Effects of staff and student tutors on student achievement.[1]

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Abstract. In the problem-based curriculum of the faculty of Law, students of the first year are guided by staff tutors or undergraduate student tutors in small tutorial groups. In this study, academic achievement of staff tutor-guided groups are compared with student tutor-guided groups. After an eight-week course students' level of academic achievement was tested by essay questions. Two methods of assessing students' performance are used: expert judgements and propositional analysis. Results of both methods used indicate that no differences in academic achievement occur. Students guided by student tutors perform as well as students guided by staff tutors. Several explanations are proposed to account for these results.

Introduction

Students tutoring other students is not an educational innovation of recent times. In the ancient Greece and Roman schools, and in the Middle Ages, teachers regularly required students of older age and higher grades to help them with reading and arithmetic in the classroom. The innovations of the headmasters Bell and Lancaster are well-known. They established, independently of each other, large educational institutions in the United Kingdom in the first half of the nineteenth century. Their schools were entirely based on the principles of peer tutoring and gained widespread attention in North America and Europe. From the mid-nineteenth century, the system of peer tutoring declined. With the exception of one-room schools of rural America and Europe, peer tutoring received virtually no attention for more than a century (Wagner 1982). In the 1970s, however, peer-tutoring received renewed interest and became widely used and studied (Allen 1976). Since that time, many new peer-based educational methods, known for instance as cooperative and collaborative learning methods, have been developed for primary and secondary education (Damon & Phelps 1989; Slavin 1989).

In higher education, a similar revitalized interest in peer-mediated instruction can be observed. New approaches of small-group learning as "self-directed student groups" (Beach 1974), "syndicates" (Collier 1969) and "associative discussion groups" (Rudduck 1978) have been implemented in many institutions of higher education. These approaches enable students to play a more active, participative role and allow them to take greater responsibility for their learning. Problem-based learning can also be perceived as an answer to the claim that learning should be an active, constructive, contextual and self-directed process (Shuell 1988). Problem-based learning can briefly be characterized as follows: a collection of carefully constructed problems is presented to small groups in this study of ten students. In most of cases, a problem consists of a description of a set of phenomena or events

that can be perceived in reality. These phenomena or events have to be analysed or explained by the tutorial group in terms of underlying principles, mechanisms or processes. A representative problem is, for instance, the following:

The revoked residence permit

Vitto Giovanni is an Italian foreign worker, who has lived in Amsterdam for several years. He has a legal residence permit. He is living with Sonja van Holland, whom he wants to marry immediately after his divorce with his legally married spouse in Italy. His future is shattered after he has been caught by the police in the very act of burglary. The court sentenced him to eight months' imprisonment and a probationary period of two years. Even worse for him is the message of the Secretary of Justice that he will revoke the residence permit of Vitto. This would lead to an expulsion of Vitto from the Netherlands. When receiving this message Sonja van Holland immediately contacts Vitto's lawyer.

(Example of a problem from the course "Law enforcement")

Essential to the problem-based learning method is that students first of all try to explain the phenomena or events on the basis of their prior knowledge. By doing that, their prior knowledge will be, in itself, most of the time insufficient to understand the problem in depth. During initial discussion, differences in opinions will arise and questions will come up which cannot be answered by the group members. In that case, students have to formulate learning objectives: questions which can be studied by subsequent self-directed learning. Students will review textbooks, articles and other resources in order to build a more satisfying answer to the problem at hand. After a two-day period of individual study, students return to their group to discuss what they have found in the literature. In a second round of discussions, students will check to what extent they now have a more in-depth understanding of the problem. When some of the information studied is confusing or ambiguous, and group members therefore do not understand parts of the literature, they try to explain to each other what is not comprehended. In summary, in a problem-based tutorial group, activation of prior knowledge, elaboration through small group discussion, restructuring of knowledge and learning in a context are cognitive effects which are purposefully built in (Schmidt 1983; Schmidt 1993).

As novices in a new domain, however, students can easily misunderstand some aspects of the newly acquired information. Students can, for example, insufficiently discern the coherence within the subject matter, remain too superficial in their discussion, use misconceptions, or not be able to dig into deeper levels. So, a tutorial group is guided by a tutor, a faculty member. The primary task of tutors is to facilitate students' learning processes, i.e. helping the students to integrate and apply information. Tutors can do so by asking probing questions to challenge students' knowledge deeply or by providing examples and metaphors which help student to remember the subject better. They can confront students with counterexamples, playing the role of a devils advocate. They can also contribute, if necessary, with some subject-matter information, evaluate progress being made and monitor the extent to which each group member contributes to the group's goals. Secondly, a tutor has responsibilities to help students interact effectively in the small-group tutorial and to keep the learning process moving. The ability of tutors to use facilitatory teaching skills is the major determinant of the quality and the success of problem-based learning (Barrows 1988).

Problem-based learning, however, is a fairly staff-intensive approach to education. As a solution to this problem, schools sometimes hire advanced undergraduate students as tutors. Immediately, of course, the question arises whether student-guided groups perform as well as staff-guided groups. Staff tutors, after all, usually have more subject matter knowledge and teaching experience compared to student tutors. Staff tutors' expertise is more sophisticated than the expertise of advanced undergraduate students. Therefore, staff would be, in principle, in a better position to help their students than student tutors. The present article aims at contributing to this discussion in two ways: first, it provides a comprehensive review of studies conducted in this area. In addition, research on academic achievement of students guided by staff tutors compared with students guided by student tutors will be reported.

Review: effects of peer tutoring on student learning

Research in the domain of peer-guided instruction in higher education shows contradictory outcomes. Research comparing achievement of students guided by students or staff members mostly showed no differences (Beach 1974; Bloom, Caul, Fristoe & Thompson 1986; Ten Cate 1986; Clement 1971; Govey, Gruber & Terrell 1963). Sometimes, a better performance of student-guided groups (Blunt & Blizzard 1973; White 1945) has been reported, but other research revealed better achievement for students guided by staff members (Beach 1983; Carsrud 1979). In his study Ten Cate (1986) gave several explanations for these differences in outcomes. Most studies differ in classroom didactic approaches – in the magnitude of the groups studied and in the manner of assessing students' achievement. Some of the research, for instance, used multiple choice questions to judge students' academic performance, while other research used essay questions. The differences in achievement outcomes could also be affected by methodology grounds. Some studies do not even report what actually happened in the control groups.

Research on peer tutoring in the context of problem-based learning, however, also shows, despite consistency in learning approach and magnitude of the small-group tutorials, inconsistent outcomes in levels of performance. De Grave, De Volder, Gijselaers & Damiofioseaux (1990); Gruppen, Traber, Paine, Wooliscroft & Davis (1992) found in their studies no differences in achievement. De Volder, De Grave & Gijselaers (1985), Gijselaers, Bouhuijs, Mulder & Mullink (1987) found no differences in one unit (a period of six weeks in which students and tutor worked together in a tutorial group), whilst in another unit staff tutor-guided students performed better. Research of Moust, De Volder & Nuy (1989) and Schmidt, Van der Arend, Kokx, & Boon (1993a) revealed that staff-guided groups achieved better. Recently, Schmidt (in press) offered some explanations for these differences in research of outcomes, suggesting that students, particularly in their first year of a problem-based curriculum, seek structure – cues that help them to decide what to pay attention to and what not. This structure can be provided internally through prior knowledge available for understanding the new subjects, or

offered by the environment in the form of cues in the learning material which gave information about what is relevant and what should be the focus of the learning activities. Schmidt assumes that if prior knowledge falls short, or if the environment lacks structure, students will turn to their tutor for help and direction. Under those conditions, students who are guided by a subject-matter expert may benefit more from the learning than students guided by a student tutor. So, the differences in learning outcomes in the studies reported above could be a consequence of differences in the prior knowledge of the students in the experimental and control condition, and/or differences in the structure of the learning material offered to the students.

The present study reports research on academic achievement of students guided by staff tutors compared with those guided by student tutors. Academic achievement was measured using short-essay questions. The answers were analyzed using two methods of scoring. First, the answers to the essay questions were scored by content experts. Subsequently, an elaborate analysis, called "propositional analysis", was conducted on a sample of the answers (Schmidt 1982).

Method

Subjects

The study was conducted in two successive courses of the first year law curriculum. Subjects were all students attending small-group tutorials guided by student tutors or staff tutors. In the first course 230 students participated, guided by seven staff and six student tutors. In the second course, 177 freshmen engaged in 18 groups guided by four staff and five student tutors. None of these students participated in the research of the first course. In both courses each tutor guided two small-group tutorials. Students and tutors were randomly assigned to the tutorial groups. Each course lasted for eight weeks. Students met in their groups twice a week for two hours.

Student tutors were recruited by an open selection procedure. Seven third- and fourth-year undergraduate students were selected to fulfill the role of tutor. All students had the same two-day tutor training program as staff-members had to follow after entering the Law Faculty. Students tutors also had the opportunity to exercise tutor skills in two block periods before the experiment was started. Their guidance of a small tutorial group, in this pre-experimental phase, was supervised by an expert staff tutor.

Procedure

To measure differences in achievement between staff tutor-guided groups and student tutor-guided groups, two courses of the first curriculum year were chosen which were well-known to be well-structured. The learning materials offered in each unit, a so-called blockbook consisting of 32 problems, had a clear introduction

to the theme and most problems were written quite well.

At the start of each course students had to fill in a multiple choice test of 24 items to assess differences in prior knowledge in both conditions. At the end of each course students had to fill in a program evaluation questionnaire. By means of a rating scale students were asked to give their opinion about the quality of all aspects of the educational facets of the course, e.g. the quality of the learning materials offered, the functioning of the small-group tutorial and the tutor, and the quality of lectures and practicals. The questionnaire was a Likert-type rating scale. Each item consisted of a statement with which students could agree or disagree. Several items were related to the structure of the blockbook, e.g. "the problems were clearly written" and "the blockbook gave me some opportunity to discover the essential subject-matter elements of this course".

At the end of both courses all students had to take an achievement test. These tests consisted of a set of five open questions in essay format, from which each student had to select three questions to answer. The test was designed to measure more than factual knowledge. By requiring use of law concepts and rules, and by stressing that full argumentation in the answer was necessary, students were encouraged to give answers showing insight. Table 1 illustrates an example of one of the questions. The questions were written by the teachers who were responsible for the teaching activities in the course units. Before offering the questions to the students, the coordinators of the other first year units checked that the questions were representative.

Immediately after the end of both courses students answered the questions under the exam conditions which are used in the faculty. After the examination the written answers were randomly distributed among seven staff members with sufficient content expertise. Every set of answers was judged by one expert. Every judge independently scored the student answers with the help of a global model

Table 1. An example of an essay question from the second course

Richard van Dalen is working as a house-painter, employed by Johnsons' Painting Inc. He has been working for several weeks at the estate of the Custers' family. The house has to be painted thoroughly, on the inside and the outside. During the painting the Custers' family goes on holiday to Switzerland. After several days Richard discovers that the Custers' family are glassware collectors. The family has a valuable collection displayed in some showcases in the living room.

By coincidence Richards' cousin Alfred is also very interested in antique glassware. To do his cousin a favor, one evening Richard suggests going to the Custers' house and taking a look. Cousin Alfred is very pleased with this offer. Since Richard has a key of the Custers' house, they get inside without trouble. After they have admired the antique glassware for a while, an accident happens. Richard slips and falls, by unknown cause, with all his weight against one of the showcases. The showcase with all the antique glassware smashes on the floor in a thousand pieces.

a. Indicate whether the Custers' family can claim for damages by Richard van Dalen or Johnsons' Painting Inc.
   Give reasons for your answer.

b. Indicate who has to pay for the damage in the end
   Give reasons for your answer.

answer and a scoring key, (Coffman 1971). The answers were scored from 1 (very bad) to 10 (very good). The course grade was based on the mean score the three answers. The data were analyzed using one-way analysis of variance (ANOVA).

Results

Results of the test to assess differences in prior knowledge between students in the successive courses do not give any indication of differences between students in either condition. The results were F $(1, 205) < 0.86$, $p < 0.35$ for the first course, and F $(1, 162) = 0.79$, $p < 0.38$ for the second course.

The results concerning the blockbook items in the program evaluation questionnaire which students had to fill in at the end of both courses showed no differences at all between students guided by a staff tutor and students guided by a student tutor. This means that the students leaning in the staff or student tutor condition had the impression they got the same information about what was relevant and what should be the focus of their learning activities.

Table 2. Means and standard deviations of the student's total test scores in the first and second course of the first year curriculum of the faculty of law.

Group	Course 1			Course 2		
	N	M	Sd	N	M	Sd
Students guided by staff tutors	125	5.6	1.6	82	5.2	1.7
Students guided by student tutors	105	5.5	1.5	95	4.9	1.6
Total	230	5.5	1.6	177	5.1	1.6

Table 2 shows the results of the end-of-course tests for both courses 1 and 2. There were no significant differences in achievement between students guided by student tutors and students guided by staff tutors. The results of the average mean score in the first course are F $(1, 228) = 0.002$, $p < 0.96$, the results of the subsequent course are F $(1, 175) = 1.42$, $p < 0.23$.

Significant differences also could not be found on separate questions. It is notable that in the second course students guided by staff tutors scored slightly, but not significantly, higher than students guided by student-tutors.

Discussion

The question whether students guided by staff tutors achieve better learning results than students guided by student tutors has to be answered in the negative. There is no evidence in this study that guidance by student tutors leads to performance

inferior to that obtained with staff tutors. The influence of other teaching activities seems to be negligible, because students only have one two-hour lecture per week. This lecture simply supports the information students have to study for their tutorial groups.

However, there were a number of features of the study which may have affected the results. First, it may be possible that students in the student-guided groups. Analysis of the distribution of the separate questions, however, shows no specific preference for one question or another. Second, there might have been variations in the academic background of staff tutors. Not all staff tutors were content experts: some had a non-juridical background (e.g., a legal historian and a legal sociologist were tutors in the first course). Yet, when these staff tutors were excluded from the comparison, no significant differences were found either. The third possible problem concerns the small number of questions students had to answer. The sampling of student achievement is therefore confined to relatively few areas. Weekly interviews with the tutors revealed that all students in the small-group tutorials discussed more or less the same learning goals and studied therefore more or less the same literature. The fourth possible problem has to do with the rather subjective nature of the scoring. Coffman (1971) shows a reliability coefficient of scores on essay questions between 0.44 and 0.96, depending on the school level, the number of judges and the number of questions. Although attempts were made to assess students' answers as objectively as possible (the answers were anonymously scored, judges had a global model-answer and a scoring key), only one content expert judged the answers to one separate question. Reliability estimates of the measurement procedure by means of a generalizability study (Cronbach, Gleser, Nanda & Rajaratnam 1972) showed a coefficient of 0.49 for the first course and 0.69 for the second course. These coefficients are only moderate. In order to deal with these issues, it was decided to screen a random sample of the student's answers in a more objective way, that is by propositional analyses (Schmidt 1982; Schmidt, De Volder, De Grave, Moust & Patel 1989).

Propositional analysis on the essay-answers

Subjects

From the material of the first course 43 answers from each condition (12%) and from the second course 74 answers[2] (27%) from each condition were randomly selected. The selection was made since the analysis of written protocols is quite laborious. Care was taken to avoid students being represented by more than one answer in the sample.

Procedure

Proposition analysis is a method used for text analyses (Meyer 1975). Propositions are subject-predicate units, each expressing one single idea. The boundaries of two

adjacent propositions can be found by identifying appropriate linguistic markers in the text: conjunctions, adverbs, relative pronouns, semicolons, and full stops (Schmidt, et al. 1989).

An example is provided by the following protocol (slashes mark boundaries):

Mrs. Custers agrees with Jongen Inc. (1)// that Jongen Inc. will do up her house in exchange for a payment in money by the Custers' family. (2)// in other words a legal relationship is established between the Custers' family and Jongen Inc. (3)// Jongen Inc. sends Richard van Dalen to the Custers' house. (4)//Richard is employed by Jongen Inc. (5)//Jongen Inc. makes use of the help of other people for the fulfillment of its legal obligation towards the Custers' family (6)//Art. 6.1.8.3. NBW holds Jongen Inc. liable for Richards' behaviour, (7)// in the same way as for its own. (8)//. The Custers' family can sue Richard on the basis of art. 6.3.3.1. NBW (9)//..............

In the scoring process, the answers produced by the subjects were first parsed into propositions by two independent judges. Next, each proposition was checked for accuracy. Inaccurate propositions were removed. In addition, a distinction was made between numbers of explanatory and descriptive propositions produced in the accurate answers (Bromage and Mayer 1981). An explanatory proposition was defined as a statement that is characterized by a juridicial qualification (e.g. the propositions #3, #7, #8 and #9). All other correct propositions were considered descriptive (e.g. the propositions #1, #2, #3, #4, #5 and #6). According to Mayer (1985), the number of explanatory propositions in free recall is a sensitive measure of depth of integration of subject matter into existing knowledge structures. Interater agreement for this task was 81%. Differences of opinion between judges were solved by discussion.

Results

The results of the proposition analysis – the number of accurate, descriptive and explanatory propositions – are presented in Tables 3 and 4. Differences between means were tested by one-way analysis of variance (ANOVA).

The results suggest that the answers of the first course show no significant differences between both conditions either for the total number of accurate

Table 3. Average number of accurate, descriptive and explanatory propositions in the first course.

Group	Accurate prop.		Descriptive prop.		Explanatory prop.	
	M	Sd	M	Sd	M	Sd
Students guided by staff tutors (n = 43)	24.6	13.4	3.7	3.3	21.0	11.0
Students guided by student tutors (N = 43)	25.3	12.6	4.7	4.2	20.6	10.3
Total (N = 86)	25.0	12.6	4.2	3.8	20.8	10.6

Table 4. Average number of accurate, descriptive and explanatory propositions in the second course.

Group	Accurate prop.		Descriptive prop.		Explanatory prop.	
	M	Sd	M	Sd	M	Sd
Student guided by staff tutors (N = 74)	21.1	10.1	4.0	4.3	17.1	9.6
Students guided by student tutors (n = 74)	20.9	10.1	2.9	3.1	18.0	9.4
Total (N = 148)	21.0	10.1	3.5	3.7	17.5	9.5

propositions $(F(1, 86) = 0.06, p < 0.81)$, or for the descriptive propositions $(F1, 86) = 1.66, p < 0.20$ and the explanatory propositions $(F1, 86) = 0.03, p < 0.87)$. The results of the proposition analysis in the second course show a similar pattern. The results for the number of accurate propositions were $(F(1, 146) = 0.01, p < 0.93)$, number of descriptive propositions $(F(1, 146) = 3.50, p < 0.06$ and number of explanatory propositions $(F1, 146) = 0.39, p < 0.54$. If we agree with Mayer (1985) that the number of explanatory propositions suggest the depth of integration of the subject matter, then the question as to whether students guided by staff tutors achieve better learning results than students guided by student tutors must again be answered in the negative.

General Discussion

In this study an experiment was described in which staff members as tutors were compared to third and fourth year undergraduate law students as tutors in two courses of the first curriculum year of the law faculty. At the start of the study possible differences between students' prior knowledge in both conditions were assessed. At the end of the course students' opinion with respect to the amount of structure of both courses was evaluated. The data revealed no differences between student tutor-guided and staff tutor-guided groups. So, in this study students in both conditions seem to have an equal level of structure so students did not have to ask their tutors for special help or direction (Schmidt, in press). Students' achievement was assessed by essay questions at the end of the course. The results suggest that students guided by staff tutors did not perform better than students guided by student tutors. A more elaborated analysis of a sample of students' answers, through proposition analysis, also indicated that there were no significant differences. These achievement results indicated that student-tutors are able to fulfil the tutor role as well as staff members. Several explanations are possible for this finding. One possible explanation would be that the students guided by student

tutors spend more time on self-study to compensate their tutors lack of expertise. Research of Moust (1993) suggests that this, at least partially, might be the case. In this study, the same group of students filled in a study time registration form weekly. On this form students kept track of their time-on-task. Results of this study time record indicated that in the first course students guided by student-tutors spent significantly more time on self study than students guided by staff tutors. In the second course, however, there were no differences.

Another explanation would be that staff tutors perhaps allow students less time and freedom for discussing the subjects in their tutorial groups. Bender (1983) and Webb (1983) found that staff teachers took 46% to 61% of the discussion time of the groups they guided. In an instructional setting where there is more equality and mutuality between students and tutor, students may feel more free to express opinions, ask questions and speculate about the problem-at-hand. When staff tutors take the floor most of the time, students are not able to formulate their own ideas, to question and explain subject-matters to each other. In a problem-based learning setting, however, the influence of the tutor is relatively small. Students and tutor meet each other twice a week for two hours in a tutorial group. During these encounters one of the group members is the chairman who is in charge of directing the discussion. The verbal contributions of the tutor have to be limited from the perspective of stimulating students' self-directedness and responsibility for their learning. However, it is unknown whether tutors keep their hands off the steering wheel. Research of De Grave, et al. (1990) suggest at least a more active and directive attitude of staff tutors.

A third possible explanation would be that student tutors behave in a different way compared to staff tutors. There are several studies (Schmidt et al. 1993a; Moust & Schmidt, in press) which suggest that staff tutors guide small-group tutorials in a different way with respect to subject-matter input and process facilitation. Schmidt and his colleagues found that staff tutors made more extensive use of their subject-matter knowledge than peer tutors. Student-tutors, on the contrary, have more relevant contributions, ask more stimulating questions and evaluate more frequently the group's functioning. The research by Moust & Schmidt indicates that student tutors are compensating for their lack of content knowledge by giving more attention, for example, to the learning difficulties of small-group tutorial students. Student tutors seem to be more "cognitively congruent", they seem to be better able to understand, and to express themselves at, their students' level of knowledge. They also behave in a less authoritarian manner and give more attention to preparation for the end-of course test. Unclear at the moment is whether these differences between the behaviour of staff and student tutors influence students' achievement. A study of Schmidt, Van der Arend, Moust, Kokx & Boon 1993b) suggest that this could be the case. Schmidt et al. compared the influence of tutors' subject-matter expertise on student effort and achievement. They found significant differences in advantage of the staff tutor. They also found significant differences on a number of critical behaviours in the domain of subject-matter input and process facilitation between expert and non-expert staff tutors. And the effect of the level of process facilitation, as well as the level of subject-matter input on achievement, is statistically

significant. The question which should be researched now is whether these differences also appear when staff tutors, either expert as well non-experts, are compared with student tutors.

Notes

1. Parts of this article were published in Moust, J.H.C., & Schmidt, H.G. (1993) Comparing students and faculty as tutors: How effective are they? In: P.A.J. Bouhuijs, H.G. Schmidt, and H.J.M. van Berkel (Eds.) Problem-based learning as an education strategy. Network Publications, University of Limburg, Maastricht.
2. More answers were selected at random from the second course due to the fact that students guided by staff tutors scored significantly better to one question after a non-expert tutor had been removed - a posteriori - from the group of staff tutors in the analysis mentioned above.

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