A TECHNO-PEDAGOGICAL DESIGN FOR ASSESSMENT WITHIN THE BOLOGNA REFORM: A CROSS-BORDER EXPERIMENT

NOVEGIL SOUTO, José Vicente
University of Vigo
Spain

DE SOUSA, Bruno C.
University of the Minho
Portugal

The Bologna educational reform taking place across Europe has reached Spain and Portugal. It places the student as the center of the entire process of teaching and learning, recognizing two main types of learning: presential and non-presential. With this in mind, the assessment methods need to be redefined and adapted to this new reality, where tutoring and learning must be integrated in the assessment process. This study takes place in two Introductory Statistics courses, one located in Vigo (Spain) and one in Guimarães (Portugal) and the results show an improvement in students' grades and also allow a more solid learning process achieved by the continuous nature of the method. Having the material virtual in Learning Management Systems (LMS) simplifies the work of the teacher and encourages the students to develop new study habits necessary for their success within the new reality of the Bologna reforms.

INTRODUCTION

Europe's Educational System is presented with a great challenge with the *Bologna Educational Reform* which has reached Spain and Portugal. The student is put at the center of the teaching and learning process, and is subject to two main types of learning: presential and non-presential. At the same time, this process must guarantee the students' ability to reach competences in term of Contents, Procedures and Attitudes. With this in mind, the assessment methods need to be redefined and adapted to this new reality, where tutoring and learning must be integrated in the assessment process.

Our study has been applied on different profiles of students at the Universities of the Minho and Vigo. At *University of the Minho* we are dealing with students in an Applied Mathematics program, in which their major can be either Statistics or Operational Research. The course in question is taken on their second year of college, but is their first course in the subject of Statistics. Due to the nature of the program, there are clearly two groups of students that know exactly the major they will chose, and one last group of undecided. Despite their age similarities, their goals, future perspectives and pre-conceived ideas on what to expect from the course are very different. At *University of Vigo* we deal with a first course on Statistics into Public Management and Administration at the Faculty of Social Sciences and Communications (Faculdade de Ciencias Sociais e da Comunicacion). This is an introductory course about foundations: Data Analysis, Probability and Official Statistics. We can distinguish two different student profiles: students that just arrived from Secondary Schools and workers at Public Administration that subscribe the course for promotion reasons at their jobs. They are different in age, ambitions and certainly in attitudes.

Although it seems to be quite two different groups of students at these universities, the problems present in this two groups are the same. Students at the two groups have no proper habits of study or no habits at all. The ones that just finished high school have some study habits, but they are not of a continuous nature, and those who work not only they do not have enough time to study, but also they have lost all possible study habits that they might have had in the past. Therefore, we must personalized the process for each one of them, and make it work.

MATERIAL & METHODS

The use of technology in-class will help to standardize the teaching-learning process. The degree on how it is applied should be a gradual process and should be performed in a way such that the activities traditionally proposed in a presential based learning should be incorporated in a virtual environment. The presence of virtual support to in-class teaching allows the student to follow the course material and work at his/her own rhythm. It establishes a new environment where there is an extension of in-class teaching which is personalized to each individual, and therefore the class is highly enhanced.

In this study we have used two different Learning Management Systems (LMS): the *Blackboard* at the University of the Minho and *Claroline* at the University of Vigo. Both differ from the operational point of view and some of its functionalities, but they both provide a friendly and simple environment which is desirable in any design process considering a virtual component. Therefore, LMS allows us to fulfill the challenge proposed by the *Bologna Educational Reform* in which the student's own work should be recognized.

To design an assessment process in Statistics with the use of ICT (Information and Communication Technologies) we must take into account the specific features that are particular to learning the subject of Statistics and follow pedagogical criteria to guide and inform the student of his/her progress in learning. In other words, considering the goals, context and procedures used in a Statistics class, we must start from what at the moment is done in a *conventional class environment* and incorporate most of the ICT tools available, such as questionnaires, e-portfolios and other ways of assessing students' work. Since this study takes place in two Introductory Statistics courses, one located in Pontevedra (Spain) and one in Guimarães (Portugal), with different goals, we need to think of the following steps:

1. Determining the competencies to be achieved within the curriculum of each course.
2. Planning activities and tasks to be perform in order to reach the goals.
3. Thinking about the type of resources that are going to be need, such as didactical material, books, documents and datasets.
4. Finding the tools and the type of dynamical work that are needed to perform the activities and tasks determined.

For the success of this study, it is essential that both the teacher and the students participate actively. The teacher must explain clearly the tasks and activities and the students must engage and fulfill the requirements for each step either individually or within the group that they belong.

To achieve the objectives and competencies for each course, we use the virtual side of the study, as explained below:

1. Establishing a structure by modulus in which the material is provided to the students on-line. This modulus are not independent and the success in each one will require material done in previous modulus.
2. Planning the amount of work within each modulus and how to optimize the sequence in which you incorporate the activities. The amount of work in the different modulus should be gradually increasing throughout the semester. It must take into account prerequisites of each modulus in order to use the sequence in a flexible way.
3. Designing learning and teaching activities, in and amongst the universities, suited to each class of learning and its relationship with the tools at our disposal. Work flows will be used, thus leading to activation of roles needed at the LMS with regard to the Bologna Reform. At each modulus specific tasks are settled: need resources, tutoring, assessment and spent time.
4. Establishing on-line tutoring activities that are conducted directly by means of the FORUM tool and indirectly by continuous feedback provided with our Continuous Assessment.
5. Assessing continuously as a way to motivate, orientate and surveying student's process of learning.

ASSESSMENT

The key issue of our pedagogical design is assessment as intended for tutoring aims. We have taken into account continuous assessment: formative, summative and reflective. This way we deal with orientation, motivation and supervision, all three viewed as tutoring aspects:

1. *Summative Assessment*. It is introduced in order to check achievements in learning goals with different learning activities. It allows us to certify the type and degree of student learning. From a practical point of view, Summative Assessment enhances students' performance and recognizes their continuous work.
2. *Formative Assessment*. It guides the students by indicating the quality and adequacy of learning to the formative process. It is very important for the student to be able to take decisions on the basis of the results obtained and the feedback from the teacher.
3. *Reflective Assessment*. With the view towards meta learning it covers the improvement of the process of learning and teaching. For each activity we establish strong points, weak points and possible improvements.

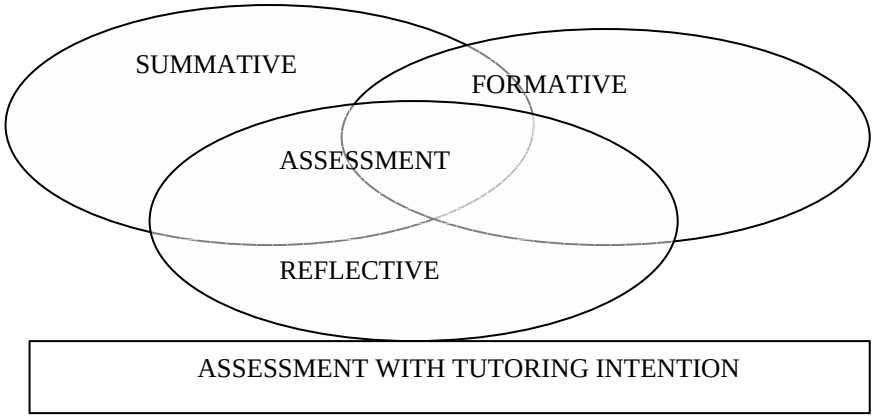

Figure 1: System of continuous assessment

Our system of continuous assessment considers a set of items for the assessment process of the different activities. Depending on the context that they are applied, each activity must be adapted towards the formative needs of each course curriculum. Both at the University of the Minho and the University of Vigo there is an emphasis on the interpretation of the results and the understanding of the concepts given. In addition, at the former university it is also considered activities directed for the improvement of students' mathematical skills, needed and appropriated for someone majoring in Statistics or Operational Research. Having this in mind, the tools available at LMS, such as, questionnaires, individual work, e-portfolios and tests are used.

Questionnaires are part of an initial form of diagnostic assessment to be used as formative and summative self assessment with different objectives: statistical literacy, statistical reasoning and statistical thinking. When writing a questionnaire we have used multiple choice questions according to Bloom's Taxonomy condensed into three levels as mentioned in Garfield, J. The questionnaires offer an immediate marking and feedback.

Homework is based on a set of problems for each modulus and with increasing difficulty level for which the student is usually given a week to complete. LMS allows us to control these process and summative assessment the students' work, in which, after a proper feedback, the student is motivated and guided for the next task.

E-portfolio is the new element in this evaluation process. It is a meta learning, allowing an effective assessment method. A learning portfolio is a selection of works done by the student where he/she states reflectively his/her own progress in class and which objectives were achieved in the entire teaching-learning process. This selection of works is centered in the decisions and reflections performed by the student with regard to the context of the modulus and the documents presented to the student in the assessment process. This allows the

teacher to be able to guide the student in his/her learning process by evaluating the adequacy of the student's work in each modulus of the course and establishing the student's strong and weak points. The e-portfolio is a reflective activity, improving the quality of learning at the end of each modulus. In each step performed by the student, he/she is required to reflect not only on the problem presented at that specific modulus but also on the entire course learning process that he/she achieved since the beginning of the course.

RESULTS

The Techno-Pedagogical Design for Assessment here proposed was offered to all students in the two courses involved. It was mandatory for the University of the Minho's students and optional for the students of the University of Vigo. At the later one, 95% of the students participate in this study, and all of these students passed the course. The 5% of the students at the University of Vigo that followed the traditional assessment failed the course. Although unfortunately, this is not surprising since most of these students are part-time or full-time workers, making it extremely hard for them to fulfil the requirements of the course. The great outcome of this experience is in fact the increased number of engaged students in the class, which is reflected by the decreasing number of drop outs. Although data is not available at the moment, we believe that the number of students at the University of Vigo that leave the stats course for their final year is decreasing. This is not the case at the University of the Minho, because 90-100% of the students that take this stats course for the first time pass the course and the remaining ones will pass the course the second time.

By considering students' own work and supervising students' progress in a continuous way through LMS, we manage to retain students longer and obtain passing marks in the course. At the University of the Minho, students were all extremely engaged in the activities proposed. These are all full-time students and, out of the 11 students, only one failed the course and 50% of the remaining 10 students obtained grades above 15 points in a scale of 0 – 20 points. At University of Vigo the minimum mark is 6 and 75% of the students get marks above 7 points in a scale of 0 – 10. In both universities the majority of the grades are between 60% and 90% as can be seen in the graphs below.

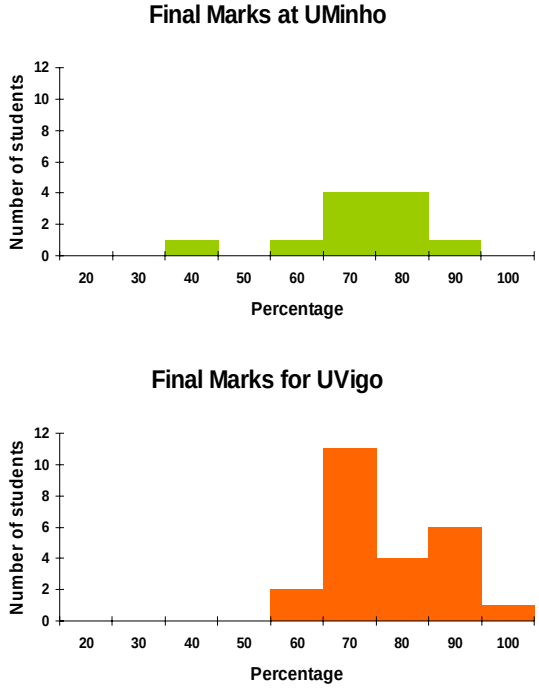

Figure 2: Final Grades at the two universities

At the University of Vigo there were two separate periods of classes, before and after Christmas. In the short period of classes after Christmas, students tend to forget about their

work and start to distance themselves from the virtual environment. We observe that test marks are directly correlated with the amount of continuous work performed by the student. If this work is discontinuous this correlation is lost. In the next graph, we can see a positive correlation before Christmas represented by the variables: Initial Mark Part 1 and Mark Test Part 1. After Christmas, due to the decrease in the use of the virtual environment, we can see that there is no correlation between the variables: Initial Mark Part 2 and Mark Test Part 2. In other words, the use of this methodology has not only shown an improvement in students' marks, directly related to the frequency of its use, but also created a more solid learning process that is achieved due to its continuous nature.

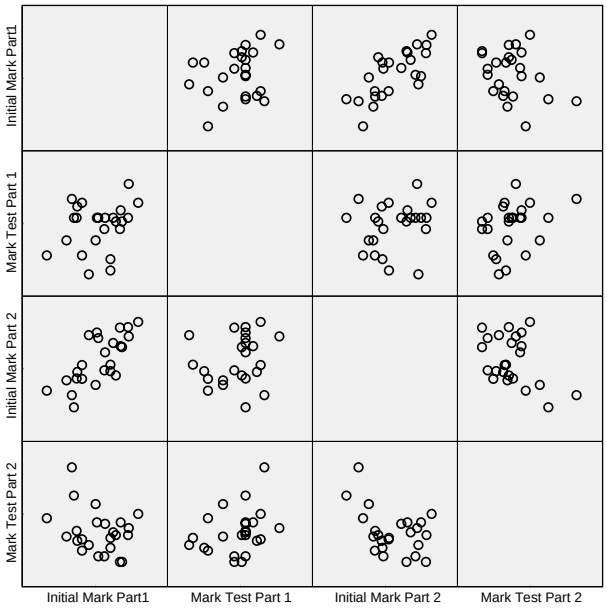

Figure 3: Correlations before and after Christmas

CONCLUSIONS & FUTURE RESEARCH

Learning is all about increasing the probability that a behavior based on reinforcement that has taken place in the past, will be considered as part of the new behavior. In other words, by reinforcing new study habits and monitoring students' progress closely, we strive to lead students to succeed in their academic goals and in their future life.

By integrating technology into the educational process we can get more control about the quality of the different parts of the process itself: resources, activities, tutoring, assessment and roles. Templates and resources for the activities performed on both universities in this study are available.

When using LMS we gain the flexibility to adapt any formative process. LMS simplifies the work of the teacher and encourages the students to develop new study habits necessary for their success within the new reality of the Bologna Reform.

Through Formative Assessment the use of this methodology has also created a more solid learning process that is achieved due to its continuous nature. The number of students who drop out of our courses has been reduced.

Reflective Assessment based on e-portfolio guides the process of learning and teaching in terms of continuous improvement of quality. E-Portfolio is acting as a cognitive and humanistic component by emphasising the role of the learner in the construction of his/her own model or points of view of the material and what is helping them in this process.

In this early stages of the *Bologna Educational Reform* and from this initial study, we realize that there is a clear need to do more in areas such as:

1. Making Reusable Learning Objects intended for being used on both Universities. Reusable learning objects will let us measure and compare learning results.

2. Constructing standardized questionnaires for measuring achieved competencies and skills at different levels based on: statistical literacy, statistical reasoning and statistical thinking.
3. Establishing a flexible system of items suited to different activities.

The *Bologna Educational Reform* is a challenge for both teachers and students in a Europe that more and more is seen as a whole. With this cross-border experiment, and with the help of Learning Management Systems, we hope to reach out to teachers and encourage students to develop new study habits necessary for their success within the new reality of the Bologna Reform.

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