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STATISTICS CONTINUOUS ASSESSMENT THROUGH AN ACTIVITY USING AN INTERACTIVE VOTING SYSTEM

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Abstract

Statistics continuous assessment was partially evaluated through a quiz for first-year students at Business and Economics degrees in the University of Valencia. However, results were not as satisfactory as one could expect, students failed in getting some points in this part of the final mark, and also in the purpose of learning during the course and not leaving all the study for the days before the exam. This can happen maybe because students did not study sufficiently or because they were not motivated.

Within this academic year, the teachers involved in the subject have decided to evaluate the same contents in a quiz, but implementing a preparatory activity with an Interactive Voting System during the previous class. This activity consists in make students study some part of the content and work in groups of experts. Each student should study accurately a unit of the program and explain it to other classmates. At the end, every student should be able to answer any question, have they prepared this part of the content or not.

The final part of this preparatory session is a quiz, with some multiple choice questions selected by the teacher and some others proposed by students. This quiz is answered through electronic devices from an Interactive Voting System, which has advantages for both parts, the students and the teacher. On the one hand, students can get an immediate feedback of their answers and also global percentages of response in each answer, so they can see how much they have learned and compare with other classmates. On the other hand, lecturers obtain the performance of each student, since answers are traceable and the system stores all this detailed information.

The use of technologies makes attractive this activity and motivates students. In addition, the set of questions is proposed as a competition among small groups of students, in order to encourage their implication in the activity. The week after this activity, students answer the quiz which counted for the final mark of the subject. Finally, results of the quiz were compared with last year quiz results in order to assess the efficacy of the preparatory activity.

Keywords: Interactive Voting System, group activity, continuous assessment.

1 INTRODUCTION

During the last years, Spanish universities are implementing progressively some reforms in their teaching methods in order to carry out with the Bologna aims. Specifically, the transition from the old academic system to the Bologna one implies to do an extra effort in promoting an active and continuous participation of students in the learning process. Within this context, we introduced a partial assessment in the Statistics subject taught in Economics, Business Administration and Finance and Accountability degrees from the University of Valencia. That partial assessment includes an individual quiz, which represents 15% of the final mark.

To motivate students for an active participation in Statistics class, however, is not always easy, since this subject is very often considered as one of the most arduous ones within the degree. Because of that, we designed an activity with a double aim, on the one hand we intended to introduce an innovative technology in class in order to awake the interest of students, and on the other hand, we try to make students lead their own learning.

The activity proposed in this paper is based on the puzzle or jigsaw method, in which we divided students in groups and each component of the group is responsible for preparing a didactic unit of the program and explain it to their group mates. Afterwards, students were divided in groups of experts in order to prepare some multiple choice question about their topic of expertise. The teacher chooses a set of multiple choice questions, which will be completed with some questions prepared by the students. Then, a group competition was performed in class using an Interactive Voting System.

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Work in groups is also enhanced and appreciated in this new Bologna model, since students should be prepared to work in teams when they are enrolled in different jobs after their academic training with the degree. It stimulates the feeling of belonging to a team, where the sharing of ideas sums more than just the addition of the individual parts.

Besides, we run this activity in the previous week to the individual quiz, as a preparatory activity for that partial evaluation. The main aim of that activity implementation was to promote an active participation in the classroom among students. In addition, this activity tried to provide to the students a more precise idea about their level of knowledge before the partial evaluation in order to motivate them to a deeper study of the subject.

2 BACKGROUND

The activity prepared is related to technologies and also the puzzle classroom method. It is expected that the use of technologies is attractive for students, since they live surrounded by laptops, tablets and smartphones. The Interactive Voting System (also known as Electronic Voting System, EVS) is not a device as sophisticated as those aforementioned ones, but it lets to obtain participants answers in real time. Students can see if they have learnt or not through a self-evaluation. The teacher can detect if any concept is not understood depending on the percentage of students answering the wrong answer. The introduction of EVS to enhance learning and motivate students has been the focus of several studies. Schmid [1] find that this instrument increase the interactivity in the lessons and helps students to become real active participants.

Obviously this EVS has also disadvantages. When syllabus is extensive, devoting some time to organize activities with EVS imply less time for other activities. However, if really students are more motivated and learn more than just using traditional methods, it is worth the effort. There also exists the possibility of answering anonymously, which can be helpful if the students answer sincerely and the teacher can have an idea whether the class has understood the concepts or not [2]. But on the other side, students can answer randomly if they know their answers are not associated to their names.

Meyer [3] thinks that participative and active students are important for teaching and learning outcomes. The traditional methods as solving exercises only catch the attention of few students, the really motivated ones. The other students remain with a passive behaviour following the class from an outsider point of view. It is quite interesting the comparison he makes: “students consume lectures like at a cinema and hope to really learn and understand the topic afterwards or *just in time* when preparing for the exams”. He also studies the difference between individual and team competition, finding that team competition achieves better long-term results, both in participation and performance.

Regarding the way of constructing the activity, the puzzle or jigsaw method was first introduced by Elliot Aronson with his university students at the beginning of the 1970s. This cooperative learning technique enhances better learning, improves students’ motivation and provides a greater enjoyment of the learning process, as we can read in the website jigsaw classroom [4]. We can find there the steps to construct this activity, which we have summarized in these ones:

1. Divide students in initial small groups (4-6 people).
2. Divide the contents to study into several topics (4-6 parts).
3. Assign each student one topic to learn about it.
4. Give students some time to prepare their topic.
5. Form "expert groups" in which students join other students assigned to the same topic. Give them time to discuss the main points of their topic and prepare the presentations they will tell to their initial groups.
6. Students go back into their initial groups to present their topic.
7. At the end of the class, give a quiz on the material so that students realize what they have learned.

The explanatory part is important. Firstly, one learns more if he has to explain a specific topic to other people, some doubts arise that did not appear when preparing the topic individually. Secondly, to let the other members of the team to ask questions for clarification to the expert allows them to question and consolidate knowledge. A quiz at the end of the activity makes the students realize that this kind

of sessions are not just fun and games, that they really serve to learn a topic with maybe not so effort compared as studying alone at home [4].

According to Imbernón [5], in the group puzzle activity the content should be divided in such a way that each member of the team gets a more or less equal part, according to difficulty and extension. Each student takes the role of the teacher, presenting and explaining her knowledge to her classmates. At the end, each member of the team should know all the content.

We take the jigsaw method theory as a base, although with some modifications. We use this same concepts of initial and experts team, however, with a different timing about when getting together to adapt to our conditions and objectives of the activity. We design our preparatory session giving first some time to study individually the topics. The explanatory process is before going to the experts' team and then this experts' team is used to create multiple choice questions. A detailed explanation of the activity implementation can be found in the next section.

There are some key features to achieve the success in a jigsaw activity. Willet et al [6] state that the teacher preparation before the jigsaw is extremely important and also the fact of maintaining small group size. Because different contexts can yield to very different outcomes regarding the utility of the class, the time needed to implement it and so on.

Some studies have explored the difference between the expert and the listener role in the jigsaw method. Borch et al [7] find that experts achieve better results in their part of the content than listeners. This strengthens our opinion that the best way to learn something is when you have to explain it to other people. This context makes you go further and think about possible questions your audience can make that you do not even consider when you study alone. If you are considered "the expert" in some topic, you should know all the details about this part of the content. They also find that listeners have better performances in most of the topics than other students who have learnt the same topics but with traditional methods.

3 ACTIVITY DESCRIPTION

The activity proposed was implemented in the Statistics subject, which is a base training common to first-year students in Business, Economics and Finances and Accounting degrees. We implemented the activity in three different groups with three different sizes. The biggest group was composed 27 students, and then two smaller ones of 12 and 17 students. The development of the session was much more fluent in the smaller groups.

The students were told by email that this was going to be a preparatory activity for a multiple choice test the following week. They were asked to bring to the class all their notes about these probability units (both the theory notes and the practical lessons exercises) and a scientific calculator to compute probabilities. The teacher explained at the beginning of the class the different steps in which the activity was structured.

The activity consisted in dividing students in initial groups of four people. They took at random the names of the teams which were names of colours (blue, red, and so on). Each member of the group was responsible (expert) in a topic defined previously by the teacher. There were four topics: general probability theory, discrete models (Binomial and Poisson distributions), the Normal distribution and finally the Uniform and Exponential distributions. They agreed to distribute the topics or the teacher assigned them if the students had no clear preference about one topic.

In the first part of the activity, every student has to prepare individually its assigned topic. They had 15 minutes to study and make a summary: time to check their notes to review the most important concepts, rules or assumptions about the probability distributions. Then, students had 20 minutes to explain what they have learned to the other members in the initial groups, which implies 5 minutes per person.

In a second phase, all the students with the same topic in the class get together in a "group of experts". These groups have 15 minutes to complete the task of preparing three multiple choice questions with four possible answers each of them in which only one answer is correct. When the work is done, they had to give the teacher the questions to select one of them and include it in the final quiz. The teacher chooses according to the clarity of the question or the fact that this concept is not repeated in the questions she has already chosen for the quiz.

Then, the teacher gave each student an individual device of an EVS (Fig. 1), which are detected with a receiver connected in the teacher's computer. A file with the names of all the students enrolled in the class was needed for the registration of the students participating in the activity. Then, the software establishes a response number associated to each student, from 0 to 9, to match perfectly the name with the ID of the device. This allows the teacher to identify the student with his answers in every moment the voting system is used and therefore the traceability of the performance of individuals and teams is assured.

Figure 1. Electronic Voting System (EVS).

The last part of the activity is the running of a quiz. Students were asked to leave all their notes to answer individually the questions, without any help from their notes, to have an idea of their knowledge up to that moment. However, a team competition was established and the score at the end was going to be an average of the team results. A first breaking-the-ice simple question was asked to be sure that everybody understood the working of the voting devices and another slide to choose the initial colour team students were part of. Finally, the quiz started, which was formed by 12 questions decided by the teachers and 4 additional questions, one of each topic, selected from the ones proposed by the students. Time devoted to answer most of the questions was one minute, with some of them having some extra little time due to the need to do a bit more complex reasoning and calculus.

Results were presented in a pie chart showing percentages of people choosing that answer. After that, a correct answer mark appeared to make clear the correct option, as it is shown in Fig. 2. The teacher asks for any clarification if the students do not know why that answer is correct.

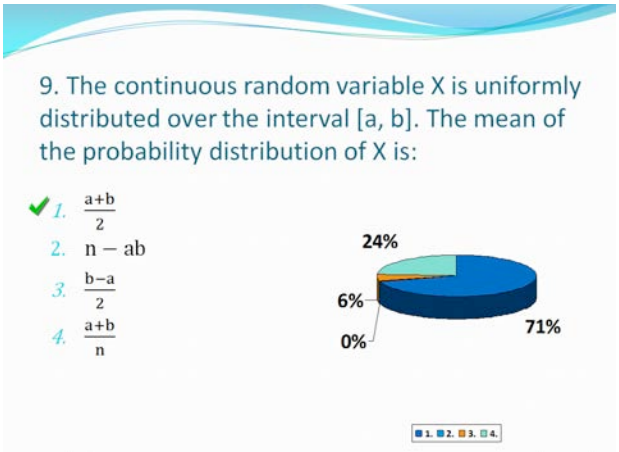

Figure 2. An example of a question of the preparatory session answered with EVS.

4 RESULTS

The most evident result of this activity implementation was the improvement in attracting students' attention. They were very surprised by the novelty of the use of the devices and a bit concerned about the fact that their answers were going to be clearly associated to their names.

Students participated very actively in the whole activity, having a satisfaction feeling when the percentage of the correct answer was close to 100%. On the contrary, when the percentage in the correct answer was very low they were a bit surprised and the teacher had to explain why the correct answer was precisely that one.

This activity was carried out in the previous session of a continuous assessment test. The results obtained in the test have been compared with the previous year results, in which no preparatory session was conducted. However, we didn't find differences in the average mark between the quiz with preparatory session and without. King et al [8] presents a study in which apparently there is no correlation between the use of EVS (Electronic Voting Systems) and improvement in student grades.

Nevertheless, we have just used the EVS in one preparatory activity. If the course was structured with daily questions and the students' performance in those questions was considered for the continuous assessment, maybe they would be more implicated in studying every day. In four-month subjects, the syllabus is quite large in extension and it is difficult to introduce alternative activities to reinforce concepts already explained. In addition, the number of students in the class is a significant restriction for the implementation and success of that kind of activities. We have check that with more than 20 students it is difficult to run the activity in an efficient way. However, the EVS provides an immediate feedback to the students' answers and that can be useful for a self-assessment about the students' knowledge of the subject. Afterwards, the dedication and study to the subject must be pushed by an intrinsic motivation.

5 CONCLUSIONS

The aim of promoting an active participation of students in the class and encouraging work in teams was achieved. However, we think that for an improvement in the students' performance should be necessary to implement that kind of activities more often during the course, in order to provide a real continuous evaluation.

The use of an EVS helps in allowing students to transmit real-time answers and displaying results in a graph immediately, with the percentage of response in each possible answer. On the one hand, the teacher can identify possible misunderstood concepts. On the other hand, this technology makes available a quick feedback for students to check their knowledge in the contents of the subject and maybe modify their study patterns.

Even if results of the quiz were not improved after this preparatory activity in comparison to the previous year results, we think that it is very useful to introduce dynamic and interactive activities in the classroom in order to promote and encourage students to actively participate. In addition, teams work and self-assessment was successfully promoted in this activity.

We think that in the long term the promotion of those attitudes should have an improvement in the students' performance. Because of that, in future courses we will introduce the EVS in teams' activities more often, in order to follow a real continuous assessment, as long as the syllabus extension and the group size allow us to do it. Certainly, that kind of activities is a useful tool to encourage students with an intrinsic motivation towards the studies.

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