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## **STUDENTS' EVALUATION OF TEACHING MAKES HAPPY PROFESSORS DOES IT IMPROVE STUDENTS' LEARNING LEVEL? CASE STUDY OF A PROJECT SCHEDULING COURSE**

## **OCENA NAUCZANIA PRZEZ STUDENTÓW USZCZĘLIWIA NAUCZYCIELI CZY POPRAWIA JAKOŚĆ KSZTAŁCENIA STUDENTÓW? STUDIUM PRZYPADKU – ZAJĘCIA Z PLANOWANIA PROJEKTU**

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**Summary.** A continuous effort from the European Union to transform the European higher education institutes can be observed in recent years. It is necessary as Europe is facing considerable challenges: economic crisis, unemployment of young people in particular, changing demographics, emergence of new competitors, new technologies and modes of working. This effort is, among others, aimed to encourage, welcome, and take account of student feedback in order to detect problems in the teaching and learning procedures. The Student Evaluation of Teaching (SET) is one of the tools used to improve educational quality. The paper presents an experiment that was conducted at a Greek University. The experiment aims to investigate how renewed educational material affected both the students' learning outcomes and the Student Evaluation of Teaching. Three questionnaire-based surveys and a set of interviews were conducted. The primary results of the experiment show that the students' overall reception of the course on Project Scheduling was positive and accompanied by a significant increase in professors' rating. However, it is debatable whether one can speak of significant improvement in learning outcomes..

**Słowa kluczowe:** wyniki nauczania, zarządzanie projektem, zapewnienie jakości, SET, zadowolenie studentów.

**Key words:** learning outcome, project management, quality assurance, SET, students' satisfaction.

### **INTRODUCTION**

With the third recommendation of the High Level Group on the Modernisation of Higher Education in mind, that is "Higher education institutions should encourage, welcome, and take account of student feedback which could detect problems in the teaching and learning environment early on and lead to faster, more effective improvements" (EU 2013), the authors have decided to examine teaching and learning processes in the field of Project Management. The paper intends to illustrate how Project Management tools and techniques are used to support efforts to innovate the curricula, implement effective pedagogies in and beyond the classroom and enhance student learning and engagement in a Project Scheduling course at the Department of Business Administration, School of Management and Economics of Technological Education Institute of Thessaly, Greece.

The higher education in Greece consists of two types of institutions, Universities and Technological Education Institutes. Technological Education Institute of Thessaly (previously of Larissa), abbreviated to TEI<sub>Th</sub>, is the third major Technological Institution in Greece. TEI<sub>Th</sub> has over 15 Departments, divided into 4 faculties, which offer high-quality courses in scientific disciplines, each inspired by innovative research. TEI<sub>Th</sub> has more than 18.000 students. The Faculty of Business Administration is based on a dynamic team of about 26 permanent academics who offer theoretically founded, high-quality and socially relevant education, research and scientific services to the community in various economic fields. The Department offers lectures to more than 2.500 full-time students. The first two years' curriculum is roughly the same, and in the next two years students pursue their minor in Tourism and Hospitality Management, Marketing or Project Management. The course that is examined in the paper is mainly attended by students pursuing the Project Management minor.

Gkountroumpi et al. (2015) pointed out that in respect to the course evaluations in the Department applying benchmarks and evaluative criteria set out by the Hellenic Quality Assurance and Accreditation Agency (H.Q.A), the European Association for Quality Assurance in Higher Education (E.N.Q.A) and the British Organization, Chartered Institute of Management (C.I.M), some deviations were detected. However, there were also many convergences that indicate positive prospects for the Department. The Hellenic Quality Assurance and Accreditation Agency (H.Q.A) conducts a yearly internal evaluation in all Greek higher education institutions. The questionnaire used for the Student Evaluation of Teaching comprises a section on course evaluation and a section on professor evaluation (the rating scale is from 1 to 5, with 1: totally unsatisfied and 5: totally satisfied). As it is apparent from the Fig. 1 and 2 below, the course in Project Scheduling (Prosched) consistently ranked above the average in the Department and the same happened for the course professor (Prosched Prof) over a few year period.

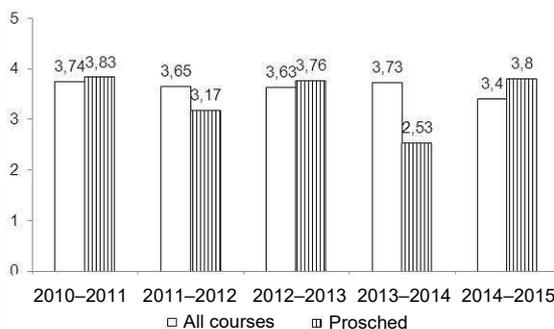


Fig. 1. The rating of the course

Source: UQA of TEI of Thessaly annual reports and own elaboration

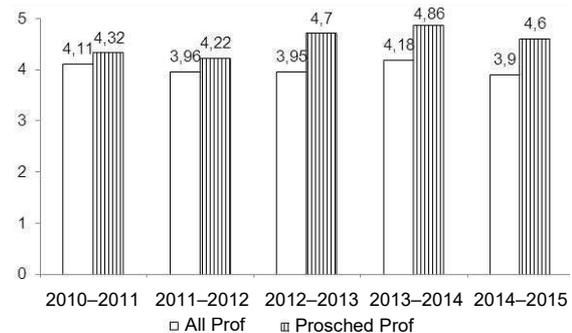


Fig. 2. The rating of the professor

Source: UQA of TEI of Thessaly annual reports and own elaboration

Interestingly, during the academic year 2013–2014 something seemed wrong since the professor rating remained excellent (4.86), whereas the rating of the Project Scheduling course decreased dramatically (2.53). This observation inspired the authors to explore what exactly happened and what were the reasons behind that change. Was it time to implement corrective measures? Further on, the authors describe the corrective actions taken that reversed this negative trend and led to the improvement of students' learning outcomes.

The paper consists of five sections. The next section presents a brief literature review on the need to enhance higher education quality, as well as the Project Scheduling course content and its learning objectives. The methodology of the case study is described in Section 3 and the research findings are presented in Section 4. The paper closes with conclusions and recommendations for future research.

## LITERATURE REVIEW

The two main activities of university faculty are teaching and research (Langbain 2008). Well-grounded common metrics were developed for research purposes, but in the case of teaching there seems to be some ambiguities. An approximation like SET (Student Evaluation of Teaching) mostly used in the USA was examined by various studies. Langbain (2008) tried to isolate the effect of grades (both actual and expected) on SETs. In her study, she measured variables that reflect grades and SETs: the average actual grade in the class, the average of the expected grades, and the average SET in the class (itself an average of the course and instructor rating, which are highly correlated). She pointed out that when faculty pay systems are based on SETs, then the members of the faculty have an obvious interest in giving higher grades to students. Higher grades result in higher measured performance and higher pay. Another important implication from the same study is that grade inflation will be greater in institutions most dependent on tuition revenues.

In a Spanish case study, Marzo-Navarro et al. (2005) investigated the hypothesis that "Student satisfaction is positively affected by five dimensions: Teaching methods, course administration, teaching staff, enrolment and infrastructure." The findings reveal that higher education institutions that would like to improve student satisfaction should focus on administration of essential services and not on services that could be called peripheral, such as enrolment or infrastructure. The study examined student satisfaction with higher education institutions in relation to student loyalty. Student loyalty was defined as students' intention to continue studies at the institution and the exercise of positive interpersonal communication. This is vital to guaranteeing the survival of universities in the competitive environment where they operate.

To evaluate teaching methods, the authors examined: (i) if the proportion between theory and practice was adequate, (ii) if the bibliography, documentation, etc., provided were adequate, (iii) if the teaching methods were appropriate, (iv) if the level at which these subjects were discussed was appropriate and (v) if the extent and distribution of the subjects were correct. In order to measure the course administration they asked if (i) the initial planning and the scheduled activities were respected, (ii) the course administrator performed his functions effectively and (iii) the course organization was adequate. Finally for the teaching staff the variables were (i) if the co-ordination between professors was good, (ii) the attitude of the teaching staff towards the students was positive and (iii) the quality of the teaching staff was high.

Generally speaking Project Management (PM) is the ability to plan, organize, and control resources in order to achieve specific goals within certain time frames and predefined budget limits. In other words, the challenge of project management is to achieve all of the project objectives (time, cost and scope) within existent constraints. According to Pollack and Adler (2014)

project management is a diffuse field of research, contributed to by practitioners and researchers publishing in a wide variety of sources, from journals exclusively focusing on PM, to publications targeted to specific industries or areas of application where projects are managed. In their scientometric analysis, the change in frequency of these keywords is depicted as percentage of the total publications per year. "Students" and "Curricula" peaked in popularity as keywords in 2001, occurring in 12% and 16% of articles respectively, before declining to 2% and 1% of articles in 2012. This data suggests an evanescent emphasis from approximately 1999 to 2005 referring to project management education as an area of research inquiry.

Recently Ojiako et al. (2011) underlined that this kind of research addresses the need to consider how to inform future pedagogy of project management by enabling the 'customer' to become involved in the enhancement process. Also this kind of research addresses the current lack of recognition that teaching and learning project management must acknowledge softer parameters such as empathy and emotion. Their study was focused on teaching and learning of project management in UK institutions. The study undertook to sample two separate University student cohorts studying project management (total n = 194). The aim was to identify some of the key components of student engagement experiences when studying project management and to consider the implications of the student view on the future of pedagogy within this discipline. The authors concluded that if academics are to successfully contribute to this desired transformation of project management professionals, then the findings of the study reiterate the need for new perspectives of pedagogy to be complemented by desired student experiences. This practically means that in order to create such learners, organizational structures, elements and limitations should be challenged, to include social interactive processes and debate between both the learners and deliverers of learning. Some directions for the future delivery of project management courses in higher education were derived from this research. Changes are required in order to facilitate students studying project management to become creators of knowledge rather than simple knowledge recipients. As an example they proposed that "educators need to embrace a different way of teaching by allowing engagement in project-based modules, where students are allowed to become proactive problem solvers and critical thinkers".

Based on the Canadian experience Mengel (2008) observed that students in their assignments have clearly reflected about and provided evidence for their increased competence in regard to both leadership outcomes in general and PM outcomes in particular. Furthermore, he concluded that undergraduate students can indeed effectively reflect on their learning about and performance in PM outcomes and significantly improve their abilities within that context. According to Mengel (2008) the teaching and learning processes should focus on what is to be achieved and why, in accordance with the PM criteria (e.g. create and document reasonable schedule) as part of a bigger learning outcome (e.g. problem-solving). On the one hand, students clearly understand what exactly is required of them, how well they meet each of the required criteria, and what they need to work on in order to improve their abilities. On the other hand, the faculty has the chance to identify students' deficiencies and analyzed the teaching needs so as to improve student learning.

For a better understanding of the long-term impact of PM teaching and learning, this study made three suggestions: A. Increase the amount of class time used to teach project management modules along the phased approach; particularly provide more learning opportunities regarding scheduling, execution, control, and closure. B. Increase the role of project check-ins for case-in-point teaching and possibly make project presentations during project execution an additional assignment and course requirement. C. Continue to engage in the scholarship of teaching and learning focusing on research of the impact of early project management learning and teaching for emerging leaders on their performance in projects or project environments after graduation (Mengel 2008).

When developing a curriculum of Project Scheduling course, it is extremely important to give students the ability in order to optimize the allocation of resources and integrate them to meet predefined project objectives, given the characteristics of the project and its Work Breakdown Structure (WBS), the scarceness of the resources available, as well as the relation between the project objectives and the stakeholders' needs.

However, the completion of a real project on time and within budget is not so easy. It requires a good understanding of project monitoring and controlling processes. Tools that are used for monitoring track project progress so as to detect potential problems in to correct them. Understanding of the basic elements and concepts is a prerequisite to successful implementation of various project control concepts in an integrated project management and control system (Vanhoucke 2012).

For the above reasons, a Project Scheduling course focuses on the integration of three dimensions of project management, in order to create the baseline schedule and manipulate the project monitoring and control. Firstly, the development of the baseline schedule is a preparatory action for the project control phase carried out during the execution of the project. This schedule according to (Vanhoucke 2014) is "nothing more than a predictive model that can be used for resource efficiency calculations, risk analyses, project control and performance measurement". Secondly, the timetable and resource allocations of the baseline schedule may lead to a sensitivity analysis of the schedule risk analysis. It must be shown as complete information set that may operate as a decision support tool during the project control phase. Finally, the project control is usually exercised using Earned Value Management (EVM) and Earned Schedule (ES) techniques. Both methods can be used to monitor the performance of projects in progress. The topic of PM course in this paper is the integration between EVM / ES control methods, baseline scheduling techniques and schedule risk analyses, referred to as dynamic scheduling (Uyttewaal 2005) or integrated project management and control (Vanhoucke 2014).

The Project Scheduling course given at the Department is a thirteen week course taught to Business Administration, Project Management minor students. They have a background in Economics and Operations Management. The course provides an understanding of key issues and methodologies related to Project Scheduling. As such, the content of this course provides the essentials of in managing and controlling projects in progress. The focus lies on integrating scheduling and control to set up a project management and control system using available tools and techniques and best practices. The framework for Project Scheduling is analyzed in the context of providing students with the information they need so as to be able to plan and

control projects. The emphasis is on making well-informed decisions concerning projects in progress by monitoring their performance and predicting their final expected duration and cost. Upon successful completion of the module, students should be able to:

- Comprehend the features of basic scheduling techniques and understand their relation to more advanced scheduling methods.
- Identify issues in resource-constrained project management systems and understand their impact on scheduling and control.
- Formulate a critical view on current integrated project management and control systems and suggest improvements.
- Understand the relations between different scheduling techniques and assess the relevance of the techniques based on project-specific parameters.
- Understand the nature and purpose of project control and apply the Earned Value Management methodology to monitor time and cost.
- Understand the nature and purpose of project control systems and apply those methodologies in order to trigger corrective actions to get projects in trouble back on track.

## **METHODOLOGY**

The study's main theoretical hypothesis is based on the interaction of three components in the class. The first component is the teaching quality (TEQ), the second is the learning level of the students (LLE) and the third one is how students perceive the teaching quality (TQR). We may evaluate TEQ in terms of the curriculum, the learning outcomes and the course preparation. The LLE of the students consists of their learning background, their soft skills and their motivations for the course after the end of the semester. Finally, TQR can be measured by the students' course rating in as compared to other courses. Under this framework, two research questions were posed:

(RQ1) Does the improvement of teaching quality affect the improvement of students' learning level?

(RQ2) Does the improvement of teaching quality affect the way students perceive the teaching quality?

In order to explore this theoretical model we determined a corresponding metric model which would be applied in the class. We assumed that it is reasonable to evaluate the teaching quality (TEQ) through the prism of three factors. The main factor was the course curriculum. In the case of the Project Scheduling course, the curriculum was clearly defined and was twice accredited, both internally by the Department and externally by the Committee of the HQA. Another factor that contributed to TEQ was the development (renewal) of supplementary course material. This material was ready before the start of the semester. Based on the course evaluation in the previous year, the material was moderated and enriched with real project case studies. The moderation procedure was implemented with the colleagues from the faculty. The last factor that remained was how to measure the level of learning outcomes that each student will gain by the end of the course. For this reason, two intermediate and the final tests were reviewed by the faculty. It was estimated that the difficulty of examination papers was the same as in the previous semesters. Students were randomly divided into six groups

of maximum 18 persons. The authors decided to distribute the renewed material in two groups: 1 and 4. These were the control groups of the experiment.

We measured the learning level of the students (LLE) in three instances. For this purpose, the experiment consisted of 3 questionnaire-based surveys, which were voluntarily completed by students, and a set of interviews conducted after the classes had ended. The students were aware of the lectures' timetable and of the three examinations to be held during the semester. The semester started in March and finished in June. The first examination was scheduled in the sixth week of the course (April), the second during the tenth week (May) and the third one at the end of the semester (June). The final grade of any student derived from all examinations, where the two intermediate exams accounted for 40% of the grade and the final exam for remaining 60%.

The first instance was before the start of the course during the first week of the semester, the second was during the tenth week and the third at the end of the course. The first questionnaire consisted of 16 questions and 3 brief problems. The first question was about previous knowledge about Project Management (dichotomist). The other questions (7-scale Likert) were grouped in four sections that recorded students' a) interest in their studies, b) difficulties encountered in the course of the studies, c) skill development in the use of out-of-class resources (like.g. University library, internet etc.), d) skill development in the English language. The three short problem-solving tasks had graded difficulty: 1) logical thinking for the first problem, 2) logical thinking plus numbers' manipulation for the second, 3) logical thinking plus university level mathematics for the last one. For each task a score was assigned from 0 (totally wrong) to 100 (absolutely correct).

The second instance was the intermediate questionnaire that consisted of 29 questions. The first was about student's grade in the first intermediate examination (from 0 to 100). The remaining 28 questions (7-scale Likert) were grouped in 5 sections that recorded students' a) interest in their studies (before this course), b) interest in the Project Scheduling course (till the tenth week), c) difficulties encountered in their studies (before this course), d) difficulties with Project Scheduling (till the tenth week), e) evaluation of the usefulness of the supplementary material (only for the control groups). The third instance occurred at the end of the course since all students have to complete the electronic version questionnaire provided by the Unit of Quality Assurance. This questionnaire consists of 26 questions divided into four parts. The first refers to the course, the second to the professor, the third to the laboratory and the last is a student self-evaluation. This is when students' learning level can be evaluated in terms of their final grade.

The first survey was conducted during the first week (March). It aimed to determine the students' feeling about their studies and the Project Scheduling class. The survey was taken by 67 students hailing from six groups. The second survey, consisting of 85 questions, was conducted after the first examination. The third survey was organized by the Unit of Quality Assurance of the institution at the end of the semester (May) and consisted of an electronic questionnaire completed by 86 students. Finally, 12 students were asked to express their opinions about the Project Scheduling course in a face to face semi-structured interview with an external moderator (former postgraduate student of M.Sc. in Project Management). This part of the research was organized in order to cover some aspects of the PM didactics that were not clear from the surveys.

Table 1. Reliability analysis of questionnaires - Cronbach's Alpha

Questionnaire 1		Questionnaire 2		Questions concerning ...
Q1-Q3	0.742	Q1-Q3	0.783	attractiveness of studies
		Q4-Q8	0.795	attractiveness of the course
Q4-Q5	0.647	Q9-Q10	0.134	difficulties with the studies
		Q11-Q26	0.759	difficulties with the course
Q6-Q11	0.796			use of the facilities
Q12-Q15	0.880			english language skills
		Q27-Q28	0.939	evaluation of the renewed material
Q1-Q15	0.712	Q1-Q28	0.809	

The reliability analysis of the questionnaires used in the two surveys gave poor results for the group of questions dealing with difficulties that students faced during their studies. Therefore, this set of questions was dropped. The Cronbach's Alpha values were sufficient for the other variables (Table 1) in order to conduct the analysis.

## FINDINGS

Only (22.4%) 15 from the 67 students which participated in the first survey had previously taken a course relevant to Project Management. This fact means that the experiment will be carried out on a sample with no previous knowledge about Project Management. Analyzing students' participation in the first two surveys we concluded that students which belong to the control groups (1 and 4) corresponded to 40% of the total students (Table 2).

Table 2. Survey participants by group

Group	Survey 1		Survey 2	
	N	%	N	%
G1cg	17	25.4	17	19.1
G2	12	17.9	14	15.7
G3	5	7.5	15	16.9
G4cg	16	23.9	18	20.2
G5	4	6.0	12	13.5
G6	13	19.4	13	14.6
Total	67	100.0	89	100.0

From the first survey we may envision a "typical" student attending this course. They have (good to excellent) command of the English language, with the majority holding at least the FCE certificate. They study in a campus-based setting, with student resources provided by the university library. However, unfortunately, they use the library only when a specific assignment forces them to do so. The students' profile is analytically presented in the Table 3 below.

Firstly, we present findings related to the students' learning level at the start of the course. As mentioned above, students were requested to solve three brief problems. On a scale from 0 to 100, students' initial learning level presented the following distribution (Table 4). Almost all students solved the logical thinking problem. When arithmetic manipulation of numbers was required, the proportion of students that solved the problem decreased, which was quite discouraging since the problem required only simple mathematical modeling.

Table 3. Students' profile

Survey 1	Median
Q6: I often use the University library for my courses	2
Q7: I visit the library to look for sources at least twice per month	2
Q8: I often use the library in order to prepare my assignments	2.5
Q9: The University library is a pleasant place for reading	5
Q10: The University library covers my needs for the courses	5
Q11: The University timetable is convenient	5
Q12: My English language level is fair enough	5
Q13: I can easily read texts written in English	5
Q14: I communicate easily in English	5
Q15: I hold an English language certificate (at least FCE)	6

Table 4. Students' statistics on problem solving

Short problem	N	Mean	Std. Deviation
Logical thinking EX1	67	96.41	17.21
Logical thinking plus numbers' manipulation EX2	67	52.02	45.93
Logical thinking plus University Mathematics EX3	67	34.18	41.42

An interesting conclusion derived from these data is that students' knowledge of mathematical modeling appears to be weak. To create a rating scale for the students' learning level, a weighted average of the previous results was used, computed according to the formula  $(EX1 + 2*EX2 + 3*EX3) / 6$ . The difficulty level of each problem corresponded to different weights. Average initial learning level was 50,5 and the standard deviation was 27.44. Having some PM teaching experience, we arbitrary constructed four classes of PM learning level based on the weighted average. A score lower than 20 per 100 was classified in class 1 representing a very weak level. A score above 20 and less than 50 per 100 was classified in class 2 representing a weak level. A score above 50 and less than 80 per 100 represented fair level and a score greater than or equal to 80 per 100 – a high learning level. Using the same classification, results were computed for the three instances of examination. The results are presented in Table 5 below.

Table 5. Students' learning level distribution in the three instances

Examination	Starting (N = 67)	Intermediate (N = 85)	Final (N = 69)
Class of learning level	%		
Very weak [0,20)	25.37	16.5	0.00
Weak [20,50)	17.91	12.9	24.64
Fair [50,80)	43.28	51.8	55.07
High [80,100)	13.43	18.8	20.29

From the results it is evident that the students' learning level of PM definitely improved during the course. More than 75% of the students obtained a score above 50 per 100 in the final examination, whereas the corresponding proportion was less than 50% at the start of the course and almost 69% in the intermediate examination. The next question was formulated

as follows: How significant was the improvement in each of the six groups? The results were interpreted with the use of non-parametric approximation since the variable that counts the learning level is of order scale. To check the null hypothesis that the learning level did not change from exam to exam in each group, the results of Kruskal – Wallis test (between all examinations)  $X^2$  values and the Mann Whitney test (between first and last examination) U values were computed, which are presented in Table 6.

Table 6. Statistical differences in the learning level between instances

Group	$X^2$	$p$	Group	$X^2$	$p$	Group	$X^2$	$p$
G1cg	13.617	0.001	G3	3.169	0.205	G5	3.103	0.212
	U	$p$		U	$p$		U	$p$
	41.5	0.003		16.5	0.310		13	0.683
	$X^2$	$p$		$X^2$	$p$		$X^2$	$p$
G2	0.084	0.959	G4cg	0.836	0.658	G6	6.128	0.045
	U	$p$		U	$p$		U	$p$
	50	0.808		123	0.867		51	0.091

There is a significant statistical difference for G1 (the first control group) in all respects. Also for G6, comparing the three examinations, a significant statistical difference can be observed. Looking at the overall performance we have to underline that this semester, regardless of the experiment, there was an improvement of students' knowledge metric. In the first examination, 50% of students recorded scores up to the average and by the end of the semester, in the final examination, the corresponding proportion became 75%. More detailed information is presented in Table 7 below.

Table 7. Central tendency statistics of learning level

	Minimum	Q1	Median	Q3	Maximum
Startex	0	25	50.0	70.83	100
Interex	0	40	60.0	75.00	100
Finalex	25	50	57.5	75.00	100

From the statistical point of view, the overall improvement is confirmed by the results of Wilcoxon Signed Run test ( $Z = -2.752$ ;  $p = 0.006$ ). If we try to interpret the results using the variable which counts learning level as a ratio scale, then the results are the following (Table 8).

Table 8. Learning level in ratio scale

	N	Mean	Std. Deviation	Minimum	Maximum
Startex	67	50.49	27.44	0.00	100.00
Finalex	69	61.22	19.38	25.00	100.00

In the second phase, questionnaires completed by students for each instance of the experiment were analyzed. The set of questions Q1–Q3 in both surveys referred to students' interest in their studies (or alternatively, the questions considered the attractiveness of the

Department). The question 1 was Q1: "The course I have been taught till now was interesting". The next question was Q2: "The teaching approach applied in these courses motivated me". The third one was Q3: "I believe that these courses will help me find a job". In the second survey students were asked to evaluate the three questions with a cut-point, the attendance of the course (Table 9).

Table 9. Attractiveness of the studies at the Department

	Survey								
	1			2 (before attending PM)			2 (after attending PM)		
	mean	median	mode	mean	median	mode	mean	median	mode
Q1	4.88	5	4	5.01	5	5	5.57	6	6
Q2	4.22	4	5	4.79	5	4	6.26	7	7
Q3	4.74	5	6	4.89	5	5	4.85	5	5

We compared the two surveys using Mann-Whitney test. There is a significant statistical difference in the answers to the second question ( $p = 0.026$ ). This fact shows that the teaching quality affected students' motivation concerning the courses. Another issue remains unanswered here: How did the other courses contribute to the way students perceived the teaching quality?

Analyzing the questions in the first survey by the learning level class of the students, one can observe a statistically significant difference in the answers for Q2 ( $X^2 = 8.074$ ;  $p = 0.045$ ) and for Q3 ( $X^2 = 9.216$ ;  $p = 0.027$ ). The students from second class of learning level (grades above 20 and less than 50) evaluated both questions lower than other students. In the second survey, the situation turned around and the corresponding statistics were for Q2 ( $X^2 = 4.187$ ;  $p = 0.242$ ) and for Q3 ( $X^2 = 2.993$ ;  $p = 0.393$ ). The set of questions about the difficulties with the studies were not analyzed due to their low reliability in both surveys.

In the second survey a set of questions about the course on Project Scheduling and the difficulties related to the course was answered by students. A general feeling about the course, described by median, is presented in Table 10. Students seem not to face difficulties with the course in terms of a subject that was new for them or the way their knowledge was evaluated by the professor. They appreciated a lot the e-class, an asynchronous educational platform and the existence of scheduled intermediate examinations for their knowledge evaluation.

The students agreed with fundamental rules that the professor set at the start of the course and they highly appreciated that lectures started on time. While everybody found the supplementary exercises helpful, there is a statistically significant difference as it comes to solving the exercises on their own. Students from groups G1 and G6 seemed to deal better with the exercises than the other groups. The same was also true in the case of how often students use the University library.

Figure 3 below shows the ratings of initial and final exam scores of each group, as well as of the initial importance of studies and Project Management that was examined in the second survey. Each group was assigned a rank from 1 to 6 related to the mean rank of its values. The higher greater mean rank corresponded with position 6 and the groups were put in a descending order. The improvement of learning level in G1 and G6 groups is obvious. The students in these groups increased their ranking referred to grades for two positions. The

students in other groups remained on the same or decreased position. The same observation holds true also for the ranking of importance. A statistically significant difference was observed in the answers to Q25. Students that did not often use the e-class material were those who belonged to the third class of learning level (grades above 50 and less than 80).

Table 10. Students' satisfaction from the course by learning level and by group

Survey 2 Questions	Median	By order		By group	
		$\chi^2$	$p$	$\chi^2$	$p$
Q11: Till now, the course as a subject was difficult for me	3	5.700	0.127	2.414	0.789
Q12: Till now, the way that my knowledge about the course was evaluated seems to be difficult for me	2	4.455	0.216	1.612	0.900
Q13: The use of e-class for teaching seems to be useful for me	7	2.425	0.489	5.152	0.398
Q14: Intermediate examinations were a good idea for me	7	2.140	0.544	8.074	0.152
Q15: I agree that entering after the lecture had commenced should not be allowed	6	3.752	0.290	5.410	0.368
Q16: I agree that the use of mobile phone should be prohibited during the class	7	1.643	0.650	4.236	0.516
Q17: Professor starts the lecture on time	7	1.010	0.799	7.270	0.201
Q18: Educational material is distributed on time	7	6.637	0.084	3.145	0.678
Q19: Professor's attitude makes it quite easy for me to communicate with him/her	7	3.221	0.359	8.457	0.133
Q20: I did the supplementary exercises from the educational material	1	0.721	0.868	15.068	0.010
Q21: Supplementary exercises are helpful	6	1.091	0.779	9.429	0.093
Q22: I often use the University library	1	3.880	0.275	13.348	0.020
Q23: I often use internet resources for the course	1	3.623	0.305	8.979	0.110
Q24: I attend all lectures	1	1.942	0.585	4.652	0.460
Q25: I often use the e-class material	4	9.133	0.028	7.342	0.196
Q26: I find the e-class material useful	4	7.732	0.052	9.824	0.080

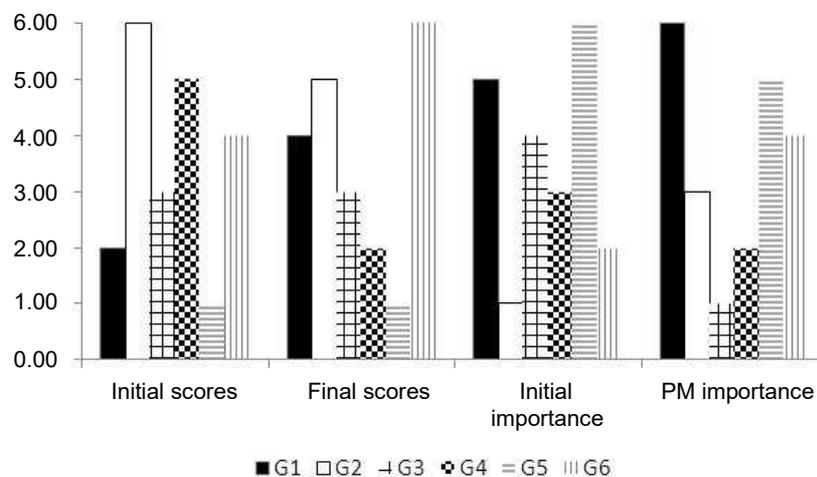


Fig. 3. Groups' rating by learning level and importance of studies

We may not verify the first research question. That is because we observed statistically significant improvement of learning level in the G1 but not in the second control group, G4.

Things were easier with the second research question. For this purpose, the results of the UQA survey conducted electronically is used. The following Table presents the questions (respondents provided answers on a five-point Likert scale, from 1: totally disagree to 5: totally agree; except for Q 33) divided into four sections.

Table 11. Students' satisfaction measured by the Quality Assurance Unit

UQA survey		Mean	SD	Mean (all courses)
<b>A. The course</b>				
1	Were the class and the equipment appropriate for the course needs?	4.0	0.9	3.6
2	Were the course objectives clear?	4.2	0.8	3.6
3	Was the educational material appropriate for the course?	3.6	1.0	3.3
	Was the procurement of educational material easy?	3.7	1.1	3.5
5	Was the course well-organized and supported your understanding?	4.1	0.9	3.6
6	Did exercises help you to understand the theoretical part of the course?	3.9	1.0	3.5
7	Did the supplementary material from the course website help you?	3.7	1.1	3.3
8	Did the literature available in the library help you?	2.6	1.3	2.7
9	Are the predecessors (courses) necessary?	3.4	1.1	3.2
10	Is the difficulty level of the course appropriate for the semester?	3.9	0.9	3.5
11	Are the evaluation criteria objective?	4.1	0.9	3.5
12	How useful is it to have access to solved examination papers in the course website?	3.7	1.1	3.5
13	Is the option of intermediate evaluation of your knowledge significant to you?	3.9	1.0	3.3
14	Is the provision of analytical schedule of teaching related to the course objectives important to you?	4.0	1.0	3.7
<b>B. The professor</b>				
15	Did he/she present the course content in a satisfactory way?	4.5	0.7	3.9
16	Did he/she boost your interest in the course?	4.5	0.7	3.8
17	Did he/she analyze and present the material in a simple and interesting way using examples?	4.5	0.8	3.9
18	Did he/she encourage students to ask questions and develop a critical point of view?	4.6	0.7	3.9
19	Was he/she on time and conscientious in his/her duties?	4.6	0.8	4.1
20	Was he/she accessible?	4.7	0.6	4.0
<b>C. The laboratory class</b>				
21	Was the analytical schedule for the laboratory class available from the beginning of the semester?	4.2	0.9	3.5
22	Was the laboratory class appropriate?	4.0	0.8	3.5
23	Was the equipment sufficient?	4.0	0.9	3.5
24	Was the equipment used?	3.8	1.0	3.4
25	Were sufficient instructions available for laboratory application?	4.1	0.7	3.6
26	Did the professor explain in depth the fundamentals of the applications?	4.2	0.8	3.6
27	Were the laboratory applications' objectives clear?	4.2	0.8	3.6
28	Is the difficulty level of the laboratory applications appropriate for the semester?	4.1	0.7	3.6
29	Are the evaluation criteria objective?	4.2	0.7	3.6
30	Did the laboratory applications contribute to your understanding of the theoretical part of the course?	3.9	0.9	3.4
31	Was the theoretical part knowledge necessary for your sufficient performance in the laboratory applications?	3.9	0.9	3.4
<b>D. The student</b>				
32	I submitted the assignments on time	3.4	1.2	3.3
33	I often attended the classes (1: almost all)	4.1	1.0	3.9
34	I regularly studies for the course	3.1	1.1	3.0
35	I used the supplementary material from e-class	3.4	1.1	3.1
36	I often used the library	2.4	1.3	2.4

Source: UQA of TEI of Thessaly.

This Table 11 consisting of the questionnaire output, is distributed to all professors that teach semester courses. One point is that this automatically produced output uses means and standard deviations instead of medians that, in our view, would be more appropriate for this kind of variables. The other point that allows us to accept the hypothesis that the improvement of teaching quality reflects the way students perceive this quality, is the fact that finally students gave high ratings to all components of the course.

## CONCLUSIONS

A model was generated that connects teaching quality, improvement of students' learning level and students' satisfaction from the course. We supposed that the high teaching quality affects the learning level positively. In this model the instructor can control only the quality of the teaching provided. In such case, the overall students' performance was satisfactory as they generally improved their learning level. However, there is no sufficient evidence confirming the positive impact of the usage of renewed material. The renewed material was the basic metric of teaching quality improvement. In order to verify the hypothesis that teaching quality improves students' learning level, an extension of this experiment would be necessary. In such an extension, the authors intend to examine all of the courses offered in the same semester at the Department. It was confirmed that improvement of teaching quality was noticeable to students. It was expressed in their positive assessment of teaching, with high rating given to all aspects of the course. In the forthcoming semester the same experiment will be conducted at the Department. In case of the Project Scheduling course a new version that includes video lectures has already been prepared. In this way, the educational material will be enriched and the model will be exposed to new feedback from the students. But some aspects will remain hidden. The improvement of students' learning level is computed in quantitative terms and it is difficult to interpret the qualitative dimension. As it comes to the qualitative dimension, student A from the first control group said that the course was "the best he has ever attended because the professor explained the theory analytically and presented effective examples". But student B from G6 who attended all classes had a sense that it was "easy to understand the new meanings during the lectures, but I was confused when I tried to read alone". In line with that, student C from G6 also wondered whether "we, as students, don't use the educational material in an appropriate way". This kind of analysis is of essence to ensure that students are not just satisfied with the course, but acquire a deeper understanding of the course content.

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**Streszczenie.** W ostatnich latach obserwować można starania podejmowane przez Unię Europejską, mające na celu reformę szkolnictwa wyższego. Jest to konieczne w obliczu wyzwań, przed którymi stoi Europa, takich jak kryzys gospodarczy, bezrobocie, zwłaszcza osób młodych, zmieniająca się sytuacja demograficzna, pojawianie się nowej konkurencji, nowych technologii i metod pracy. Wysiłki te mają między innymi na celu zachęcenie studentów do dzielenia się informacjami zwrotnymi, które pozwolą na identyfikację ewentualnych problemów w procedurach nauczania i uczenia się oraz ich uwzględnianie w programach kształcenia. Jednym z narzędzi służących poprawie jakości kształcenia jest ocena jakości kształcenia przeprowadzana przez studenta SET (Student Evaluation of Teaching). Niniejszy artykuł opisuje eksperyment przeprowadzony na jednej z greckich uczelni. Celem eksperymentu było zbadanie tego, jak poprawiony program kształcenia wpłynął na rezultaty nauczania i ocenę jakości kształcenia przez studentów. Badanie opinii studentów przeprowadzono z użyciem trzech kwestionariuszy i wywiadów. Wstępne wyniki eksperymentu wskazują na to, że ogólny odbiór przedmiotu planowanie projektu był pozytywny, a ocena profesora prowadzącego zajęcia znacznie wzrosła. Jednakże kwestią dyskusyjną pozostaje to, czy świadczy to jednoznacznie o poprawie wyników nauczania.

