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IMPLEMENTATION OF THE CONTINUOUS ASSESSMENT IN PHYSICS IN THE OPTICS AND OPTOMETRY DEGREE. REFLECTIONS AND RESULTS

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Abstract

The assessment is the most complicated task in the teaching work and it should be especially useful to improve the features and results of the learning process proposed at the beginning of an academic year. It must incorporate tools with which we are able not only to qualify or assess the continued acquisition of knowledge by students but also must provide information on the skills acquired by the student. The use of continuous assessment has been imposed in all degrees at the University of Alicante, limiting those situations where a final test is performed not to exceed the 50% of the student final mark.

In this work, we present and analyze the results of developing and implementing a model of continuous and summative assessment in Physics, a subject of attending classes in the set of considered basic ones of the Optics and Optometry Degree of the University of Alicante. Final results have been disappointing considering the involved effort, although some questions enable us to provide further improvement. Compared to previous two years when there were two tests, a midterm and a final qualifying examination, there is a quantitative improvement. Regarding the average score of students who passed, there was also a slight improvement in the current year. It should be noted that students who attended Physics in secondary school show great facility to get the minimum knowledge and ways of working required to pass the year. Finally, we propose possible improvements in the methodology of the teaching-learning process.

Keywords: Continuous assessment, EHEA.

1 INTRODUCTION

The assessment can be understood as the whole set of activities that allows us to obtain objective information to determine which have actually been achieved objectives and meets our initial expectation. Furthermore, they form the basis to take decisions that optimize the teaching-learning process. The assessment is, in our view, the most complicated task in the teaching work and it should be especially useful to improve the features and results of the learning process proposed at the beginning of an academic year (although this one may vary during the year). It is a powerful tool that allows lecturers to influence the response and behaviour of students [1].

In the literature, one can find a large number of references related to how to conduct the assessment process [2, 3]. However, most are too vague and general or difficult to translate to particular situations. As can be seen on Internet, if you search on ways to assess a subject such as Physics in Spain, you can find very few alternatives. We note that, normally, it is assumed that continuous assessment just consists of a small increase in the number of performed written tests. In many cases, it is noted that these tests are performed within a virtual environment and reduced to a few multiple choice questions and immediate correction. Obviously, this type of assessment may improve outcomes in terms of rating the students, however it does not guarantee an increase in the level of knowledge and skills acquisition.

As it is indicated in [4], the assessment should incorporate tools with which we are able not only to qualify or assess the continued acquisition of knowledge by students but also should be able to provide information on the skills acquired by the student. Thus, the students acquire some specific skills that prepare them for professional life, as the European Higher Education Area (EHEA) claims. These requirements increase the complexity of the assessment and, moreover, do not take into account the status and profile that a matter has within the current curriculum. Obviously, the analysis of skills acquired by students in a specific subject of a related degree in advanced courses is easier than to conduct the assessment in core subjects of first year of college, as Maths or Physics.

In 2008, the University of Alicante (UA) imposes the use of continuous assessment in all college degrees. Paragraph f) of 16th Article of the Legislation of the UA for the implementation of Degrees states that: “The new curricula require continuous assessment system. Therefore, due to the fact that students must acquire some of the competences from the development of the planned teaching activity, in those situations where a final test is performed, its contribution to the final mark will not exceed the 50% [5]”. Hence, in the subject of Physics of the first year of the Degree in Optics and Optometry of the UA, we have developed and implemented a model of continuous and summative assessment. This paper presents the analysis of early results. Physics is a subject of attending classes in the set of considered basic ones, with a workload of 6 credits under the European System of Credit Transfer and Accumulation System (ECTS). It is temporarily located in the first half, but the conditions make that it is taught in a mere four months (from about mid-September to mid December).

2 SYLLABUS AND DEVELOPMENT

The level of achievement of the goals is a variable that depends on many factors. Many of them are random and difficult to take into account sufficiently in advance: type and number of initial objectives, number of students in the group, characteristics and abilities of the students, characteristics of the subject, form and type of assessment, limitations of space and time, etc.

Table I. ECTS Layout

Teaching activities	Subject	Activity		Assessment		On-site hours	Off-site hours	ECTS hours
		Lecturer	Student	Procedure	Weight			
Classroom lectures	Theory	Exposition of the theory.	Assimilate what is said, asking the doubts that arise.	Two controls from	18%	22	30	52
	Problems	Resolve the issues and problems previously proposed Propose problems or questions to each student	Assimilate what is said, learning to solve problems. Problem resolution and exposure.	Given in problems Presented problems	9% 6%	15	35	50
	Group Tutorship	Answer questions, raise exercises, guide the resolution, raise issues	Plan and perform as a team the activities proposed by the group and/or the lecturer	Attendance and participation	3%	3	3	6
Laboratory	Practice	Preparation of working practices and scripts. Explanation and resolution of questions	Previous study. Full implementation of the practice. Tests	Results presentation Laboratory Tests	18%	15	8	23
Supervised activities	Practice report	Propose practices to expose and help in the preparation.	Making a presentation of one of the practices	Raising questions in the presentation	6%	2	4	6
Final assessment tests	Theory, problems and practices	Raise, monitor and correct the test. Mark the students as a whole	Prepare and conduct the examination	One final test of 3 h duration	40%	3	10	13
TOTAL STUDENT TEACHING LOAD					100%	60	90	150

The entire subject syllabus began, together with all other of the first half, during the academic year 09/10 in order to well in advance prepare and analyze the start of the new degrees [6]. As a starting point, we took the general guidelines expressed in the memory of Optometry Degree by the UA [7]. In this analysis, there were discussed and agreed on the ways of acting, significant changes in curriculum, impact of declining allocation to the subject, new forms of mark and assessment, implementation of the continuous and summative assessment, conditions relating to spaces, faculty, schedules, work plans, etc. The results were reflected in the teaching guide of the subject [8], which shows all the necessary aspects that students should learn. Naturally, all the points discussed are interrelated, i.e. the way to assess the student depends on what it is expected to achieve and the proposed activities. Table I shows the distribution of ECTS credits according to the proposed activity.

These activities should be planned temporarily. To this end, the schedule of the subject was built bearing in mind the following preliminary considerations:

a) The weekly work assigned to students should be balanced out and its load should be distributed among all the subjects included in the half year. Learning strategies should be able to set the pace.

b) The process must have a workload viable for lecturers.

c) All information about the subject and its contents, from presentations used in lectures, problem statements and/or questions, laboratory practice scripts, activities, etc., should be accessible to students in good time.

d) Assignment of problems in each of the topics will be made so that the lecturer will have already treat the theory and performed some problems “type” in previous lectures. For this reason, it shall be done in two different runs.

e) In general, each student will be assigned a different problem and/or question.

f) The delivery and/or presentation of the assigned problem will be made no later than one week after the assignment.

g) The correction of the problems will be held, as a rule, in the following session assigned to problems.

h) After the handing over and/or presentation of all the problems related to a thematic unit, students will have access to solutions.

i) The set of developed questions and problems covers all minimum essential theoretical concepts.

j) The labs are temporarily planned so that the student will have received the necessary theoretical information as close as possible to the date of performance of the practice.

k) The short and/or multiple choice questions tests, used to assess laboratory practices, shall be made immediately after the completion of these sessions.

l) One hour last tests with theoretical questions and problems will be held in the last session of the thematic area.

The result of the temporary planning used to monitor the subject is reflected in Table II.

We must take into account the different characteristics of students entering the Degree of Optics and Optometry. The vast majority does not choose these studies as the first option and comes from secondary school without having studied Physics in the last year. Hence, there are obvious shortcomings in both the “know” as in “know-how”. It was suggested that, in the first classes, the student will try to detect potential knowledge gaps in order to promptly correct them. Therefore, we urged students to review minimum contents to enable following closely the subject (International System of Units, basic magnitudes in kinematics and dynamics, Newton's laws and conservation laws, basic geometry and trigonometry and vector calculus). In addition, when necessary, brief comments were introduced as a reminder of these concepts. At the beginning of the year, a brief summary, questions and problems on such relevant content for self-evaluation was provided to students.

Table II. Subject Schedule					
Week	**Activities**				
W1	Presentation	T1.1	T1.2	Lab practice #1	
W2	P1.1 Proposal topic 1 problems	T1.3	T1.4	Lab practice #2 or #3	
W3	Handing over and presentation of proposed topic 1 problems	T1.5	P1.2	Lab practice #3 or #2	Lab test (practices #1, #2 and #3)
W4	Handing over and presentation of proposed topic 1 problems	T2.1	T2.2		
W5	P2.1 Proposal topic 2 problems	T2.3			
W6	T2.4	Handing over and presentation of proposed topic 2 problems	T2.5		
W7	P2.2	Handing over and presentation of proposed topic 2 problems	Test (Topics 1 and 2)	Lab practice #4 or #5	Group tutorship
W8	T3.1	T3.2			
W9	T3.3 P3.1 Proposal topic 3 problems	Handing over, presentation and proposal of topic 3 problems		Lab practice #5 or #4	Lab test (practices #4 and #5)
W10	T3.4	T3.5	P3.2	Group tutorship	
W11	Handing over and presentation of proposed topic 3 problems	Test (topic 3)	T4.1	Lab practice #6	Lab test (practice #6)
W12	T4.2	P4.1 Proposal topic 4 problems	T4.3	Lab practice #6	Lab test (practice #6)
W13					
W14	T4.4	T4.5	Handing over and presentation of proposed topic 4 problems	Presentation of lab practice	Group tutorship
W15	P4.2				
TX.Y=Theory lecture (1 h.); **PX.Y**=Problems lecture (1h.). Laboratory sessions last 2h. Tests lasts 1 h.					

3 ASSESSMENT PROCESS

Student assessment consisted of two parts. A first continuous evaluation (*CE*) and a second formed exclusively by a final written examination (*FE*) of the whole subject. The first party corresponds to 60% of the mark, while the final exam was the 40%. The part of continuous assessment was carried out as follows:

a) There were two tests, T_1 and T_2, at the end of each of the first two topics. The tests consists of a problem and one or two theoretical questions. The mark of these tests were performed over ten points.

b) Each student submitted for correction, a problem posed by the lecturer from each of the four topics of the subject (P_1, P_2, P_3 and P_4). The mark of each problem was carried out on ten points each one. One of these problems (P_4) was resolved and explained by the student in the classroom. In cases

where the student was unable to solve and present correctly the problem in the classroom, the mark was zero.

c) Three tests were performed consisting of short questions and multiple choice questions of one-hour sessions in the laboratory (L_1, L_2, L_3). These tests were focused on achievements and concepts discussed in the laboratory sessions. The first one, integrated 1st, 2nd and 3rd laboratory practices, the second test evaluated the 4th and 5th practices, and finally, the third test is referred to that studied in the 6th practice. Each of these tests was evaluated on ten points. Students must attend and conduct practice sessions in order to perform the above tests

d) The presentation of the lab practice at the 7th session was evaluated on ten points (*E*). We took into account the exposition, the correct presentation of the results and answers to questions that students and lecturers made. This assessment was conducted by two or more lecturers.

e) The presence and participation in the group tutorship was counted (*G*). The mark in this section was about ten points.

The continuous evaluation score is determined by:

$$EC = 0.15 \sum_{i=1}^{2} T_i + 0.05 \sum_{i=1}^{3} P_i + 0.1 f P_4 + \sum_{i=1}^{3} L_i + 0.1 E + 0.05 G$$

The factor f corresponds to a correct presentation and resolution of the proposed problem, and its value is 1 if that is the case and 0 otherwise.

The final written examination lasts three hours, and consists of problems (50%), theoretical questions (25%) and issues concerning the laboratory practices (25%). The mark of this test was performed on ten points.

The final student mark will be: $C = 0.6\,CE + 0.4\,FE$

To pass the subject, the final mark must be greater than or equal to 5 points. In the case of a failure of the subject, the lecturers maintains the part of the mark for the continuous assessment until the retake of the final exam to be made in July of this academic year. If the lecturer could not carry out any part of continuous assessment, the corresponding mark is distributed between each of the remaining parts.

4 DIFFICULTIES

The group of lecturers who teach the subject consider that:

a) Physics is a subject to be developed in a very short time interval. This fact restricts the work of education (and learning). It is very difficult to continuously assess in order to propose immediate changes that may involve improvements.

b) Although there exist significant improvements in the students, we have not found, in such a short time interval, the means to fill the initial gaps and reach the required minima knowledges.

c) Learning requires student to be involved, regardless of learning environment that is offered (quality and ease of access to materials, scheduling and compliance schedule, etc). One must therefore bear in mind that there is a certain immaturity in students (and initially low self-motivation).

d) The work load for lecturers has increased considerably, with groups of 80 pupils it is difficult, if not impossible, to enforce both the activities and the schedule that were previously established. Each student is evaluated in part on thirteen occasions apart form a final examination.

e) Even when attendance is high, the lecturer misses a more active participation of students in the lecture. Almost all questions or doubts are arose by lecturer (who obviously tries to exploit to highlight a concept that looks wrong or poorly treated). Student are not used to do these kinds of questions. Furthermore, they do not to ask questions each other, and in most cases they are restricted to questions such as: "Can you make the problem X?"or " I do not understand the question section X Y ".

This is, at least, surprising. How a student from an educational system based on the Organic Law of Education (LOE) with pedagogical basis based on significant knowledge and participation, is so inactive?

f) A too high percentage of students (29%) begin to attend classes and activities when the year has already started (between the second and third week). These students generally are those from the September entrance examination. This aspect has been addressed in different forums and remains unresolved. For example, a study commissioned by the Conference of Rectors of Spanish Universities (CRUE), titled "Study of a unique academic calendar in the EHEA framework" [9], indicates this fact as the greatest drawback. Even, recently, in a decision pronounced by the Andalucian Ombudsman in September 2010 suggests that: "... from the University Unique District Committee it should be established a special entrance examination in early July and it should be taken all other necessary measures in order to college registration deadlines could conclude before the start of the academic year [10].

g) A significant number of students (12.5%) leaves the subject from the first moment, does not attend lectures and performs no activity (this group is included, almost all of it, within the 29% above).

h) There remains the difficulty of ensuring a reliable way to evaluate the personal work and the effectiveness of the implemented self-assessment proposals.

i) The final test is far removed temporarily from the last lecture (almost two months). This fact involves little time for review and accumulated fatigue in the students.

5 RESULTS

Final results have been disappointing if we consider the effort involved, although some questions enable us to plan further improvement.

First, previous experience in this subject (a 9 credits annual first-year Diploma in Optics and Optometry) showed an exponential decrease in attendance at the activities and maintained a stable (with very few students) from the beginning of second semester. In this regard, the change is remarkable: although attendance has not been imposed as mandatory, it is clear that the required participation in activities promote such attendance, more than 75% of registered students regularly attended the lectures and almost 85% to the practices, problems and tutorship sessions. Seventy of the 80 registered students have been continuously assessed and 57 have taken the final examination. That is, 29% of registered students decides not to bet on passing the subject in the first chance. The percentage corresponds to that indicated in paragraph f) of the previous section, virtually all students who joined late left the subject at the beginning of the year or did not conduct the final examination. Even so, it appears that 38.6% of assessed students (70 of 80) pass the subject. This corresponds to 33.8% of those registered, and a 47% of those who conducted the final examination (27 of 57) managed to pass the subject.

As shown in Figure 1, the final examination results have been poor. All activities in the continuous assessment improve results and modulate, almost always, for the final student mark.

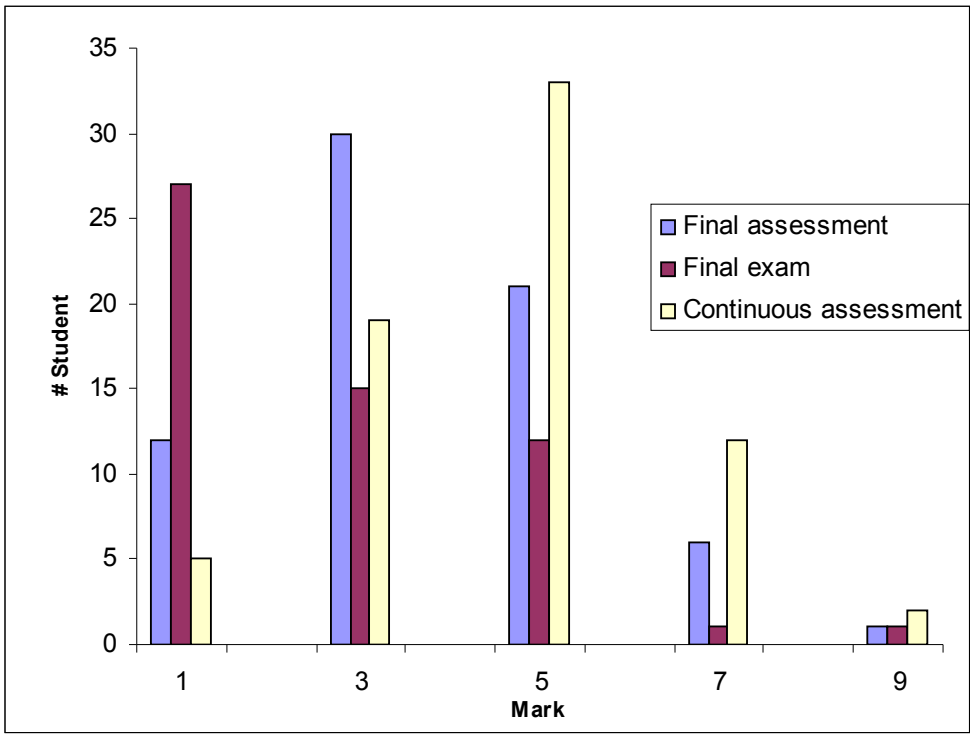

Figure 1. Year 10/11. Results of continuous and summative assessment

Although, as shown in Figure 2, the percentage of students assessed negatively, has increased with reference to the registered ones, the percentage of passes has also significantly increased. Moreover, note that in previous years a significant majority of students who performed the final examinations were students repeating a year.

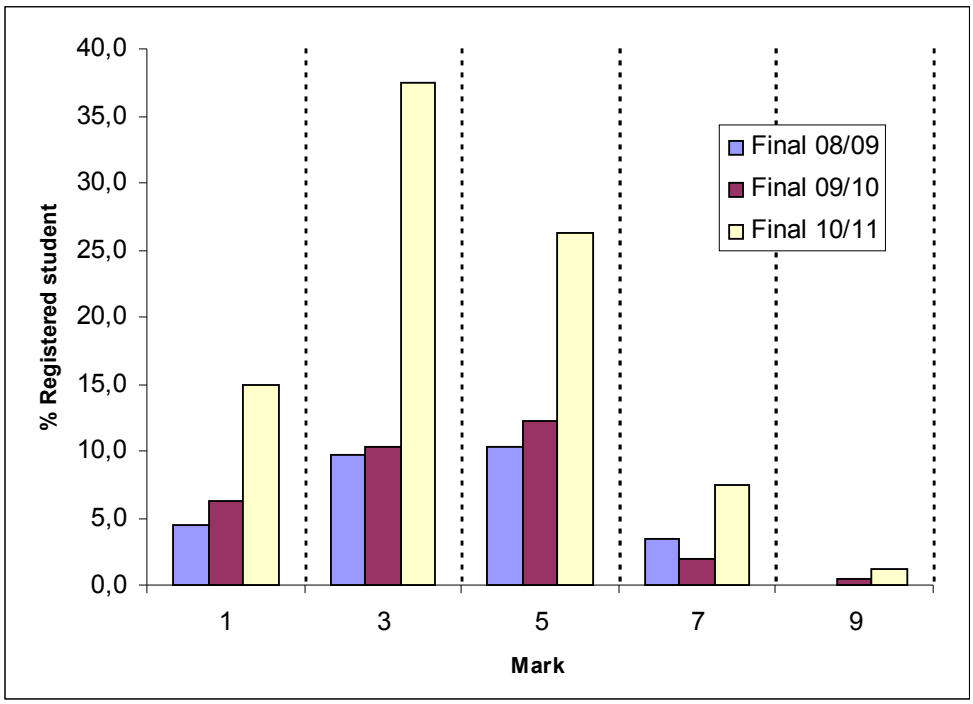

Figure 2. Comparison of results in terms of registered students between the current year and two previous years

Compared to previous years, when there were two tests, an assessment and a final examination,

there is a quantitative improvement. In the year 08/09, a 40.0% of students took the examination and only a 11.4% passed the subject in the June/09 exams. In the academic year 09/10, these percentages were 42.2% and 13.2%, respectively. Regarding the average mark of students who passed, there was also a slight improvement from a 5.50 in the year 08/09 to a 5.61 in the academic year 09/10 and 5.67 in the current course .Finally, it should be noted that students who have done Physics in high school show great facility to get the minimum required knowledge required to pass the course.

6 CONCLUSIONS AND PROPOSALS

First, we think that the joint programming of all subjects has been beneficial to plan the students' workload.

We are concerned that learning is not significant, as shown in the fact that the final exam result does not improve compared to previous years although the learning model does not focus solely on an intensive preparation of a final examination.

It has been shown that, in general, continuous and summative assessment promotes the continued work of students. We believe in the short to medium term benefit of such action.

The continuous assessment contributes to the performance of a deeper study and evaluation of the skills and knowledge of the students, allowing the analysis of other aspects that the previous system did not take into account.

The activities undertaken by students as the presentation of solved problems, presentations of practice and results using Power Point, are useful as a tool for feedback on concepts and skills acquisition for anyone who performs and for the rest of students who receive them.

It is undeniable that many of our students need more time to assimilate the basics and to acquire the necessary skills which imposes the memory of the degree approved by the National Assessment and Accreditation Agency(ANECA).

If we take into account the evaluation obtained in the continuous assessment, it is expected that, together with the extraordinary proof of July, 60% of students reach a positive evaluation.

The purpose of the change in the methodology should always be in order to improve the teaching-learning process. Our proposals are:

a) Getting time to strengthen the aspects that the professor team considers most important and are worst grasped by students. Even if this should be individually done in tutorial sessions or virtual tutorials(online), it is evident that they are rarely used. The timing and temporal limitation of the subject are strong constraints to carry out this process improvement.

b) Solving the late entry of students.

c) The use of tools for verifying, by teachers, self-evaluations.

d) Trying to find ways for students to propose their doubts publicly.

e) The completion of the final exam at a date close to the last classes.

f) Performing mandatory activities without mark as a requirement for final exam.

g) Using group tutoring sessions for students to expose, discuss and solve the most common mistakes observed in the activities.

h) Trying to make a change in the attitude of the students. They must stop being spectators and take an active and independent attitude in relation to planned activities to be undertaken.

7 ACKNOWLEDGEMENTS

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