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TECHNOLOGY ENHANCED ASSESSMENT MODEL IN HIGHER EDUCATION E-LEARNING

JUAN V. CAPELLA
Universitat Politècnica de València, jcapella@disca.upv.es

RAFAEL ORS
Universitat Politècnica de València, rors@disca.upv.es

Abstract: *An assessment model for the knowledge acquired in engineering studies is not a simple task, especially when it is an eminently practical matter, in which a theoretical base should be conjugated with its application to solve real communications problems in the industry. Also, it is sought that the student develop the necessary abilities so that, once concluded the discipline, the student be able to upgrade its knowledge and to adapt with success in the changing world of the industrial communications engineering. In this manner, this work presents the experiences that during several years the professors have been carried out in higher education, with the objective of finding a good assessment model of student e-learning. The proposed model consists on continuous multi-criteria e-assessment that seeks to evaluate the student learning keeping in mind all the activities that the student carries out. With this method, the students knows in all moment their qualifications, allowing to guide the learning process better. The present paper describes the proposed assessment model, analyzing for each activity the assessment method and criteria.*

Keywords: *New assessment methods of student learning, ITC application in education, mini-projects, laboratory diary, active methodologies*

1. INTRODUCTION

The accurate assessment in e-learning is an relevant aspect of the university education. It constitutes the part of our educational activity that has bigger repercussions on the students, and that appropriately used it can be a decisive tool in the improvement of the learning process [1]. In this sense, the present work pretends to show the experience of engineering professors.

The formation in the University has some particular characteristics that make it different from the formation offered in other instructive centers. The most important is that the university prepares to exercise a profession, that is to say it has an accreditation paper. It is supposed that, in certain sense, the University guarantees that the students that overcome the studies complete its formation or at least they reach the enough level as to be able to exercise the corresponding profession. Therefore the evaluation is part of the university curriculum, that is to say, it is part of the formative project that each center develops.

But anyway, this double dimension (formative and of accreditation) constitutes a basic element when analyzing the sense of the evaluation in the university. As part of the formative process, the evaluation should be a tool that allows getting upgraded information about the formative process and about the quality of the effective learning of our students. As part of the accreditation process, the evaluation constitutes a necessary mechanism to verify that our students possess the precise basic competitions for the correct exercise of the profession that they aspire to exercise. It is supposed that the graduated students will continue their formative process during much more time (life-long learning), but the institution guarantees that the recently graduate possesses, at least, the minimum knowledge necessary to exercise the profession.

Without a correct evaluation, it would be irresponsible that professional titles were granted because the universities would not have constancy of the real knowledge level and competitions reached by the students. On the other hand, professors neither would know if the formative project design has been appropriate, and if it has been developed in the desired sense, even more in e-learning environments.

Traditionally the evaluation in the disciplines corresponding to the university education has been carried out by means of an only written exam, usually at the end of the course. This method presents some inconveniences, mainly in technological disciplines due to the importance of the experimental aspects. The fact that the student only has an opportunity to demonstrate his knowledge cannot always be the fairest manner of qualifying, since multiple factors can influence in this type of exams. Also with this type of evaluation other learnings like the capacities and abilities that seek to inculcate in our students cannot be measured. And lastly, the professor won't have information about the assimilation of contents by part of the students until the course finishes, being already too much late to correct the detected deficiencies.

The evaluation model should be adjusted from the students and professors point of view. On one hand, a fair model that allows discovering with the biggest accuracy the degree of assimilation of the discipline should be obtained. Always keeping in mind that our subject is not

the only one that the student is studying, for this reason the evaluation won't load the student excessively, in order to not interfere in their work in other disciplines. In the other side the evaluation process neither has to load the professor excessively since he has to carry out the assessment of all the students' activities.

Therefore, our proposal is based on breaking the traditional assessment model, in order to implant a continuous evaluation, focused in several lines and whose objective is to measure the real student knowledge [2], keeping in mind that the experimental part is fundamental in the industrial communications area. During several academic courses diverse experiences have been contrasted, obtaining different results, achieving finally an evaluation model that follows the next guidelines (see figure 1):

- Use of more evaluation techniques than only the written exam.
- To adopt evaluation modalities that improves the inter-disciplinary learnings such as shared works between several disciplines and projects development as evaluation system.
- To implant a continuous evaluation system that allows having a diachronic vision of the learning of our students.
- To apply informative techniques after the evaluations, in order to clarify the students the errors that have made, to suggest recovery formulas, etc.
- To use the results of the evaluations like a database that allows maintaining a diagram of the general yield in the discipline. This will allow to analyze what is happening and to introduce readjustments if it is necessary.)

2. ASSESSMENT MODEL

In this section the proposed evaluation model is presented, describing each one of the used techniques. In the figure 1, the weight of each activity in the final qualification is shown, and in the figure 2 the general scheme for the proposed model is illustrated.

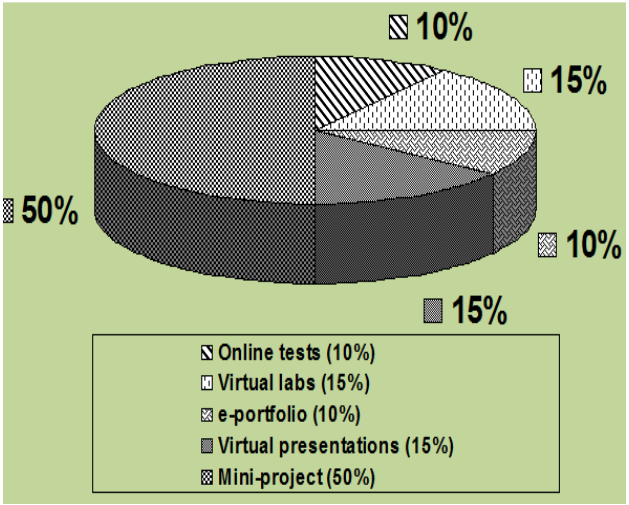

Figure 1: Weights distribution for each strategy

Basic concepts evaluation

When concluding each thematic unit, an evaluation of the knowledge acquired by the students will be carried out by means of e-meetings tutorship groups. This technique consists on forming 6 students groups that will discuss the theme during 6 minutes to reach a conclusion. Each group chooses a coordinator and a secretary; the coordinator's functions are to control the work time and the total participation of all the members, on the other hand the secretary should write the conclusions with the rest of members and read them to the other groups. Once defined the group, a minute of individual reflection it is left, later on all and each one of the group members act exposing their ideas. Next, the group has three minutes to summarize the conclusions, and finally each group reads them to the other ones. To finish the activity the professor outlines a general summary in the blackboard highlighting the important points.

This technique favours the active and total participation, stimulates the responsibility and the enthusiasm helping to overcome the inhibitions to speak before others, and on the other hand the speed develops the synthesis capacity.
As a result, this technique allows in a quick way to investigate on the general information level acquired by the students on each thematic unit, that is to say, to verify if the explanation has been understood. It also serves as review of the main ideas of each thematic unit.

Objective online test

At the end of each content block, an objective online test that picks up the fundamental concepts that the student should know to overcome the discipline is carried out. At the present time this test is carried out by means of short questions or problems in those that the student should choose among multiple answers [4]. The objective is to know the assimilation degree of the fundamental concepts. The weight of this test on the final qualification will be of 15%.

Virtual public presentations

To extend the theoretical contents of the discipline, the oral expositions have been used.

Each student should gather the necessary information on a concrete topic related with the discipline, and to expose it later on in public virtual presentation in a structured and summarized way. The use of themes related with the new technologies forces the student to use Internet as bibliographical source. The restriction of exposing the information gathered with time limitation takes to the student to select the most important points and summarize them (synthesis). Also, with this activity the student's social abilities will be improved.

The exposition quality, technical contents and the answers and comments that take place will be evaluated by the professor keeping in mind the opinion of the students [5], in order to obtain the public presentations qualification that will suppose 10% of the final qualification.

3. TECHNICAL-PRACTICAL ABILITIES ASSESSMENT

Evaluation in the virtual lab

Along the course the student should carry out a series of practical exercises through which a project in all its phases will be implemented. This project consists on the implementation of a simplified real engineering problem. The idea is that this work is carried out in groups formed by two students.

For the practices development the case method is used. The proposed cases have been selected following an educational approach that allows structuring the practical contents [6]. In this manner, cases related with the different levels that later on the students will have to implement in the mini-project are proposed. Each student will implement in its mini-project the resolution of the case that has reached. In this manner, the students will experience in a real way the advantages and inconveniences that first, in a more theoretical way, have been reasoned, being penalized or being gratified this way the success in the proposed case resolution.

For the laboratory practices, the student previously has a publication with all the instructions to carry out the sessions. During the session development the group of students should respond and develop the different questions that are outlined.

An e-portfolio will be used in the practical sessions, consisting on a record where the student writes down all the tasks that he goes carrying out in the virtual laboratory. At the end of each session the students can meet via virtual tutoring with the professor to evaluate the developed work, verifying if the objectives have been reached, proceeding to its evaluation and validation in the e-portfolio, exchanging ideas about the practical session and the related theoretical knowledge, obtaining a qualification for each session. In this manner the professor knows if each student has understood the necessary concepts. The average of the qualifications obtained in the practices will suppose 15% of the discipline final qualification.

The communication and contact with the students along the course give the professors a very clear idea of how the discipline goes evolving and what aspects can be darker or non understood. In this way, it is possible to take the necessary actions to correct the deviations that can take place regarding the proposed objectives.

By means of the pursuit and assessment of the practical sessions is sought to motivate the student and to achieve that pupils make an active effort, with the objective that they learn to learn and learn to make, that is to say, to discover, to identify and to interpret the problems; search solutions, to foresee the obstacles to the proposed solutions and its possible remedies, to conceptualize and to deduce principles from the real situations analysis [7].

Global evaluation: Mini-project development

Another objective that is pursued is that the student interrelates concepts, not only inside the own discipline but with other related ones. This is not easy to get, since the student tends to only be centred in the problem that is outlined in each moment and it is difficult to get that constantly the student goes further on. The realization of a mini-project is proposed in order to palliate this deficiency. This activity will be carried out in groups formed by two students, as it has been introduced in the previous section.

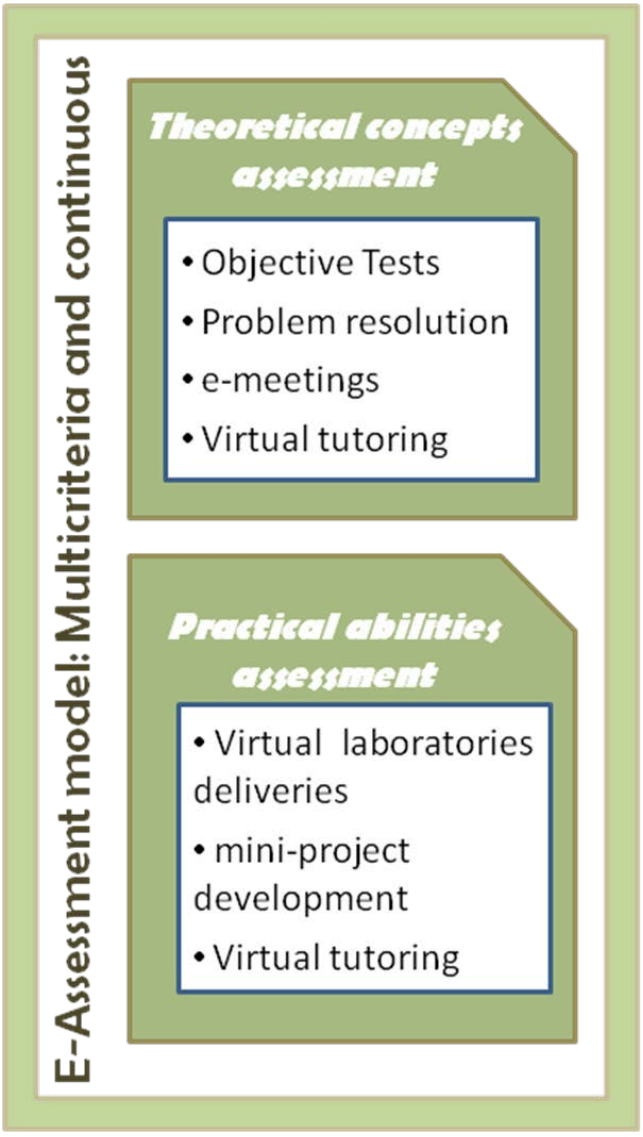

Figure 2: Proposed e-assessment model

To carry out this activity correctly students should:

- establish the own objectives to achieve,
- decide the work methodology, that is to say the form of achieving their objectives,
- carry out a bibliographical research until the point that they consider enough),
- synthesize the gathered information
- as well as to extend the scope of the work (optional)

The realization of the mini-project in group improves the abilities of work division and coordination [8]. Also, with this activity it is pursued that the student uses more the virtual tutorships that are a task with a great educational potential.

During the elaboration stage, each group will carry out an implementation hardware and software of the proposals selected by the case method in the practical sessions, writing the followed steps, difficulties and results to which have arrived, etc. in a final memory. The mini-projects technique is a teaching-learning process based on the student's own creativity that pursues objectives of high order problems resolution (analysis – synthesis – implementation - evaluation).

It is sought that for the mini-project realization the student uses the discipline fundamental contents and at the same time obtain a horizontal benefit since the student will also manage concepts that have been presented in other previously studied disciplines. The result to apply the technique of mini-projects is positive, nevertheless certain inconveniences that hinder the performance relatively in this line exist.

The main advantage that is obtained with the mini-project realization is purely academic; since it has been proven that it is a good exercise to consolidate the knowledge better. If the students only study to pass an exam they lose certain practical aspects and obtain a different and more perishable vision. Also, a set of added values associated with the mini-project realization exist:

- Final report. A technical documentation must be elaborated by the students. The students are not excessively familiarized with this task that will carry out in their professional future.
- Virtual public project exhibition and defence. The students should prepare a presentation about the developed mini-project.
- Work in group, since it is the manner of work in the engineering world,
- decide the work methodology, that is to say the form of achieving their objectives,
- carry out a bibliographical research until the point that they consider enough),

On the other hand, real projects have certain inconveniences:

- It is an additional overload for the students that they have to coordinate with the rest of disciplines, as shown in Table 1.
- It is also an overload for the professors because the evaluation is quite difficult and the public presentation of all the groups should be assisted and valued.
- It is necessary to buy laboratory material for the projects development with the consequent economic cost,

In spite of the inconveniences, the experience is highly positive demonstrating that the students respond thoroughly to the deposited expectations, manifesting a great interest for the mini-project, even in spite of all the difficulties that they find during its realization.

At the course end, the students should present the mini-project. The presentation consists on an oral exhibition and a practical demonstration. Later on the professors ask questions about the project opening a debate. The qualification obtained by each student will have a weight of 50% in the discipline final qualification.

Table 1: E-learning activities dedication

Activities	Dedication (%)
Study theoretical concepts	20
Online tests	10
e-portfolio	10
Mini-project	30
Virtual labs	20
Virtual tutoring	10

4. CONCLUSION

A new e-assessment model used in engineering studies has been presented. This proposal is the result of previous experiences in e-learning higher education, where some of these techniques have been partially applied in similar disciplines, with very satisfactory results, together with a reflection about the different assessment methods and its possibilities in our discipline.

With the presented proposal, each one of the activities to carry out by the students has associate a qualification and a feedback. In this manner the students are motivated to make an effort in all and each one of the proposed activities improving their learning process. On the other hand, this qualifications and feedbacks are known shortly, so that the students in all moment have conscience of the evolution of their learning, allowing them to act in consequence. This information is also important for the professor; since it can allow him reconsider the educational task to correct possible deficiencies in the e-learning process.

The proposed assessment model seeks to measure the different learning types that are objective of the discipline, and not only the theoretical concepts learning. For this reason diverse techniques are used, to be able to evaluate capacities such as virtual labs problems resolution, experimental development, information search, especially through new technologies, information synthesis and public presentation e-meetings, etc.

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