GAME-BASED EVALUATION AND SELF-ASSESSMENT OF THE ACQUIRED KNOWLEDGE IN THE LABORATORY SESSIONS OF QUANTITATIVE METHODS

Isabel Narbón-Perpiñá, Jesús Peiró-Palomino

Universitat Jaume I (SPAIN)

Abstract

This education project is implemented in the subject of Quantitative Methods for Business and Economics (core subject, second course of the degrees in Economics, Finance and Accounting and Business Management, University Jaume I, Spain), which combines theoretical with practical sessions using statistical software in the computer room. This project aims at encouraging the student self-assessment in the practical sessions, with the final objective of improving the learning process and the students’ results. To do so, a new tool, the Socrative platform, is used. Firstly, at the beginning of the session, the students should answer a series of simple questions regarding the practice to be carried out. The questions, related to the content previously studied in the theory part, are launched in the Socrative platform, which simulates an anonymous competition between students. Next, the usual exercises of laboratory practices are performed, in which the questions are implicitly answered. Finally, the students try to answer again the initial questions, for which the right answer is eventually given by the docent. Using this method, it is expected students to be able to answer supposedly known but actually unknown questions at the beginning of the session, thus reinforcing their knowledge and connecting theory and practice. In addition, as they know that at the end of the session they will have to answer again the initial questions, their interest is fostered, encouraging participation during the practice session. The use of this self-assessment and monitoring tool also allows teachers to determine the extent to which learning has taken place.

Keywords: Learning process, Self-assessment, Socrative platform.

1 INTRODUCTION

Higher education is one of the most important responsibilities of nations. In the European context, the Bologna Process (1999-2010) brought a series of adaptations of the existent educational plans to the new guidelines from the European Higher Education Area (EHEA). Not only the university degrees have been adapted, but also the teaching methods have undergone a profound redesign (Keeling 2006).

In particular, the new methodologies pursue a closer monitoring of the students’ daily work by means of continuous assessment tools, which can today be based on the use of the new technologies (TIC) and a more intensive use of the tutorials. In addition, active participation of the students should be fostered through applied exercises, team work and professional internships. In this context, game-based learning has been proved to be beneficial to improve learning achievement. Some examples are found in Sung and Hwang (2013) and Tobias et al. (2014), although the literature on this issue is abundant. Another important method to improve the acquisition of knowledge is self-assessment, which, according to Stizmann et al. (2010), is especially useful for enhance motivation and satisfaction. In particular, self-assessment of prior knowledge is a precise predictor of knowledge and provides a useful guidance for future instruction (Dochy, 1996).

In this context, this paper describes one of the activities derived from the adaptation to the EHEA guidelines in the subject Quantitative Methods for Business and Economics, which is a second year core subject in three degrees of the economic and business areas in the University Jaume I (Castellón, Spain): i) Economics, ii) Finance and Accounting and iii) Business Management. The initiative is part of a project granted by the University Jaume I, related to the teaching innovation group “Inclusion of the new technologies in the Master’s of Financial Management and Advanced Accounting”, (Code: 3296/16).

The subject Quantitative Methods for Business and Economics is a subject from the branch of applied statistics to social sciences. It is, in essence, an applied subject although it has a remarkable mathematical character so, to be successful in the subject and meet the knowledge targets, it is
advisable for students to have previously coursed the first year subjects *Mathematics I, Mathematics II* and *Statistics*. Students have both theoretical (50%) and practical sessions (50%). The latter, which take place in the computer room and using specialized statistical software, have a more reduced number of students to facilitate the learning process and to maximize the individual attention by the teacher.

However, even in the case that students have passed the two previous subjects, they find particular difficulties with the current subject. In general, a common problem found by students is the difficulty to relate theoretical concepts learnt in the theory sessions with the practical activities in the computer room, which are exercises based on practical situations common in the daily activity of a firm. In this sense, we find the following scenarios:

1. Some students declare that they understand the theory but then they are unable to apply the concepts in the practical sessions.
2. Some students declare that they do not understand the theory but the practical exercises help them to understand.

These situations are normally linked to a high rate of abandon of the theoretical sessions, which severely difficult the learning process and the final success in the subject. The subject is taught by several professors and, although all they strictly follow the program of the subject and a similar teaching methodology, the fact that the students have a different professor in theoretical and practical lessons does not help them to assimilate the concepts.

Therefore, the main objective of this teaching project is to integrate the learning process and boost the autonomy of the students, also increasing their involvement in the subject. In doing so, the concepts of self-assessment and game-based learning will be incorporated to the practical sessions by means of the interactive platform *Socrative*, whose details are given in Section 2, together with the rest of elements and methodological issues of the project. Section 3 contains the main results and, finally, Section 4 concludes.

## 2 METHODOLOGY

### 2.1 Dynamics of the practical sessions and problems detected

The teaching methodology of the subject is based on traditional master classes, where the teacher tries, at the same time, to enhance the student’s participation. The great challenge is to do it properly. In the subject, there are five theoretical units and ten computer room practical lessons. In each group, there are between 20 and 25 students—in the theoretical classes there are about 90—and each one has access to a computer with the necessary software to carry out the exercises.

In a standard practical session, students have studied in previous theoretical lessons the concepts that they need for a successful resolution of the exercises proposed. Each practice consists of 3-4 exercises. The exercises are all available in the *Aula Virtual* – the virtual classroom – of the subject. The docent has its own computer, connected to a projector, and project the exercise statement. After that, he/she gives the students some time to solve the exercise themselves and ask questions if they need so. When this time is over, the teacher projects the solution of the exercise and the class continues with the next one.

During this process we detected the following problems:

1. An important share of the students does not know how to solve the exercise because they simply do not remember the theoretical concepts learnt in the theory lesson. In this situation, some of them ask the teacher to explain again what they are supposed to know, which is very inefficient.
2. Other students, as they know that the solution of the exercise will be projected on the screen, adopt a passive role and simply copy the solution, which is even more worrying.
3. Even the efforts of the teacher to enhance participation in class, students have no special motivation to do so, and the class becomes unidirectional, from the teacher to students, with very low interaction and students’ active involvement.
2.2 A change in the dynamics of the practical lessons

In order to improve the dynamics of the class and to solve the mentioned problems, we propose a methodological change, based on two concepts: i) game-based learning and ii) self-assessment; and one tool: the Socrative platform, which will allow to implement these concepts in the practical lessons. The new dynamic of the practical lessons can be summarised as follows:

1. The teacher reminds what was done in the previous session and briefly introduces the current practice.

2. Using the Socrative, the teacher prepares a test/quiz with three basic questions, related to the theoretical concepts and needed to solve the practical exercises. This allows for the self-assessment of the students, who can evaluate to what extent they have the theoretical knowledge necessary for solving the exercises. In addition, it is also positive for the teacher, since he/she knows the actual level of the students in class. Individual answers are saved but the questions’ correct answer is not given at this stage.

3. The teacher exposes the concepts learnt in the theoretical lessons, also related with the quiz. This does not mean a complete explanation of the concepts; it is just a conceptual map, where the concepts are briefly described and, more importantly, connected and related to potential real problems as those in the exercises. Both the quiz and this exposition should help students to refresh their knowledge before starting the exercises.

4. The resolution of the exercises begins. Again, some time is given to students. The teacher fosters the discussion in pairs, giving also clues and guidelines on the resolution and incorporating moments of total silence for students to take notes and to assimilate the explanation. Finally, the solution is projected on the screen. After that, there is again some time for discussion before proceeding with the next exercise. The teacher connects the solution to the theoretical concepts and invites students to discuss the results.

5. At the end of the lesson, the initial quiz is launched again, this time showing the answers.

2.3 The Socrative platform

The Socrative platform (https://www.socrative.com/) is the online tool used to implement the above-mentioned changes, in particular to elaborate the quiz. Its use is very intuitive for both the students and the teacher and it allows for a wide array of possibilities.

First of all, the teacher has to get registered, giving a name and a password. After that, he/she creates his/her own virtual classroom, shown in Figure 1. For example, our classroom is called “AULAISABEL”. Then, he/she proceeds to create a new quiz using one of the three options available: multiple choice, true/false or short answer. In “Quiz” we have stored all our quizzes, with details on the correct answers, explanations to each question, etc.

![Figure 1. The Socrative environment](image)

We use the multiple choice option, with four possible answers. We then indicate the correct one and include a short explanation of the question below in a box provided for that aim. Questions can be of different nature, even numerical. Figure 2 provides an example of a question formulated in one quiz during this academic year 2016/2017:
Once the quiz is created, we launch a Space Race, which is actually a game consisting of an anonymous competition among students. There are some options to personalise the race, from the number of teams, which in our case is the number of students in class, to the icon representing each student. For example, we select rockets. Figure 3 shows some of these options:

Once the race is launched by the teacher, each student should join our virtual classroom “AULASABEL” to participate. They log in to the platform as a student and introduce the name of the classroom to join the session. Then, a name is also required. The students answer the questions and the Space Race is projected on the screen, where each student is one of the rockets. They can see only the colours, that is, the process is anonymous for them, but the teacher knows the name of each student. If they answer correctly, rockets move ahead; otherwise they remain static. If one student answers correctly the three questions is assured to be among the winners, who are those who have answered correctly the three questions. As explained before, the race takes place twice; at the beginning and at the end of the lesson. Although the process guarantees anonymity, students are motivated to do it properly, since they actually know their position in the race. Figure 4 displays a hypothetical example of a Space Race.
After each response, the student receives instant feedback on the correctness of the answer, as well as a short explanation, as shown in Figure 5.

Finally, the teacher obtains the report of the race, with detailed statistics on the right and wrong answers. Since two races are performed, it is possible to easily compare results at the beginning and the end of the lesson, and assess the improvement of the students. The students, through this self-assessment are also able to check whether or not they have learnt in the practical lesson. The desirable and expected scenario is an improvement in the correct answers at the end of the lessons. The quiz motivates students to be more attentive in class, since they know that at the end they will have to answer the quiz again. In this second round, the correct answer is shown after all the students have answered.

3 RESULTS

The results at this stage are only preliminary. This is the first academic course that we implement this methodology and we are still compiling results, since the course is still ongoing. We have results from the reports of the tests done until now and a quick analysis of the information obtained shows that, in most of the cases, there is an improvement between the initial and the final test results, although this information should be analysed with further detail once the course will be over.

Finally, we have designed a 1-5 Likert scale survey for the students in order to obtain feedback for future improvements of the method. In the survey, we ask questions regarding the usefulness and adequacy of the quizzes for the acquisition of knowledge, both theoretical and practical, and the improvement in the motivation, the environment in the classroom and the appropriateness of the quiz as a self-assessment tool. We have also provided space for comments and suggestions. In a first round, we have obtained a global score of 4.1/5.0 from students, which we interpret as a good result.
that lead us to be optimistic. The students have also declared informally that this methodology has increased their motivation and has fostered their participation during lessons. Some of the suggestions in the surveys (translated from Spanish) are:

"I really liked the initiative, I think it helps to review / learn more"

"Include more questions, for example five instead of three"

Apart from the information from the quizzes’ reports and the surveys, we have perceived an increased interest for the subject and a higher rate of participation in the lessons. We have also noticed more motivation and certain degree of rivalry between students, which like to be between the winners, even the rest of the students do not know the name of the other participants. Students have also transmitted us that they appreciate the second chance at the end of the class since, in case they have wrong answers in the first round, they pay particular attention during the class with the aim of doing it properly in the second attempt.

Finally, this new methodology will be better assessed once the course will be finished and the exams taken, by comparing the final marks from previous years to those in the current course. We expect that this methodology enhances the acquisition of knowledge which, in addition, is expected to be acquired in a more integrated way (theory-practice), so that students would be better prepared for the exam.

4 CONCLUSIONS

This project has introduced the concept of game-based knowledge and student self-assessment through the Socrative platform in the second-year core subject Quantitative Methods for Business and Economics, taught in the degrees in Economy, Finance and Accounting and Business Management of the University Jaume I (Spain).

Despite this is the first academic year in which we implement this innovative education project and the initiative it is still ongoing, our perception as teachers is highly positive. Students are more motivated and adopt a more active role during lessons. In addition, and before the formal evaluation in the final exam, we have noticed that the knowledge level is higher than in previous courses. We have collected the students’ opinion via surveys and the initiative receives great support from the students, which declare that this methodology helps them in the assimilation of knowledge and encourages their participation in class.

Also, the teacher has better control of how the concepts are being assimilated by the students. The quiz provides daily information on both the understanding and the improvement during the lesson, which is also useful for the teacher to assess his/her capacity to transmit the knowledge and guide the students, as well as that adequacy of the exercises selected in each lesson. The reports can provide useful information for introducing changes in the immediate courses if we detect that a particular session is not well-designed and it is not helping students to assimilate the concepts.

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REFERENCES


