need for reliable technological and organizational frameworks. This conflict is further accentuated by the predominant mode of financing ICT-related projects according to the traditional rules of third-party research funding (i.e. external validation of project ideas and project funding for limited periods of time only). As a result, common practice quite often challenges both the sustainability of ICT in higher education and the every-day viability of tools and platforms used.

Hence, in order to secure the sustainability of innovations in the field of media and technology, it seems that there is a need to shift the emphasis

- from idiosyncratic approaches and solutions to institutional as well as inter-institutional technological standards, norms, and forms of

cooperation (and here the alternatives "make or buy" with regard to platforms, software, and tools is a very pertinent one);

- from tackling media-related issues and problems individually to linking technological innovations to an overall institutional strategy;
- from a bottom-up orientation of media development, driven by individual research interests, to a process of organizational reform and institutional planning initiated and supported top-down;
- from project-based, research-oriented forms of "doing new media" to integrating media development into broader institutional, infrastructural contexts and professional forms of support (support for faculty and staff among other things);
- from technology-driven initiatives to the use of technology based on comprehensive pedagogical concepts.

In short: There seems to be a need to re-invent the university – in terms of its organization, its structure, its management, etc. – for sustainable technological change. In this regard, some of the following questions are of crucial importance:

- What are the prerequisites for successful and sustainable technological innovations?
- Which organizational forms, on the institutional level, are suitable to support the effective use of technology-based instruction in higher education?
- What is needed to make them endure?
- What are the essentials of a successful "change management" with regard to promoting media on a broad institutional scale?
- What are the strategic options for a university to engage in media-based and technology-driven education? And what are the economic implications of these options (i.e., where are the future markets?)
- To what extent do institutions relying on technology for instructional purposes have to reconsider and change their traditional institutional goals and mission?

Hence, an approach is needed that moves beyond the (research-oriented) project level. Institutional approaches are needed, with a clear focus on the *strategic* issues involved. Four dimensions are of particular interest in a holistic and *balanced* institutional approach (Programmbeirat 2001), i.e.

The adaptation of organizational structures and internal "business" processes to the new demands;

Financing and economic issues with regard to the use of ICT in teaching and research;

A perspective on the educational market and the increasingly competitive HE sector,

Personnel development and training with regard to new demands.

Fig. 2 ICT in Higher Education: Strategic Framework

And finally, new partnership and cooperation models are needed for strategic investments on the infrastructural and technological level.

2. Cooperation and Partnership

Now, universities, in general, are rather reluctant when it comes to opting for standard software and e-learning platforms in their efforts to create a "virtual campus." Given the limitations commonly associated with commercial standard products – e.g. limited adaptability, pre-definition of a specific e-learning philosophy, dependency on specific companies – this reluctance appears to be justified and in line with the curiosity-driven culture of an academic setting.

However, there are no viable alternatives in sight. Idiosyncratic approaches, for instance, are quite popular in academic contexts for their high degree of individuality and the independence they grant; yet they are costly, time-consuming, and hard to implement on a broader institutional scale. Open source approaches, by contrast, tend to produce lower costs, offer R&D opportunities to the people involved, and promote the idea of adaptability; yet in general, they move rather slowly, do not provide support services required for implementation and every-day use, and they hardly exceed commercial products in their degree of flexibility and reliability and the scope of customization that comes with them.

This situation prompted imc to adopt a new approach to designing new e-learning environments and to cooperate with institutions in the higher education sector: the imc Higher Education e-learning network.

2.1. imc information multimedia communication

imc information multimedia communication AG is a spin-off company from the Institute for Information Technology at the University of the Saarland, established in 1997. It has a strong R&D-background in the area of ICT-based university teaching. It is experienced in conducting complex media-projects in university settings, from the initial designing stage to their implementation and curricular integration. On the basis of its e-learning platform CLIX imc develops integrated e-learning solutions for companies and universities in Europe (Kraemer/Müller 2001).

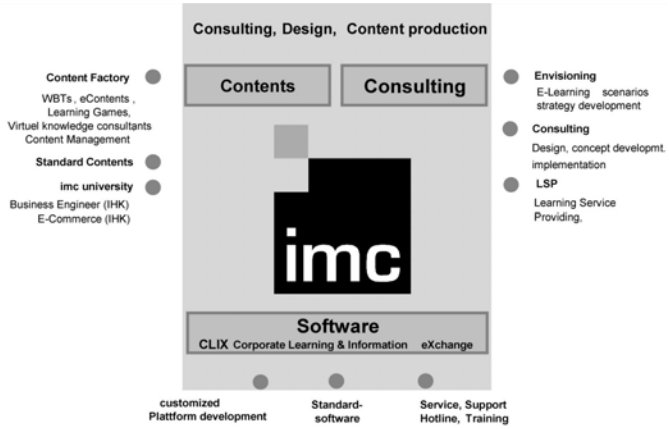

Fig. 3 imc eLearning Solutions

2.2. imc Higher Education eLearning Network

The rationale behind the imc Higher Education e-learning network is to turn potential customers – i.e. universities – into company partners. Within the network, imc and its partner universities cooperate in order to make full use of the advantages of standard software solutions, while at the same time making standard software more flexible and adaptable to the universities' specific needs. Network members enjoy preferential rates and special licensing agreements, and they receive support and training services provided by imc.

The imc Higher Education e-learning network, thus, is designed as a private public partnership (PPP), combining standard company software production/adaptation with an open source component. It aims at creating a product particularly suitable to universities, to their e-learning requirements, and to their specific organizational as well as administrative demands.

3.3. eLearning Platform CLIX

The imc Higher Education e-learning network is structured around the imc learning platform CLIX®*Campus*. CLIX®*Campus* is built on CLIX®*Enterprise*, an AICC-certified product that serves as the standard platform for numerous corporate universities.

The imc Higher Education e-learning network, thus, serves as a forum in which universities voice specific needs with regard to their prospective e-learning environment. On this basis, imc adapts and modifies CLIX®*Campus* in view of providing partner-universities with a platform that uniquely fits their needs. Member universities, thus, participate in the further development and specification of standard software.

CLIX® Campus

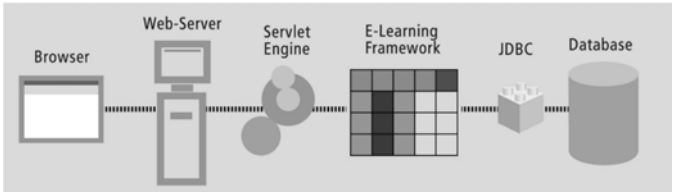

Fig. 4 Clix® Campus: Software Architecture

2.4. Private Public Partnership

The imc Higher Education e-learning network is a private public partnership that brings together private and public interests in view of generating a win-win-situation for all the partners involved. Its rationale is to foster cooperation so that private/commercial *and* public interests meet on a common ground.

The network, thus, aims at generating synergies – e.g. cost reduction, risk sharing, competitive advantages, transfer of know-how – in the course of an R&D process of continuous and cooperative experimentation and adaptation. Its over-arching concern is the most effective realization of both private and public goals.

With this approach, the imc Higher Education eLearning Network operates within a general framework of cooperation – i.e. a Public Private Partnership – that increasingly proves to be successful in the area of research and development (Vogel/Stratmann 2000).

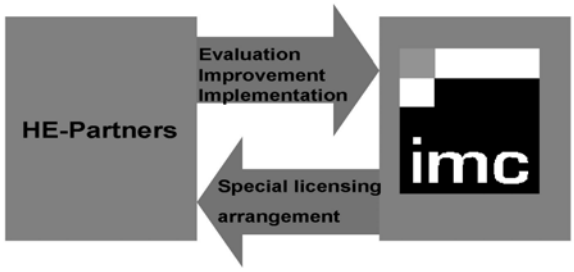

Fig. 5 Partnership and Cooperation Model

3. Preliminary Results and Lessons Learned

Since it started operating, the imc Higher Education eLerning Network has grown considerably. A number of universities have joined the partnership, interested in bringing their needs into the further development of the software they use. On such a broadened base for cooperation and exchange, imc has implemented a number of new system components geared toward the universities' specific needs (e.g. new course structures, workflows, a learning logic).

What turns out to be a real asset – besides software improvement – is the forum for communication and experience exchange the network provides. Very often, individual needs and idiosyncrasies have to be sorted out and made explicit in an inter-disciplinary discourse. It is quite difficult to define a common ground beneath the specifics of the various disciplines involved and to engage in a communicative process of prioritizing different needs. Yet at the same time it is a rewarding experience to see different interests merge to a common understanding of what needs to be done next.

In this process, imc very often takes on the role of a mediator and moderator – not that of a company trying to sell a product. Marketing generally plays no role at all in the course of network-meetings.

Finally, besides all the "hard" facts underlying the cooperation there is one "soft" factor that turns out to be crucial: trust. In a context where private and public interests meet, open communication and cooperation would be impossible without the general feeling that the parties involved actually can trust each other, that they "speak the same language", and pursue a common goal.

References

Kraemer, W., Müller, M. (2001), Corporate Universities und E-Learning.Personalentwicklung und lebenslanges Lernen. Strategien – Lösungen – Perspektiven, Gabler, Wiesbaden.

Programmbeirat Virtuelle Hochschule Baden-Württemberg (2001), *Leitlinien für die Medienentwicklung an den Hochschulen in Baden-Württemberg* (http://www.che.de/html/news_medienentwicklung.htm).

Vogel, B., Stratmann, B. (2000), Public Private Partnership in der Forschung. Neue Formen der Kooperation zwischen Wissenschaft und Wirtschaft, HIS GmbH, Hannover.

39 Issues Surrounding the Widespread Adoption of Learning Management Systems: an Australian Case Study

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Abstract

This paper discusses the evolution of the online learning environment at Murdoch University, in Perth, Western Australia, beginning in 1997, and continuing, in late 1998, with the adoption of the WebCT Learning Management System. WebCT adoption was supported by central funds through the Murdoch Online Mainstreaming (MOLM) Project, which set out to establish online teaching and learning as a mission critical activity of the University, but also to give academics control over their material. The rationale behind the MOLM project is described, in terms of a model of adoption of technological innovations.

The Murdoch Online Mainstreaming Project met its objectives. Currently 223 units are available through WebCT, with the highest uptake in the Schools of Commerce, Law and Information Technology. Over the last twelve months, 9364 individual students have been enrolled in a WebCT course. This is over three quarters of the students enrolled at the University.

However, despite demonstrable and enthusiastic uptake by teaching staff and students, the MOLM initiative encountered significant problems in 2001, when the initial two years of project funding was exhausted. It then became apparent that the University's strategic directions were not well-coupled with its budget allocation processes, with the result that ongoing funding was not initially available to support online learning.

The paper discusses various approaches taken to secure ongoing funding for online learning, including a comprehensive, user-pays model, which was eventually rejected in favour of a central allocation. The paper concludes with a discussion of recent moves by the University to radically redesign the ways in which it conceives of a unit of study, both in pedagogical and administrative terms.

1. Introduction

Murdoch University, in Perth, Western Australia, is relatively small, with approximately 12,000 students studying from a selection of approximately 1,000 units[1] of study. The University made a strategic decision in 1997 to move towards online provision of units of study, and commenced the Murdoch Online initiative. This set out to provide internet-based teaching and learning to a wider range of students in more interesting and flexible ways. Murdoch's move into online teaching and learning was facilitated by its experience in distance education, building from a history of structured study guides, based on the UK Open University model. Staff were accustomed to a coordinated, but flexible, approach to designing self-study materials.

1.1. First Steps with Murdoch On-Line

Murdoch Online was launched in November 1997, as a special initiative of the Vice-Chancellor and Pro-Vice-Chancellor (Academic). Implementation was managed by the Teaching and Learning Centre (TLC), with initial objectives to:

1. establish an online teaching and learning facility for Murdoch University, building on its existing academic programs, academic support services and administrative policies and procedures;
2. contribute to the quality and effectiveness of the University's teaching and learning through the use of internet services;
3. attract new students to Murdoch University and provide a vehicle for University promotion amongst the rapidly growing population of internet users: locally, remotely and worldwide;
4. take advantage of new opportunities for improved efficiencies in teaching and learning.

Murdoch Online was a timely and popular initiative. A number of schools and individuals expended substantial effort in producing online units, notably in the Schools of Engineering, Energy Studies and Economics. The number of units designated as 'online' rose from 23 in 1997, to 79 in 1998, and 141 in 1999. However, many of these were online in name only, and production of online materials had not commenced in many cases. There was enthusiasm for the Murdoch Online initiative, but after the initial enthusiasm, progress slowed.

Murdoch Online units were originally designed according to a frame-based HTML template, supported by public-domain discussion and communication tools. Technical support was needed to assist most academics in this process. This was provided partly by the TLC, and partly by those schools that had invested resources in Murdoch Online. As time went by, it became apparent that the system was too difficult for most

academics to cope with, and demand for services exceeded available TLC resources.

While the original Murdoch Online initiative was championed by the Vice-Chancellor, it was not supported by any funding allocation. This lack of investment impacted negatively on the impact of Murdoch Online on the wider University community.

1.2. The Adoption of WebCT

The shortcomings of the original approach prompted Murdoch University to adopt the WebCT (WebCT, 1999) Learning Management System in late 1998. This choice was made to simplify online development and to give academics control over their material and the tools available. The adoption of WebCT was supported by $Aus230,000 of central funds through the Murdoch Online Mainstreaming (MOLM) Project, which set out to establish online teaching and learning as a mission critical activity of the University, providing essentially uninterrupted access to online course materials for students.

There were three aspects to the MOLM project, discussed more fully below:

- hardware and systems support, including integration of WebCT with the University's administrative and information systems;
- staff development workshops, seminars and documentation – to provide academic staff with the knowledge and skills to develop educationally sound online units using WebCT;
- production support and assistance to staff, including WebCT templates that are uniquely presented for each target audience, whilst adhering to a set of Murdoch University standards.

2. Factors Affecting Adoption

The planning of the MOLM project was informed by considerations subsequently published in McNaught et al. (2000). This Australian project investigated factors relating to the adoption of ICT resources in universities through a case study of five faculties at universities throughout Australia which had achieved widespread adoption rates. The themes identified in the study were refined into the ideal model shown in Fig. 1, with three major contributions: *policy*, *culture* and *support*.

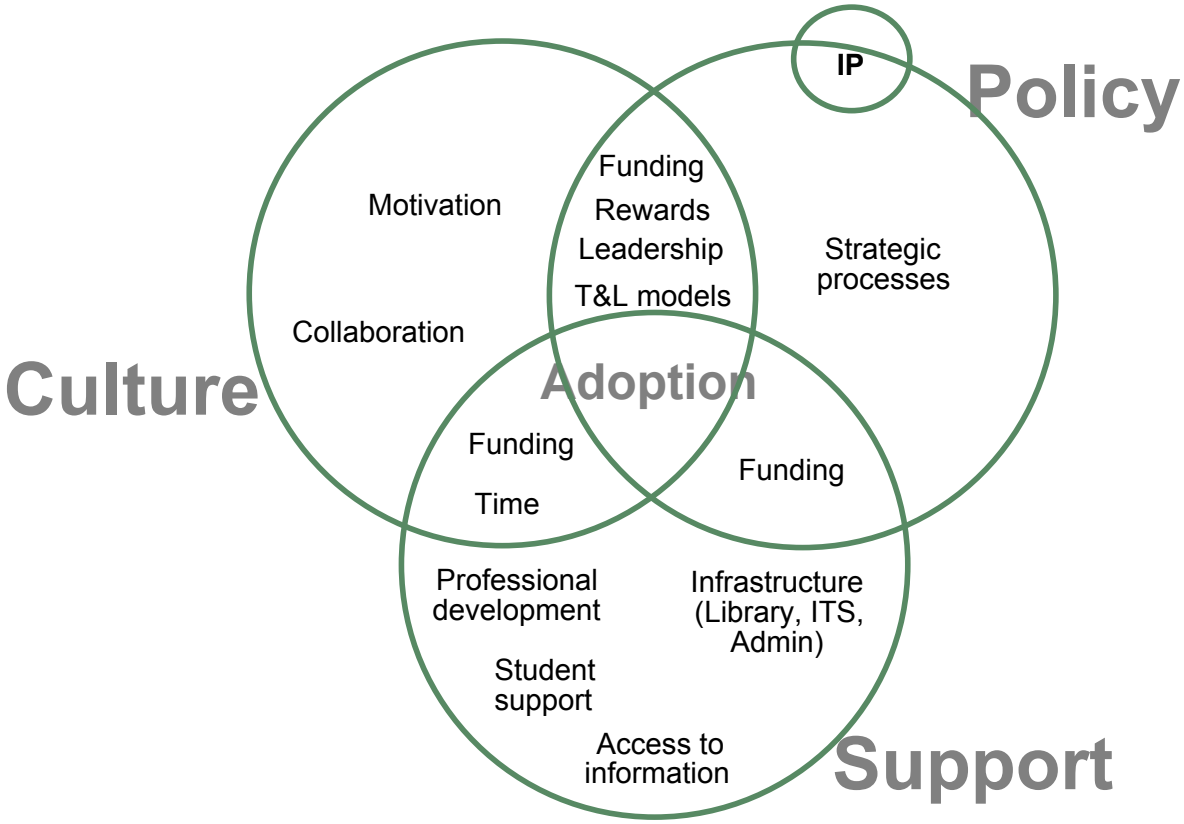


Figure 1. Three phase technology-adoption model (from McNaught, Phillips, Rossiter, & Winn (2000)). IP is an abbreviation of Intellectual Property and ITS is an abbreviation of Information Technology Servicers

While all faculties were deficient in some aspects, the conclusion was drawn that an institution which addressed all of the themes shown in Fig. 1 would be likely to achieve high uptake rates of any educational innovation. A further implication of the model is that policy direction needs to be both from the top down, and from the bottom up.

It is informative to analyse Murdoch's performance[2] in terms of the adoption model. The initial Murdoch Online Initiative was supported by leadership and policy direction, followed by project funding. The MOLM project funding explicitly focussed on providing appropriate support and professional development, as well as focussing on the needs of academic staff, by seeking to develop partnerships with academics, reducing administrative load and empowering them to have control over their own educational material. A strong pedagogical emphasis was central to the initiative.

While the initial impetus of the MOL initiative was top-down, it soon became bottom-up as staff took ownership of the initiative.

Weaknesses in Murdoch's approach were in rewards for staff, and taking a strategic approach to the initiative, particularly with respect to funding.

3. The Murdoch Online Mainstreaming Project

3.1. Hardware and Systems Support

The TLC worked closely with the University's Information Technology Services area to provide hardware and systems support for WebCT, aiming at 24 hour x 7 day availability. A dedicated, central WebCT server was purchased, and staff were appointed to manage the WebCT installation. A second server was subsequently purchased as part of a disaster recovery plan.

WebCT has been integrated with other corporate systems, such as the Callista student records system, the Concept human resources system and Murdoch's own MAIS authentication system through a middleware application called WebCTMan (Phillips, Strong, Hallam, & Benschop, 2002)

WebCTMan manages courses, the students within courses, and staff roles within courses. A web-based interface enables administrative staff to easily control which groups of students should go into (or out of) each course, and when this should happen. A subset of functions is available to helpdesk operators, who can look up details of both students and staff within the system and troubleshoot problems.

By integrating WebCT with other systems, we have reduced the amount of administrative work required by academics in managing their course, thereby freeing up time for teaching interactions with students.

3.2. Staff Development and Training

Staff development was an integral part of the MOLM project. A staff development officer was appointed to develop documentation and present a range of technical WebCT workshops. This person complemented existing staff who presented seminars about pedagogical aspects of online learning. Seven technical workshops and ten pedagogical seminars made up a staff development series entitled "Designing Units for Online Learning".

The aim of the staff development was to enable lecturing staff to become self-reliant in their use of WebCT, empowering them to manage their own online teaching environment without requiring technical support.

3.3.Production Support

The third aspect of the MOLM Project was the production of new units in WebCT format, and the conversion of existing Murdoch Online units into WebCT format. Increasingly, staff develop their own WebCT courses, although some staff still require production assistance. Once WebCT materials are developed, almost all staff maintain them themselves.

WebCT courses are based on a template which adheres to Murdoch University standards. Where possible, unit information is provided in a way that course designers can 'fill in the blanks'. In the Murdoch University environment, it was not possible to mandate a common look and feel for all units. However, the use of a standard template increases the likelihood that courses will be recognised as a Murdoch University product. Some schools and departments developed their own unique templates. The template approach also reduces work for lecturing staff.

Production work uses a project management approach. All project effort is recorded on timesheets under categories of work. Data recorded in this way has allowed the development of a standard price list for entering standard content into WebCT, shown in Table 1.

Entering administrative details into existing WebCT Template	$420
Entering administrative details into a specially-tailored WebCT Template	$960
Study Guide (up to 60 pages of content)	$360
Powerpoint slides	$15 per lecture
Extra additions to WebCT unit	$60 per hour

Table 1. WebCT unit production pricelist (in Australian dollars)

4. Project Outcomes

At its outset, the Murdoch Online Mainstreaming Project set targets for the number of units which were expected to be

	Target		Actual	
Semester	Production	Preparation	Production	Preparation
1/99	20	40	19	29
2/99	60	40	47	43
1/00	100	40	65	84
2/00	140	40	122	43

Table 2 Targetted and actual numbers of units put online as part of the Murdoch Online Mainstreaming Project

Teaching area	Semester 1	Semester 2	Other	Total
General	7		1	8
Information Technology	8	7	1	16
Commerce	17	19	27	63
Education	2	8	4	14
Humanities	16	12	0	28
Law	16	16	4	36
Physical Sciences	1	6	0	7
Biological Sciences	12	16	0	28
Politics		3	0	3
Social Sciences	1	7	0	8
Veterinary	5	6	1	12
Total	85	100	38	223

Table 3. Current numbers of WebCT units broken down by teaching area and teaching period.

Teaching Period	S1/00	S2/00	S1/01	S2/01	S1/02
Business, Information Technology and Law	1593	3461	3734	7906	4249
Science and Engineering	246	302	633	1359	1265
Foundation Units	1721	1912	2184	2158	2201
Social Sciences, Humanities and Education	563	1223	1165	2161	2345
Veterinary and Biomedical Sciences		11		276	315
Total	4123	6909	7716	13860	10375

Table 4. Summary of student enrolments in WebT courses for each of the teaching Divisions, for the last five semesters.

available in WebCT at the end of the project. Both the targets and actual achievements are shown in Table 2, for courses which were both in production and in preparation.

While the final figure of 122 units in production during semester 2, 2000 is below the target of 140, project funding did not commence until semester 2, 1999, and the project, therefore, was six months behind schedule. Given this delay, the project exceeded all its targets.

The number of WebCT units offered by each teaching area is shown in Table 3. Table 3 also shows the number of units offered online in each teaching period: semester 1, semester 2 or other (trimesters and summer school). Currently, 223 units are in production in WebCT, up from 193 in 2001. The highest uptake of WebCT is currently in the Division of Business, Information Technology and Law (Commerce, Law and Information Technology).

In addition to the figures reported in Table 3, approximately 140 other units are available to students online through other mechanisms. Most of these are in the Schools of Engineering and Physical Sciences, and had been developed before the MOLM project commenced. Over one third of Murdoch's units now have an online presence.

It is also apparent from Table 3 that some areas of the University have not yet embraced WebCT and online learning. However, Biological Sciences have increased their WebCT presence over the last year, and Politics, Psychology, Education, Chemistry, Environmental Science are beginning to follow the rest of the University.

4.1. Student Usage

Student use of WebCT has increased substantially since 1999. Table 4 shows student enrolments over the last 5 semesters for the University's teaching 'Divisions'. A particular characteristic of Murdoch University is the interdisciplinary Foundation unit which all students must study. Because these units cross Divisional boundaries, they are reported as a separate row in Table 4.

A strong increase in the number of students using WebCT is consistently apparent in Table 4. The figures shown in Table

4 indicate student enrolment in WebCT courses. That is, if a student is enrolled in two courses, that student is counted twice in Table 4. Over the last twelve months, 9364 individual students have been enrolled in a WebCT course. During the same period, 17169 students were associated with courses, indicating that each student is enrolled in approximately 2 courses, on average.

Table 4 needs to be interpreted carefully. At first glance, it would seem that enrolments had dropped in semester 1, 2002. However, the figures shown in the two 'semester 2' columns (S2/00 & S2/01) are cumulative, representing the total enrolment for the year, rather than just the enrolment for that semester.

Despite the intentions of senior management to increase student enrolments by offering study online, this has only been marginally effective, as shown in Table 5. Table 5 displays the number of students currently enrolled in each of four types of study. By far the majority are enrolled as internal students, that is, they attend normal classes and receive complementary online functionality. External students are enrolled in the traditional distance education mode, and also receive complementary online functionality. When Murdoch Online was established, two new enrolment options were established, 'online internal', where students were managed according to the infrastructure set up for internal students; and 'online external', where students were managed as an external student. Table 5 shows that few students currently use these enrolment modes. Other evidence, to be discussed in the final section of this paper indicates that students find them confusing.

Enrolment Type	Number
Internal	5931
External	698
Online Internal	137
Online External	106
Total	6872

Table 5. Enrolment types of currently-enrolled Murdoch students

4.2. Server Usage

Figures 2 & 3 show the average distribution of WebCT use per day of the week, and the average usage per hour of the day, respectively. Usage is spread relatively evenly over the entire week, even on weekends (Fig. 2). WebCT is also used throughout the day, including in the early hours of the morning (Fig. 3). This data reinforces the need to have the WebCT system supported 24 hours a day and seven days a week. This system is, arguably, more important than any other university information system.

5. Sustainability

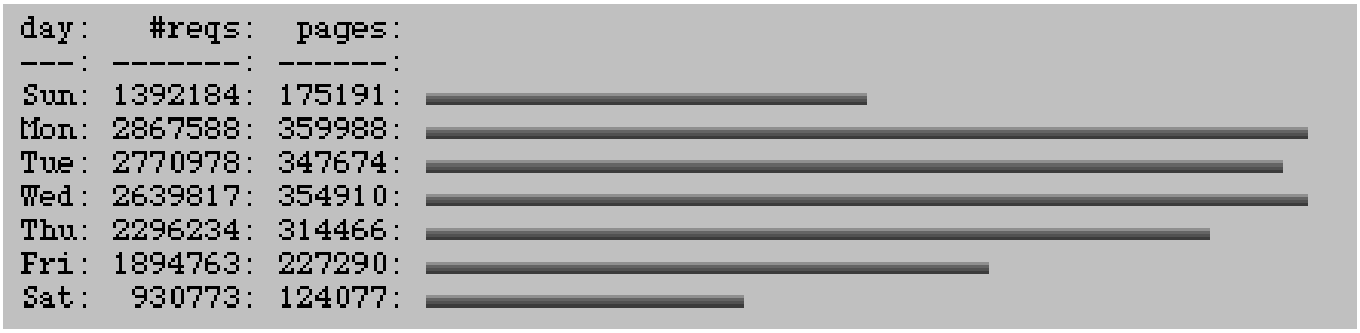
The impressive uptake rates described in the previous section indicate that the MOLM project has been successful. Murdoch Online has met the first two of its objectives (see Introduction); namely, establishment of a facility that is building on the institution's existing academic programs, and contributing to the quality and effectiveness of the University's teaching and learning.

Objective Three, essentially the commercialisation of online offerings, has not been met, except in a very small number of rather unique areas. Locally, however, Table 4 shows an enormous growth in online usage that extends the diversity of flexible learning options available to Murdoch University students. In terms of policy direction, bottom-up enthusiasm outstripped top-down attempts at income generation. Murdoch's experiences are similar to those of Columbia University, New York University and the University of Maryland, reported in the New York Times (Hafner, 2002), although less expensive.

Nevertheless, despite demonstrable and enthusiastic uptake by teaching staff and students, the Murdoch Online initiative encountered significant problems in 2001, when the initial two years of project funding was exhausted. It then became apparent that the University's strategic directions were not well-coupled with its budget allocation processes, and no ongoing funding was available to continue with online learning. McNaught et al. (2000, p. 87) identified a presumption that any sector of an institution that agrees to take responsibility for a university-wide initiative at its formulative stage – and receives short-term funding to try and meet the institution's goals – will absorb future costs when specific establishment grants are exhausted.

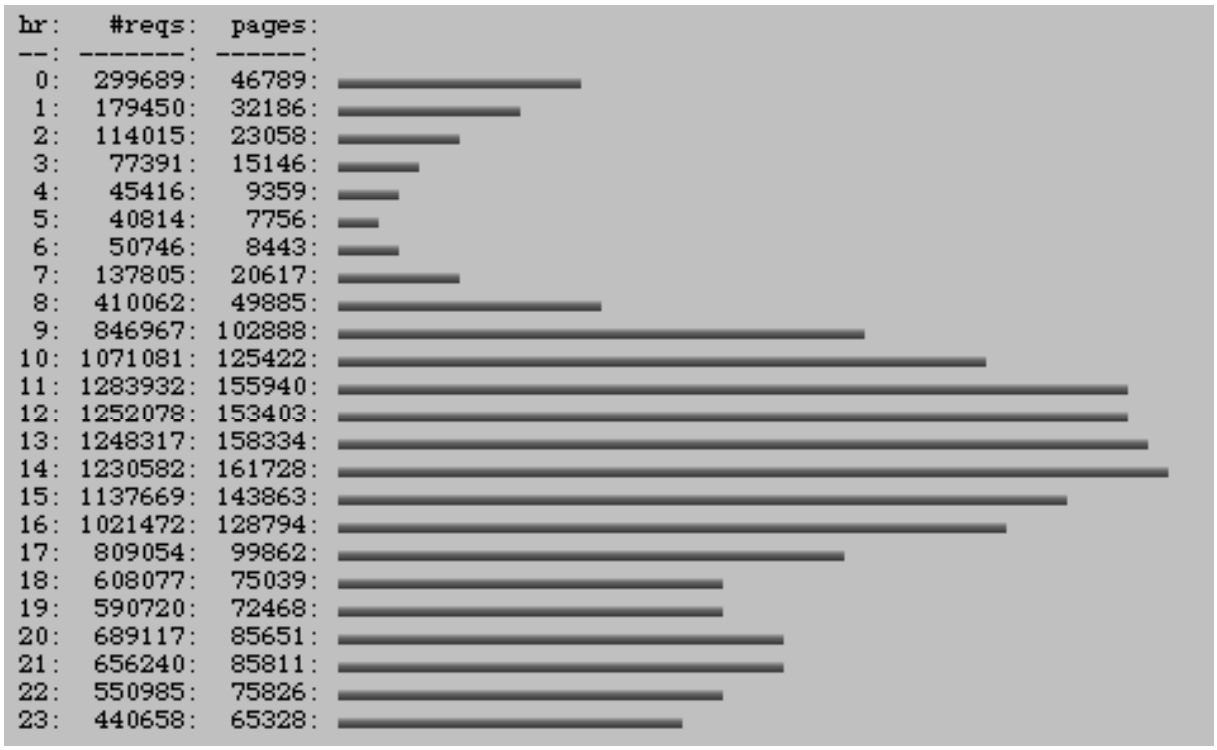
This was certainly the case for the Teaching and Learning Centre, which was the sponsor of the MOLM Project, and the driving force behind the success of a University-wide initiative. The very success of the project, and concomitant growth of WebCT usage, contributed to the inability of the TLC to support it from its own resources. There was, initially, only one technical support position, with no ongoing funding, leaving the University potentially exposed to system unavailability. The exposure became real when the technical support person chose to leave. At approximately the same time, some unusual and complex circumstances resulted in significant system unavailability early in 2001.

A proposal was therefore developed for central funding to sustain the Murdoch Online initiative. However, in the currently-devolved management structure at Murdoch University, a proposal for an 'off-the-top' funding allocation was not initially supported by decision-makers. Instead, a, user-pays model had to be developed. This model anticipated all costs for running WebCT over the next four years, including potential hardware upgrades and software price rises. The staffing profile to effectively manage WebCT at Murdoch is shown in Table 6. The total cost of supporting WebCT was estimated to rise from $Aus290,000 in 2002 to $Aus400,000 in 2005. Funds were to be recouped by charging a nominal rate per course and a fixed rate per student using WebCT.



day:	#reqs:	pages:
Sun:	1392184:	175191:
Mon:	2867588:	359988:
Tue:	2770978:	347674:
Wed:	2639817:	354910:
Thu:	2296234:	314466:
Fri:	1894763:	227290:
Sat:	930773:	124077:

Figure 2**.** Average distribution of WebCT use per day of the week.



hr:	#reqs:	pages:
0:	299689:	46789:
1:	179450:	32186:
2:	114015:	23058:
3:	77391:	15146:
4:	45416:	9359:
5:	40814:	7756:
6:	50746:	8443:
7:	137805:	20617:
8:	410062:	49885:
9:	846967:	102888:
10:	1071081:	125422:
11:	1283932:	155940:
12:	1252078:	153403:
13:	1248317:	158334:
14:	1230582:	161728:
15:	1137669:	143863:
16:	1021472:	128794:
17:	809054:	99862:
18:	608077:	75039:
19:	590720:	72468:
20:	689117:	85651:
21:	656240:	85811:
22:	550985:	75826:
23:	440658:	65328:

Figure 3. Average distribution of WebCT use per hour of the day.

The Executive Deans of the four teaching divisions requested that the funding model be refined to account for different usage rates between units. A revised model was built, based on the Australian Government's Department of Education Science and Technology (DEST) definitions of online usage:

1 Web Supplemented (participation online is optional for the student)

2 Web Dependent (participation online is compulsory)

3 Fully On-line (there is no face-to-face component)

A refined funding model, which was agreed to by senior management, is shown in Table 7. However, when announced to teaching departments, this scheme was met by significant resistance. It appears that senior management had agreed to the scheme without consulting, or informing, teaching staff. After some protest, senior management were persuaded to formally acknowledge the importance of online learning, and to provide ongoing funding for the continuation of WebCT at Murdoch.

Management	40% FTE
Administration/training	100% FTE
Administration support	50% FTE
Technical support - WebCT internals	100% FTE
Systems Programmer, incl. systems support	100% FTE
Helpdesk – casual staffing costs	$Aus10,000
Annual fixed costs – hard-, software, training	$Aus5,600

FTE – Full time equivalent

Table 6. Estimated staffing costs for effectively managing Murdoch's WebCT installation.

An off-the-top allocation of $Aus150,000 was provided in 2002 to cover salary costs not already provided by existing budgets. In addition, hardware and software license costs were accepted centrally, and Information Technology services entered into a partnership with the TLC to jointly support WebCT.

Setup price	$Aus100	per course
Online level 1	$Aus10.00	per student per course
Online level 3	$Aus12.50	per student per course
Online level 3	$Aus20.00	per student per course

Table 7. Differentiated user-pays funding model

6. Flexible Learning at Murdoch

At the same time as the funding crisis was impacting on WebCT functionality, a Flexible Learning Working Party of Academic Council (second only to the Senate as a University-wide decision-making body) was reviewing Murdoch's provision of external and online study options. External studies (distance education) had been progressively devalued under the devolved administrative structure, and, as described above, the notion of online enrolment was both unpopular and confusing.

The Flexible Learning Working Party report (Thiele, 2002) attempted to resolve these issues by proposing "that instead of thinking of a unit as having various delivery versions, we should think of a unit as a coherent package of resources that can be accessed in various ways".

Currently, a Flexible Learning Implementation Committee is investigating ways of moving towards a single version of a unit of study, where students can choose the ways in which they access resources – online, in print or face-to-face; and where an equivalence of assessment is offered. This radical reconceptualisation of a unit of study will require significant organisational cultural change, but may also provide significant institutional efficiencies.

The remainder of 2002 will be spent in piloting five prototype flexible units, and developing a plan for the implementation of the project over the next three years. With this strategic direction, hopefully supported by appropriate funding, the remaining aspect of Fig. 1 which may form an obstacle to widespread adoption of online learning at Murdoch University is rewards and recognition for academic staff.

References

Hafner, K. (2002, May 2, 2002). *Lessons Learned at Dot-Com U.* [online]. Retrieved 12 July, 2002, from the World Wide Web: http://www.nytimes.com/2002/05/02/technology/circuits/02DIST.html?ex=1021310020&ei=1&en=bcb160867f6404b2

McNaught, C., Phillips, R., Rossiter, D., & Winn, J. (2000). *Developing a Framework for a Useable and Useful Inventory of Computer-facilitated Learning and Support Materials in Australian Universities* (Evaluations and Investigations Programme). Canberra: DETYA. [online] Available at http://www.dest.gov.au/highered/eippubs1999.htm

Phillips, R., Strong, J., Hallam, M., & Benschop, O. (2002). *A Comprehensive WebCT Integration System.* Paper presented at the WebCT Asia Pacific 2002 Conference, Melbourne, Australia. [online] Available at http://www.webct.com/asiapac02/viewpage?name=asiapac02_presentations

Thiele, B. (2002). *'DEGREES OF FLEXIBILITY' Report of the Academic Council Working Party on External Studies and Flexible Delivery, March 2002* [online]. Murdoch University. Retrieved 12 July, 2002, from the World Wide Web: http://www2.murdoch.edu.au/admin/cttees/ac/2002/march/ESFDC%20Final%20Report.doc

WebCT. (1999). *WebCT: World Wide Web Course Tools.* [Online source]. Retrieved 8 March, 2002, from the World Wide Web: http://www.webct.com

Notes

[1.] The term *unit* is commonly used in Australia to refer to a course of study undertaken over a 13 week semester. Typically, four units make up a full-time study load.

[2.] No Murdoch faculty was part of the original study

6. Authors in Alphabetical Order

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