

Advanced Methodologies for Student's Tests on e-Learning Courses: e-Examinations

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Abstract: - The use of Information and Communication Technologies in the education domain has been characterized by the need of providing customizable new learning solutions and evaluation procedures, which would offer great benefits to the Academic Institutions. This paper deals with the realization of e-learning courses and several related tests, efficient for the education of University students. It details some experience-based considerations on a successful realization of e-examinations in higher education process at the University of Bari. “Lectora Publisher” Course Maker (CM) authoring tool and “NetLearning” Learning Management System (LMS) platform, used in this experience, are presented, showing their features as for the manipulation of e-learning courses as for the creation of different typologies of questions. Results of experimentation in terms of e-learning satisfaction at the University of Bari, by means of student e-examinations, are illustrated.

Key-Words: - e-Learning, Course Maker, Learning Management System, e-Examination, Internet, Academic Education.

1 Introduction

The Information and Communication Technology is changing rapidly. In today's culture, everything is moving to the web, as data and applications, as people and communication in use [1]. Internet services have promoted the development of systems that support web-based education. These systems overcome the student and teacher isolation with the introduction of new communication and collaboration services. In this situation, the courses based on electronic learning [2], well known as *e-learning* courses, are becoming a good answer to the citizen need since they spread education with training systems in the today society, providing an optimal balance between traditional and innovative forms of knowledge transfer and a faster learning process at reduced costs for all participants [3, 4].

Among many Italian Academic Institutions involved into searching activities, the University of Bari [5] is promoting an e-learning initiative for a fast transmission and distribution of the knowledge into several Faculties [6, 7], with respect to different disciplines. First of all, in order to improve its academic capacity in using e-learning, it has realized an extension and a specialization of its network infrastructure [8], by means of the “PROTEO” Project (PROTEO: “Project of Technological Educational Organizational Oriented Networks”) [9, 10], economically financed by the

Italian Ministry of Education, University and Research.

Actually, the University of Bari is allowing students to have their lessons in an e-learning mode, also with experiments of e-examination, with an evident reduction of costs of distance classroom training and understanding evaluation.

This paper shows in details the specifications adopted in managing a comprehensive academic course and in creating its related tests, able as to evaluate the undergraduate student level of e-lesson understanding as to pass e-examinations.

Education at the undergraduate level is often a difficult task, due to the significant theoretical contents of the courses. It becomes more complex when a course is translated into an electronic mode. There is a number of significant factors to be analyzed in the evolving e-learning courses, including the selection of properly essential “units of information”. They move away from the traditional lesson, in order to become smaller and more detailed, sometimes stand-alone or able to form a part of a larger aggregation, such as a course. However, requirements of learning design and of understanding evaluation methodologies indicate that more flexible models of learning content and new types of questions and tests are now needed [11, 12].

Today, there is a continuous development of specific e-learning software tools, commonly known as *Course Makers* (CM) and *Learning Management*

Systems (LMS). For the e-learning initiative at the University of Bari, both “Lectora Publisher” CM authoring tool [13], distributed by Trivantis [14], and “NetLearning” LMS platform [15] are considered.

The organization of this paper is as follows. Section 2 describes relevant issues and didactical features, provided for the creation of questions and tests associated to a generic Bari’s University e-learning course. It shows the human computer interaction influences on knowledge transmission and on content comprehension. In Section 3, “Lectora Publisher” is presented, by showing its adopted metrics, compliances and standards for the creation and the correct publication of e-courses. In Section 4, “NetLearning” LMS platform is introduced, with a focus on its achievement testing approach as for student self-training and self-evaluation as for their final e-exam. The most valuable benefits on the carried out e-learning university courses, by means of e-examinations, are summarized in Section 5. Conclusions about this experience are reported in Section 6.

2 Question and Test creation: relevant issues and didactical features

e-Learning process is influenced by a large number of factors. This paragraph focuses on the most relevant issues to be pursued in test construction. A test is a collection of questions with multiple forms (true or false, simple/multiple choice, filling in the blank, etc.). The whole set of questions is properly considered as a test section or test collection. A test is the best statement of the course expectations and, therefore, it should reflect the teaching. In order to produce a valid test collection on a fixed unit of information (the so-called Learning Object), it is necessary to put in evidence the most relevant concepts to be converted into questions. So that, the total number of produced questions depends on how large is the treated argument. An unambiguous topic and several related items of the same type have to be fixed for each question. The absence of overlapping question contents has to be verified, also establishing that no question has the answer to others.

Sometimes, one of the major justified complaints students have is that the evaluation tests are unclear to them. Although an originally designed question may produce a very fine and relevant measure of the objective, it can be badly presented. This fact causes it to be misinterpreted and the student to end up answering a question different to

that the teacher meant. In fact, frequently a bad performance of the student e-exam results can be caused by ambiguous questions or unclear assignment of instructions, and not by the student ignoring the notions. A teacher should choose question types clearly related to the contents and the main activities of his course.

In order to prevent all these problems, different types of questions have been created in this experience, paying great attention to several practical issues. They are reported in the following:

- ❖ **True/False:** student has to establish if the question sentence is rightly true or false. Every part of a true sentence must be obviously “true”. Furthermore, the assertion should be concise and always positive. In this type of sentence, quantitative requisites are preferred to qualitative ones.
- ❖ **Simple/Multiple Choice:** student has to answer to a question, called stem, with one or more correct responses and multiple possibilities. The stem should be clear, grammatically correct and without irrelevant information. The correct response/responses should be surely correct and located in a random position in the response set. The alternative sentences have to differ enough from one another to be discriminative. Sometimes, some alternatives may be created partly correct or correct statements in themselves, but they aren’t when joined to the stem. The question may ask “choose the most correct answer”, or “mark the one best answer”, or “mark all correct answers”, etc.
- ❖ **Fill in the Blank:** student can fill in the missing letters on dots by referring to a furnished list of known word or numeric values. Only significant words or numbers should be absent in incomplete items, the length of the responses should be limited to single words or at most to short phrases and blank should occur at the end of the question.

In this experience, by planning the overall system for evaluating undergraduate students, questions and tests are created following these

instructions from the beginning, in order to produce a good chance of getting an accurate estimation of each student achievement upon which to base his learning.

Both “Lectora Publisher” CM authoring tool [13, 14] and “NetLearning” LMS platform, based on Oracle iLearning [15], have been used. With the first, several e-learning courses have been experimentally produced. The LMS has been properly used to publish them, by providing in some cases related test collections for the student self-training and self-evaluation, without any resulting feed-back to the teacher. It has been useful also to establish the student getting through the final exam, by tracing their total number of made test attempts and the achieved scoring results. In this University experience, tests have scores, overcoming thresholds, max number of attempts and no limit of time.

3 “Lectora Publisher” Course Maker’s features and usage

This paragraph will focus on the “Lectora Publisher” Course Maker authoring tool’s features, considering the aspects of course management. It has been adopted to easily realize e-learning content applications. Lectora allows to develop without difficulty educational multimedia products also by non-programmers, to easily create and integrate interactive multimedia components (audio, video-streaming, graphics, animations, scrolling text, etc.) and to access the lessons by standard browsers, also for disabled people. Its user interface design and human computer interaction have a big influence on information transmission.

Its content organization provides a visual, efficient way of arranging courses. It organizes a course in a tree view, by using the book metaphor, in order to help teachers to create and to put their contents into chapters, sections and pages. At the end, each course is published on the “NetLearning” LMS platform following the AICC (Aviation Industry CBT Committee) standards.

4 “NetLearning” LMS platform

The blended learning consists on an integration of diverse networked technologies in a single planned learning package, on an assembly of several knowledge management strategies and different delivery methods that enable to achieve the most advantageous quality of learning process. In this experience, the blended learning is realized by

combining the LMS technologies with the CM authoring tool, according to the AICC compliances.

Each course, previously created with “Lectora Publisher” and consisting of several units of information, is stored on the LMS platform to be accessed by students. At the end of each chapter of the course, teachers are able to create and insert comprehensive tests, clearly related to the just explained contents. Evaluation questions can be of *True/False*, *Simple/Multiple Choice* and *Fill in the Blank* types.

Undergraduates can train their content understanding and they can practise with the LMS. Students’ responses of questions are compared against a predetermined set of correct answers, obtaining a final score. Appraisals of the feed-back are extracted by correct/incorrect answers and they are recorded on reports, visible only to students. Their test score and correct answers to the questions may appear displayed in a message box. E-learning with tests is very useful for students. In fact, the output feed-back makes it possible to them to self-evaluate their own understanding level of the just explained e-learning lecture contents, in order to revisit the avoided concepts.

With “NetLearning” students may be unable to move forward in the subsequent paragraphs until all current questions are answered with no time limits. The entire section of tests has to be answered by students. Questions and items in a question are both presented to them in a random sequence. If a student exits a test, while he is in the middle or at the end, he can re-enter the retained test session to eventually complete it.

All the produced self-training and self-evaluating tests allow students to prepare their final e-examination on the LMS platform, in order to get to know all about the different testing typologies and their difficulty level, their related topics and knowledge depth specification. The adopted technique of self-assessment can fail only if students aren’t honest with themselves and with the teacher.

“NetLearning” platform is helpful since all the learning and testing activities are traced, by storing the time, the date and the duration of connection to the e-learning platform. In addition, the total number of attempts made to answer to the test collections, and their completion state are outlined, as it is shown in Fig.1.

Answers to the test collections are accurately achieved, allowing students to eventually pass their exam [16] and to obtain a final certification. In the Bari’s University experience, questions have all the same score. A question collection is passed if the total number of correct responses is at least major

than the half part of the collection. An exam is passed only when all its question collections are passed. It has been noticed that for a student several smaller assignable units tend to be more valuable than one large assignment and so the exam more difficult to be passed.

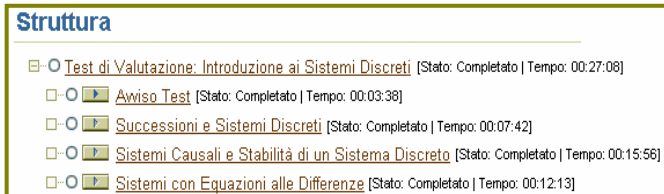


Fig.1 Tracing visualization

At the University of Bari, some e-learning courses [17] have been developed with “Lectora Publisher” CM and then published on the “NetLearning” LMS platform. Examples of e-learning courses, realized each for a given topic, are:

- ❖ “Intelligent Systems”;
- ❖ “Operating Systems”.

In several cases, since the LMS platform doesn’t allow to produce tests with complex algebraic formulas, teacher is obliged to create questions, that aren’t an intuitive and verbatim transcription of the course explains, but they become a transversally interpretation of content material. For this reason, the produced tests sound the student understanding in a lower level depth of comprehension.

5 Experimental Results

Advanced forms of distance education provide courses over Internet. Learning and evaluation activities are conducted electronically via the web in a satisfactory way [18, 19, 20]. So that, complete certifications and examination passing can be now delivered according to the teacher aims. For this purpose, among several e-learning courses and relative tests published on the LMS platform for the Bari’s University, the *Intelligent Systems* e-course is put under consideration.

In the first months of 2006, thirty-eight students have followed the published *Intelligent Systems* course on the “NetLearning” LMS platform and they have been requested to provide formal responses to tests on several learning objects regarding its chapter. A large number of them has obtained the certificate of exam proficiency, by

getting through the threshold for all the question collections. Only another attempt has been sufficient to allow the remaining ones to pass their final examination.

Experimental results are extracted from reports produced by the LMS platform. The percentages of the total number of students who have/haven’t passed the exam at first attempt are reported in Fig.2. The percentages of the number of students who have obtained a specific final scoring achievement, in a fixed mark scale, are shown in Fig.3.

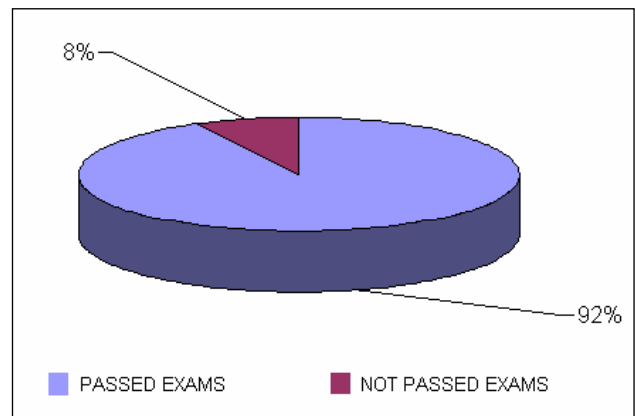


Fig.2 Results on passing exams

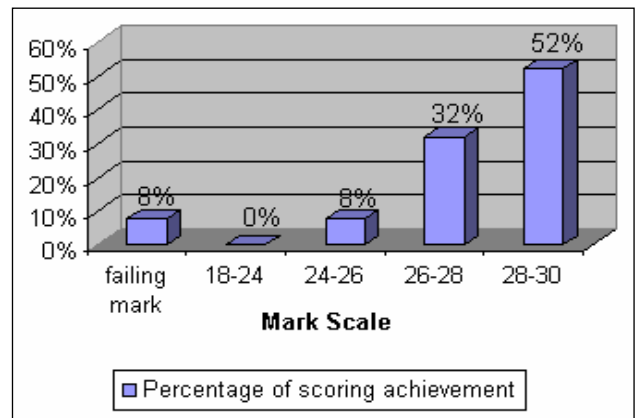


Fig. 3 Scoring achievement

This experience shows that student education and level of understanding don’t seem to suffer the e-learning approach. These results underline the importance of e-learning activity’s promotion and they accentuate the quality of new methodologies of teaching process. First of all, since students can have their courses probably alone faced to their own personal computer, and not in full classrooms, their assessment can be transformed from a timid

involvement in a more attractive and enthusiastic lesson, getting perhaps the total comprehension of the arguments.

In addition, the production of self-evaluation strategies helps them to gain a full control over their learning level process and individual comprehension progress. Undergraduate students have demonstrated to be able to easily work with an innovative and multimedia interface, becoming the central figure in the educational process, according to the Learning Management System. The obtained results are of extraordinary significance for the University's aims.

6 Conclusions

The focus of this paper is to closely analyze an experimental process of education of undergraduate students at the University of Bari, by means of an e-learning approach.

This new technological opportunity demands a revision of the classical educational model on which innovative systems are based. Tests are an important factor for learning, since they provide hands-on self-training of concept comprehension level and an innovative approach to evaluate the highly number of e-exam getting through.

The experimental results demonstrate the utility of the e-learning approach for the student education and encourage to repeat this experience by enrolling a larger number of undergraduates in University e-learning courses. This experience shows how a new way of knowledge transfer and teaching/evaluation methods can be faster, more efficient and attractive, not only for the today's students, but also for those of the future.

Acknowledgements: The authors thank the MIUR (Italian Ministry for Education, University and Research) for the economical support to realize the technological infrastructure.

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