Application of Confidence Intervals
in the Multiple Choice Evaluation System

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Abstract

Exams should not be considered only as a tool for the evaluation of the knowledge acquired by the students during the teaching-learning process. Exams should be used as a feedback tool, so the lecturer can detect which subjects have not developed properly, or not enough, or should be explained in another way.

In open-response exams it is easy to detect the deficiencies produced in the learning process, since students develop the knowledge acquired. The analysis of the writing allows the teacher to detect whether the correct answer was answered with full confidence or not. In contrast, in test exams the students mark only the answer which they think it is correct, so it is hard to know whether the response was made safely, with doubts or it has been chosen at random.

With the implementation of graduate degrees in the Spanish Universities it is required a continuous assessment; this implies several screening performed during the development of the subject, not just a final exam at the end of the term. This causes an increase of workload on the lecturer who often uses objective evidence or "multiple choice" tests because they are easier and faster to correct. This test is performed more quickly and therefore can be performed in the time available in a class session. The main drawback of the test exam is that the student does not have to support the response, and therefore it is impossible to identify whether the student has responded with conviction, by elimination of the other answers or randomly. The handicap of this evaluation system is that there is no feedback to the lecturer and he cannot identify whether there have been problems in the learning process.

The aim of this work is the development of a methodology which detects the percentage of confidence that the students have in the answer given in order to provide feedback to lecturers.

1. Introduction

The university professor must combine research and teaching work. The teaching work can be divided into 5 major functions [1]: a) design and program planning, b) design and development of classes c) communication and relationship with students, d) tutoring and e) evaluation. This paper is to develop a methodology for evaluation. The faculty considers evaluation as one of the most tedious and costly task of teaching. Zabalza [2] indicated that one of the functions that have most impact on the students. Evaluation is one of the most important means for change and innovation in college [3].

2. The evaluation in the university

The evaluation process should not be the last step of the educational process. It must be an intermediate step which help the student leaning providing feedback and feedforward information
The activities to be developed by university professor in the evaluation process are:
  - Planning the evaluation.
  - Track the student learning
  - Encourage student participation in the assessment.
  - Review, improve and innovate in assessment

The evaluation planning has to be done when the subject is planned. Most universities require teachers to make it public along with the objectives of the course, program, evaluation criteria and evaluation system.

Evaluation should not only be a mechanism for measuring the student's knowledge should be used to improve student learning and the teaching and learning process [4]. In order to guide the efforts of students in an appropriate way is necessary to have detailed feedback. In short, it is to provide useful information not only for the improvement of this performance, but for its generalization to future academic and work tasks.

The assessment is a substantive part of our life. Either way we are always being evaluated. It is intended to convey the idea that assessment is part of lifelong learning, so that the assessment covers the knowledge, skills and dispositions required to support lifelong learning. This implies that the evaluation should also be in the hands of learners and not just the teacher. Students should be able to evaluate both their actions as those of others.

Equally it is necessary to the above three tasks is to monitor, improve and adapt the assessment and the class. Monitoring and evaluation of the tasks and procedures that are in place to lead the continual improvement of planning and therefore the assessment procedure itself.

With the implementation of the new degree titles under the European Higher Education Area (EHEA) requires several acts of evaluation during the development of the subject. This forces teachers to spend large amounts of time in correcting tests. To avoid this loss of time many teachers use multiple choice tests because it can automate the correction.

Such evidence does not allow two functions to be fulfilled by an evaluation process to develop properly. Students respond only pointing to an answer so do not get involved in the evaluation. Nor there is any improvement achieved in teaching process and it is hard to know whether the response was made safely, with doubts or it has been successful at random.

2. The proposed model

This paper proposes an improvement over the multiple choice tests. Thus, evaluation system can confirm if the requirements of learning which are considered appropriate for a period or a particular course have been achieved.

In order to achieve the goal proposed it is proposed that for each question the student fill a "confidence range" of the selected answer. This will get the student to participate in the evaluation process. Once the results of the confidence intervals of the exams of all students are analysed it is possible to determine if the questioned concept has sufficiently and correctly explained in class.

In order to get students to answer freely and honestly the "confidence level" is answered in an anonymous form. In this way the student will deliver two answer sheets, one named with the exam answers and another one anonymous with responses with confidence level. (Figure 1)

Sheet 1 (Question sheet)	Sheet 2 (Confidence sheet)
Question	**Confidence of selected answer**
☐ Answer 1	☐ Completely certain
☐ Answer 2	☐ Partially certain
☐ Answer 3	☐ Partially uncertain
☐ Answer 4	☐ Totally uncertain

Figure 1. Exam sheets

The "Completely certain" option of the confidence sheet must be selected when the student has dismissed the other three responses, so he has a 100% of confidence of chosen answer. "Partially certain" must be chosen when the student has dismissed two responses and he is doubt between two answers. The option "Partially uncertain" must be chosen when the student has dismissed one answer

and the chosen response has been selected among three possible alternatives, but the student is not confidence. The option "totally uncertain" must be chosen when the student has selected an answer at random.

This process must be done for all the questions of the exam. It must be reminded that the confidence sheet is anonymous. So the student can answer freely.

3. Application of the model

The proposed model in the previous section has been tested in five subjects. All the subjects are taught during the second semester in Alcoy Campus of the Polytechnic University of Valencia in the Mechanical and Electrical engineering grades. Table 1 details the subjects where the model has been applied.

Table 1. Subjects

Subject	Degree	Course type	Number enrolled students	Number of students taking exam	Number of questions
Materials. Selection and service behavior	Degree in Mechanical Engineering	Elective	13	11	50
Materials Science I	Degree in Mechanical Engineering	Mandatory	58	52	25
Materials Science II	Degree in Mechanical Engineering	Mandatory	63	56	25
Industrial Production Systems	Degree in Electrical Engineering	Mandatory	85	69	20
Polymer matrix composites	Degree in Mechanical Engineering	Elective	10	7	40

The "confidence sheet" was completed by more than 95% of students who took the exams. Students have shown a willingness to participate in the study.

Tables of results are not shown in the paper as no enough space, but it will show the main conclusions. It is very easy to identify the very easy and very difficult questions. The easy questions have a high success rate and the students have high confidence in the response. Wrong planned questions can be identified, because the success rate is low and the confidence index is high

4. Future work

The proposed model aims to take a step forward in the methodology applied in the multiple choice exams. Currently the project is in a very early stage of implementation and development. In order to advance the project, it is necessary to collect as much information as possible in different subjects and different types of exams (midterm and final). The results shown were obtained with a small sample of midterms exams and it is necessary to obtain more information from more midterms and also from final exams which are taking place at the same time as this conference. Thus, information for the following steps will be obtained.

For the next course it is intended that the degree of confidence of each answer will influence over the qualifications of the related question

5. Acknowledgements

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