PREFERRED FORMAT OF TEACHING TUTORIALS

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Abstract

Tutorials are an essential part of the academic teaching process. They play an important role in students' understanding of the material and have a direct influence on their final marks. Selection of proper tutoring policy for improving students' success in engineering disciplines is a subject investigated all over the world. It is common to think that efficiency of tutorials in smaller groups is higher. However financial considerations limit sub-division of classes into small groups. This paper is focused on the issue of the preferred teacher of these sessions – lecturer (faculty member) or teaching assistant. The current study examines the effect of this administrative decision on students' performance, as measured by ratings of their teachers, and also by students' final grades. The influence of additional factors like class size, students' grades, or majors is also examined. Our findings show that there is no significant advantage of tutorials taught by teaching assistants in small groups over those taught by lecturers in plenum.
Keywords: *tutorials, teacher ratings, effective learning.*

Introduction

In recent years, the Israeli high education system has experienced a dramatic "revolution" through the establishment of a large number of academic colleges. Until a few years ago, the national educational system was based on a relatively small number of rather exclusive universities. After the "revolution" the number of undergraduate students in Israeli colleges has significantly surpassed the number of university students. An important aspect of this transformation is the opportunity given to a larger number of students to complete academic degrees, find better jobs, and improve their potential quality of life. However, to increase access to higher education, colleges have defined more lenient and flexible admission requirements, and have found that students frequently lack a strong scholastic background and deep understanding, especially in the field of natural sciences that form a basis for further successful undergraduate studies at faculties of engineering.

Bergeron and Paquette (1990) have reported that in order to maximize the learner's cognitive development, knowledge-intensive environments are essential to help him explore a situation, construct his own concepts, and discover general laws by his own problem-solving activity. Pek and Poh (2002) have shown that lecturers could make decision on selection of tutoring methods to maximize student learning and take action for different situations with greater confidence that is gained through

a clearer understanding of the problem.

It is common to think that efficiency of tutorials and laboratory works in smaller groups is higher. Box et al. (2001) have reported on development of a suite of computer-based tutorials as part of teaching laboratory and tutorial classes in Engineering Materials to first year mechanical engineering students. They have demonstrated that dividing an original group of twenty-five into two groups of about twelve increased student activity during the two-hour period. However financial considerations restrain sub-division of classes into small groups.

The Faculty of Engineering at the Ariel University Center of Samaria in Israel has initiated a program for undergraduate students, based on extensive investments in introductory courses, in the form of various preparatory programs and extended teaching hours during the first years of studies. In most engineering courses and in the obligatory "service" courses, required for engineering students, teaching assistants were assigned to teach tutorials. This decision was based on the expectation that teaching assistants could provide more individual assistance and explanations in a small-group setting, and would ultimately contribute to students' achievements in these courses.

An alternative way to improve the students' success in a course is teaching tutorials by the course lecturer, who has more experience compared to teaching assistants. In this case in order to avoid higher cost of the tutorials, the group is not divided into small subgroups. This paper deals with the effect of the tutorials' preferred teacher – the course lecturer teaching in plenum or teaching assistant teaching in a small group. The paper is based on students' ratings of their teachers and their final grades.

Importance of Tutorials

The rationale behind tutorial sessions is the understanding that certain subjects require more than passive attendance of a frontal lecture. Problems' solving and drills are essential for the study of engineering disciplines, exact sciences, and all the mathematics-based subjects. Preferably, students should have access to a feedback system, in which their homework is corrected and graded or solved in class. At engineering faculties, where courses are of a more technical nature, tutorials are designed to aid students attain an acceptable level of competence in the technical components of the relevant disciplines and help them with their general understanding of the course material.

Tutorials are a structured opportunity for students to receive additional assistance, when the material that was taught in the frontal lecture is not sufficiently understood. In this case the tutorials are aimed to yield deeper feeling of the subject. Tutorials are also designed to expand students' grasp and understanding of the material by providing an opportunity to clarify concepts that must be mastered in order to cope with the course. Good tutorials should include sufficient time allotted to discussion and accepting students as partners (Ravens, Nitsche, Haag and Dobrev, 2002).

Research literature attests to the essential contribution of tutorials to courses and the teaching assistant is perceived as essential to the success of the course (Hativa, 1997). There is a wide consensus that tutorials are basically designed to enhance effective learning (Condravy, 1995; Hawley & Valli, 2000) through the implementation of the principles of retention and application. Condravy (1995) has reported that effective learning is the complete understanding of the material so that it can be applied to situations or new material in the future.

Davis (1996) has suggested that good experiences of teaching and learning in the early stages of an academic education program can have positive and lasting effects on students' approach to learning, retention and academic success. Studying with graduate teaching assistants (GTAs) is particularly significant for first year students, who are relatively vulnerable to such effects; this vulnerability is even greater for students from minority groups, particularly ethnic minorities (Barrington, 1999). The increase in the number of GTAs in American and UK universities (Barrington, 1999) exposes a large number of students to their teaching.

Models of Tutorials

In many universities and colleges around the world, frontal lectures of courses are supplemented with separate practice classes or tutorials (also known as discussion groups, seminars, or

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 10, 2009

supplemental instruction (SI) programs). One common model is in which problems pertaining to homework assignments are dealt with separately, outside of the lectures, in a separate drill session or tutorial. According to this model, the same individual who teaches the lectures also conducts the tutorial sessions for the same class, irrelevant of its size. There may be several drawbacks to this arrangement: group size may be too large to allow effective discussion, or the lecturer may tend to "steal" some of the tutorial time to complete teaching of subjects from the lecture.

In another model, which is widespread in the Israeli academia and around the world, separate tutorial classes are devoted to drills. Larger classes are divided into smaller groups. In addition to problem solving and presentation of more examples these sessions enable the participant to discuss difficult issues in smaller groups, thus greatly enhancing the understanding of the material. This is true for most students and particularly for students with a weaker foundation in the subject matter.

Tutorials are designed to facilitate implementation and clarification of the subject matter, and provide a more in-depth understanding by permitting students to discuss the material and ask questions about subjects that they did not fully understand during the lecture. The small group setting allows tutors to establish and maintain more close personal contact with the students.

In the second model several teachers are required to teach relatively small tutorial classes. These teachers, known as teaching assistants or GTAs, are usually graduate students studying towards their master or doctoral degrees at the same institution or adjunct teachers working in the industry and having big professional experience. There are several advantages to employing teaching assistants as teachers for tutorials. One advantage is economical. Teaching costs are reduced, since the cost of a teaching assistant (and even several teaching assistants) is lower than that of a faculty member. Secondly, the teaching experience that the assistants gain may benefit the institute in the future, since many assistants intend to pursue an academic career and eventually join the faculty. Employing qualified specialists as teaching assistants has also the advantage that students learn important aspects from professionals and get examples not just from the literature, but from the leading enterprises in their field.

Indeed, proven success as a teaching assistant is known to be an important factor for the career advancement of graduate students, who seek work in the academia after completing their graduate and doctoral degrees (Hativa, 2003). Furthermore, an experienced GTA may have a heightened awareness of students' needs, or the ability to present the material in a manner more easily understood by the students, compared to the professor. Teaching assistants can substitute for the professor in case of emergency, and assist him or her in checking assignments and examinations as well.

Importance of Coordination Between Lecturer and Assistant

Efficient use of tutorials to promote students' course learning requires considerable efforts and an ongoing dialogue on part of both lecturer and tutor. It requires lecturers and their teaching assistants to maintain a relationship of interdependence, in which their performance is linked to one another (Davidovitch, 2003). In courses where the tutorials are taught by teaching assistants, there is an important interrelationship between the course lecturer and the teaching assistants, with the functioning of one affecting the functioning of the other (Jane, 2002). Coordination between lecturers and tutors regarding lesson content, level of understanding, type of explanations and illustrations used and other teaching elements is extremely important (Smith & Walpole, 1998; Martin et al., 1995). Practical methods for enhancing such coordination have also been suggested (Hativa, 1997). Effective utilization of the tutorial for promoting the students' learning requires that both the professor and the teaching assistant invest considerable time and effort to keep each other up to date on a regular basis.

Attributes of Effective Teaching Assistants

All types of effective teaching behaviors relevant to the lecturer, also apply to the tutor: lesson organization, clarity, positive attitude towards students, and effective use of lesson time (Gibbs, 1981). Other crucial characteristics necessary for a good tutorial are the tutor's ability to respond to students' needs, tutor's knowledge of the course structure, and tutor's ability to encourage independ-

ent thinking in the students (Feletti et al., 1982). The teaching assistant should display a positive attitude towards the students (Menges and Mathis, 1988).

Comparing Expert and Non-expert Tutors

The issue of the tutor's necessary level of expertise has received extensive attention in the literature on the role of the tutor in problem-based learning. The underlying assumption in the tutoring literature is that tutoring is the most effective method of instruction and that expert tutors are better than less skilled ones. Barrows and Tamblyn (1980) and Barrows (1988) state that ideally, tutorial groups are best guided by experts who are competent in subject-matter and in tutoring skills. In a review of studies by Schmidt and Moust (2000) obtained inconclusive results when comparing the academic achievements of students studying with expert staff tutors and non-expert staff tutors, and cited the contradictory results of a large number of empirical studies on this issue.

However, according to Schmidt and Moust (2000), our knowledge of expert tutors is rather limited for several reasons. One of them is that most tutoring studies include typical or less experienced tutors rather than expert ones. There are only a handful of studies in which expert tutors are the focus of the analyses. Other reasons have to do with the expert tutoring studies themselves. It is difficult to generalize the results to all expert tutors. It is also the case the there is considerable variability in what constitutes an expert tutor. Graduate students who are paid to work in a university tutoring program may be considered experts tutors in some studies but typical, non-expert tutors in others.

Student Evaluations of Tutorials

Studies show that satisfaction from lecturing in large classes is significantly lower than in small ones (Nevo and Ben Shaul, 2002). On the other hand, most teaching assistants have limited teaching experience, and their knowledge of the subject material is usually limited. Research has shown that the faculty members obtain their teaching skills mainly through trial and error. Lecturers with more extensive teaching experience are usually ranked higher by their students than novice lecturers (Hativa, 2001). Therefore, one can expect the students' satisfaction from inexperienced teaching assistants to be lower than their satisfaction from their more experienced lecturers. On the other hand, the younger teaching assistants may present a different perspective of the study material, or offer a superior understanding of students' needs, leading to higher student satisfaction. These opposing arguments raise the question: Which type of tutorial induces the greatest student satisfaction, and which is most effective?

Methodology of Research

Our research is based on students' performance as manifested by the final grades, and their satisfaction as reflected on their feedback surveys. Many faculty members question the validity of these surveys on the grounds that the students' satisfaction does not necessarily reflect their learning experience. They claim that frequently the students do not have the capability of assessing the lecturers' contribution to their learning. Therefore, in addition to examining the students' satisfaction from their teachers of the tutorials, it is also important to examine the relative contribution of each type of tutorial teacher to students' learning and understanding of the study material, as manifested in their final grade.

On the basis of the aforementioned surveys, the study concentrates on two types of tutorials:

a. taught by lecturers in the class plenum (generally in large classes);
b. taught by teaching assistants in small groups.

Our research questions were formulated are as follows:

1. Is there a difference in the evaluations given by students for the different types of tutorials?
2. Is there a difference in the students' mean grades for the different types of tutorials?
3. Are there differences between the various academic disciplines with regard to the first two questions?

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 10, 2009

Method and instrument

The study is based on a survey questionnaire (teaching feedback), distributed to the students of the Ariel University Center of Samaria in Israel. The questionnaire comprised the following five items, which the students were requested to evaluate for each course, on a scale of 1-5:

(1) Overall evaluation of the course instructor;
(2) Course structure and organization;
(3) Clarity of lectures;
(4) Instructor's attitude to the students;
(5) Overall evaluation of the course tutor;
(6) The degree of coordination between course instructor and tutor.

Students were also given space to add their unstructured comments as they desired. In courses, in which lecturers have taught also the tutorial, the students evaluated all seven items (although the last question was irrelevant). In tutorials given by teaching assistants the students evaluated only the two items pertaining to the tutor.

The following data pertains only to courses that were accompanied by a tutorial session. At the time the survey was conducted, there were 222 courses that included tutorial classes. The students in these courses completed 6,319 evaluation questionnaires pertaining to 113 tutors, teaching assistants or lecturers, who also taught tutorials. These results are presented in Table 1, by faculty.

Table 1. Tutor identity, by faculty.

Teaching assistants (%)	Lecturers (%)	Number of courses with tutorials (N)	Faculty
83.1	16.9	71	Engineering
59.1	40.9	88	Social Sciences and Humanities
96.4	3.6	56	Natural Sciences
71.2	28.8	215	Total

The table indicates that the vast majority of the tutorials (over three quarters) were conducted by teaching assistants. The exception is the Faculty of Social Sciences and Humanities, where the percentage of tutorials taught by lecturers is significantly higher.

The questionnaire was administered to students in their classrooms during class time, over the final three weeks of the semester. It was explained to the students that the data would be used solely for the purpose of evaluating the lecturers and courses. The questionnaire was anonymous and the time allotted for completion was unlimited. In practice, students completed the questionnaires in approximately 10-15 minutes.

The questionnaires, filled by the students of the Faculty of Engineering, were compared to those filled by the students at other faculties. The highest percentage of tutorials, taught by teaching assistants, were found in the faculties of engineering and sciences, compared to social sciences, in which one third of all course tutorials are taught by the course lecturers themselves.

Statistical procedures

We used three items from the Students Survey of Faculty (overall evaluation of instructor, overall evaluation of tutor, and extent of coordination between instructor and tutor). We compared students' achievements and faculty evaluations in courses in which instructors also function as tutors with courses in which lectures and tutorials were given by different individuals.

Statistical analysis was based on a two-way ANOVA for overall evaluations of instructors and tutors, to examine differences between evaluations. Two-way ANOVA was also used to compare students' achievements in courses of both types. Sheffe tests were applied to examine the source of any differences obtained.

Results of Research

The first research question pertained to the difference between the student evaluations of lecturers, who taught the tutorials (in large classes), and of teaching assistants (in smaller classes). The evaluations were performed on the "general evaluation of the tutor" item. A bidirectional variance analysis was performed, by tutorial teacher and faculty. Tutors were rated on a scale of 1 to 5, where 1 represents the lowest evaluation and 5 represent the highest one. The mean evaluations, by tutorial type and faculty, are presented in Table 2, where N is the number of courses, in which the questionnaires were filled by the students. The table also includes the results of the variance analysis of tutors' evaluations.

Table 2. Variance analysis of evaluation of tutors by tutorial type and faculty.

Tutorial staffing									Faculty
Total			Lecturers			Teaching Assistants			
SD	Mean	N	SD	Mean	N	SD	Mean	N	
0.82	4.00	71	0.70	4.21	12	0.84	3.80	59	Engineering
0.85	3.99	88	0.69	4.18	36	0.92	3.80	52	Social Sciences and Humanities
0.71	3.72	56	0.53	3.80	2	0.72	3.64	54	Natural Sciences
0.81	3.91	215	0.68	4.06	50	0.82	3.75	165	Total

The variance analysis indicates that no significant statistical differences were found between evaluation of tutorials taught by the lecturer and those taught by a teaching assistant ($F(1,209) = 2.13$, $p > 0.05$). No differences were found in the analysis by faculty ($F(2,209) = 0.43$, $p > 0.05$), nor was any statistically significant interaction found in the analysis between tutorial type and faculty ($F(2,209) = 0.09$, $p > 0.05$). It is important to note that the number of teaching assistants and lecturers in each faculty is different, and it was taken into consideration in the variance analysis examining the differences by faculty and by tutorial type.

The second research question pertained to the difference in students' mean grades in courses where the lecturers taught the tutorials and those where the tutors were teaching assistants. A bidirectional variance analysis was performed over the students' final grades, according to tutorial type and faculty. The results are presented in Table 3.

Table 3. Students' mean grades as percentages, by tutorial type and faculty.

Tutorial staffing									Faculty
Total			Lecturers			Teaching Assistants			
SD	Mean	N	SD	Mean	N	SD	Mean	N	
8.54	72.95	68	7.99	72.35	11	8.70	73.55	57	Engineering
6.67	77.42	86	7.34	77.67	35	6.83	77.00	51	Social Sciences and Humanities
7.55	73.84	55	1.15	76.74	2	7.61	70.95	53	Natural Sciences
7.97	74.74	209	7.29	75.38	48	8.13	74.09	161	Total

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 10, 2009

Table 3 indicates that no differences were found in the students' grades by tutorial type F (1,203) =0.39, p>0.05). According to results of a Scheffe test, the differences between the average grades in the various faculties) F (2,209) =4.74, p<0.01) were significant. In the Faculty of Social Sciences and Humanities, the average grade was higher (M=77.42) than at either the Faculty of Engineering (M=72.95) or the Faculty of the Natural Sciences (M=73.84). However, no interaction was found between the course grade by tutorial type and the faculty (F (2,203) =0.71, p>.05).

Conclusions

Tutorials are intended to add clarification, enhance in-depth understanding and the ability to apply the material in the future, as well as to provide an opportunity to respond to and discuss students' questions. Therefore, in contrast to lectures attended by dozens and sometimes hundreds of students, tutorials take place in small groups. The tutor's job is to identify and elucidate the topics, in which students encounter difficulties, introduce problematic issues in a manner, which is distinct from the lecture presentation, or discuss sources and literature, requiring reading. Tutors – when they are teaching assistants - also function as mediators between students and the lecturer. In engineering courses, and in the natural science courses, such as mathematics and physics, providing background for engineering students, tutorials play an important role in enhancing students' understanding of the material, and their ability to progress to more advanced and challenging levels of study. Compared to courses at other faculties, engineering and science tutorials are typically taught by teaching assistants rather than by the course lecturer in a plenum. Therefore it was interesting to compare students' evaluations and achievements in these two types of tutorials.

The findings of this study surprisingly show that students do not give higher rating to their experience in tutorials, taught by teaching assistants, compare to tutorials, taught in a plenum by the course instructors themselves. Neither was any significant difference in students' grades found when comparing both types of tutorials. This finding is especially pertinent in engineering and natural science courses, where we expected teaching assistants' work to have a more significant impact on the students' outcomes and evaluations.

Like many other academic colleges in Israel and around the world, the Ariel University Center has opened its gates to increase access to higher education for populations who did not traditionally proceed to academic education, due to their failure to meet admission requirements. When we take this fact into account, the findings becomes even more surprising since we would expect teaching assistants in small-group tutorials to be a significant contributor to the achievements and evaluations of students with a frequent lack of a strong scholastic knowledge in natural sciences.

The academic establishment maintains a distinction between the role of the course lecturer and the role of the tutor: While the goal of the course lecturer is to teach at a level that is appropriate for the majority of students in the course, the tutor's goal is to aid the students in clarifying the material or add a new perspective on difficult to understand topics raised in the lecture. Tutorials taught in small groups offer the added advantage of a personal approach, good integration of the study material, and solving students' problems of understanding, as well as the financial saving on salaries. Some critics therefore argue that tutorials conducted by course lecturers may not adequately fulfill their purpose.

In view of the academic and budgetary considerations, involved in tutorial staffing policy and tutorial group size selection, we examined the differences in the students' evaluations of the tutors who are lecturers in tutorial classes taught in the plenum, and tutors who are teaching assistants in small tutorial classes, and compared students' grades in courses accompanied by each type of tutorial. Our hypothesis was that teaching assistants' unique understanding of students' difficulties would be manifested in students' higher course grades. We estimated that the importance that the students attach to the tutorials would also be manifested in their satisfaction as reflected in the student evaluation questionnaires.

The findings of this study indicate that no significant differences were found in students' evaluations of their tutors or in the students' mean grades, in the different tutorial types. We have also found that the only factor related to the students' mean grade for the course (but not to their evaluation) is the faculty, in which they study, although no interaction effect was found with regard to

the mean grade between the faculty and the tutorial type. The differences between the faculties in terms of the mean grade for the course are related to other reasons like differences between faculties, class size, etc.

The findings of this study indicate that there is no academic justification for dividing course work between lecturers and teaching assistants, since lecturers are equally effective as tutors. The distribution of the work between lecturers and teaching assistants may, however, involve a budgetary advantage and an advantage in terms of training junior faculty members for teaching.

In order to assess the contribution of tutorials to students' understanding, additional studies should be conducted at a variety of academic institutions using various research methods, including qualitative studies employing interviews, observation and lesson analysis. It is important to study this issue in order to develop an in-depth and well-established approach to staffing policy of tutorial classes in the academic curriculum, with special consideration of the diversity of students studying at institutions of higher learning.

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