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 (Chi² (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 (Chi² (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 (Chi² (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.

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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)