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THE PROCESS OF ACTIVE LEARNING AND 3D SIMULATIONS IN TECHNOLOGICAL ENVIRONMENTS ON ECONOMICS AND BUSINESS COURSES

1. IMPLEMENTING ACTIVE LEARNING STRATEGIES IN ACADEMIA

The process of adapting to the European Higher Education Area (EHEA) involves considerable changes to university teaching methods and an opportunity to improve teaching quality. Making students a part of their own training process is the most innovative teaching aim. Nevertheless, lectures are still undoubtedly the most widespread method in university teaching and highly suitable if the objective is to transmit information. The results of a several empirical studies show that in comparison with other disciplines, economics has been slow to adopt teaching methodologies other than the traditional lecture (Becker and Watts, 1996). Even those teachers who have carried out experiments to increase active student participation in learning processes point out that lectures are still the prevailing teaching methodology (Benzinger and Christ, 1997). The lack of student involvement in classroom lectures has been the object of much criticism. Partly in response to these criticisms, economics teachers have started to consider other methodologies for teaching economic concepts. A good example of this are the experiences described in the books Teaching Economics to Undergraduates: Alternatives to Chalk and Talk (Becker and Watts, 1998), and Teaching Economics: More Alternatives to Chalk and Talk (Becker, et. al., 2006).

The transmission of ideas and concepts through traditional classes (chalk and talk) is a passive method that disregards any effort students might make to actively involve themselves in the learning process and is of no use for the acquisition of competences if it is the only type of activity that students carry out during their university education. However, lectures have survived many generations of criticism because, despite their limitations, they are an efficient way of transmitting the content of a subject. The new paradigm of the teaching-learning process that is being put forward with the construction of the EEES, though, means that both teachers and students must get involved in new ways of teaching and learning. In this context, formulating competences is fundamental if the expected learning outcomes are to be achieved.

Specific and general competences should enable students to learn to think and generate

their own ideas and reasoning in such a way that learning is more genuine. This new system requires new methodologies based on active student learning. These new instruments search for the most appropriate way of involving students in their own learning process. The aim is to include students in their own education, to encourage students to reflect about their deductions and to see how students can obtain results and draw conclusions that were traditionally obtained and drawn by teachers.

The fundamental objective of active learning methodologies is not only that students memorize content but that they acquire the professional competences that the degree course is expected to provide. They should be able to cope with new challenges on their own initiative and not merely limit themselves to applying what they memorized, which they gradually forget as time goes by. Active learning encourages a critical spirit and invites students to regard themselves as the constructor of their own knowledge and the central element of everything that is done in the classroom. Interaction with other students is encouraged through work groups, debates or presentations in class. In this way, the students actively discover and understand the topics studied for themselves, they construct their professional competences and improve their communicative skills.

Both teachers and students benefit from these active methodologies. On the one hand, students learn to assess the extent of their learning and their ability to cope with new problems and concepts. And on the other, teachers feel themselves to play a more relevant role in the process of generating and monitoring the students' education. The teaching and learning process must make the most of the resources available to teachers. The wide range of ways in which teaching methodologies and educational resources can be used should focus on searching for the best strategy by which students can acquire the expected knowledge and competences.

Therefore, active methodologies can be used to diversify the strategies that can be applied in teaching and learning processes. These alternatives to the traditional lecture have gradually gained importance in the planning and distribution of time allotted to the various activities that students carry out during their university education. And it is here that simulation games can play an important role.

2. TECHNOLOGICAL INNOVATION AT THE SERVICE OF TEACHING IN ECONOMICS AND BUSINESS COURSES

Innovations in the field of ICT have led to the creation of new communication environments that have made it possible to develop new teaching and learning experiences by allowing activities that were unimaginable until very recently (Ferro *et. al.* 2009). The incorporation of ICT into university teaching has provided new opportunities for improving the quality of student learning, although in themselves they are not sufficient to improve the educational process. Canós et al. (2009) point out that ICT requires teachers and students to develop new competences if the innovations are to be successful. And they also require teachers to have new competences in the preparation of information and in relating to the students. Likewise, students need to have the ability and the attitude to undertake a process of autonomous learning, and to maintain a fluid relationship with their teachers.

Ferro et al. (2009) point out the following advantages of using the information and communication technologies in university teaching:

- Space-time barriers are removed from teaching and learning activities.

- Communication between teachers and students is improved.
- Teaching can be personalised, adapted to the characteristics of the students.
- Students can interact with information. After searching for information on the Internet, they can analyse and reformulate what they have found.
- Students' motivation and interest improve
- The development of new teaching methodologies improves educational efficiency.

Canós and Ramón (2007), however, pointed out that the new technologies also have some drawbacks:

- Students and teachers depend on technology to interact with and use the material.
- There is a risk of students being cut off from the teacher and classmates because of the depersonalisation of relationships in the educational process
- Materials and activities require more effort and time to prepare,
- Some teachers opposed to change may reject the new ways of organizing education.

University faculties and schools, then, are acquiring computer supplies and equipment that are to be largely used for teaching purposes. However, finding the tools and programs that are appropriate for the educational process is a task for teachers.

3. SIMULATION GAMES IN ECONOMICS AND BUSINESS STUDIES

Business games have increased quite considerably in recent years and they have a long and varied history. Faria et al (2009) made a detailed review of the history, uses and changes that have taken place over time in business games, particularly since the advent of the new technologies. The first use of a business game in a business management seminar can be traced back to 1956. The game *Top Management Decision Simulation* was developed by the American Management Association (Hodgetts, 1970) although it was not until 1957 that there is any reference to a simulation game being used in a university course. The game *Top Management Decision* was used in a course on commercial policy at the University of Washington (Watson, 1981).

From then on, business games developed rapidly. The *Business Games Handbook* published in 1969 (Graham and Gray, 1969) listed more than 190 business simulation games. Later, *The Guide to Simulation/Games for Education and Training* (Horn and Cleaves, 1980) identified more than 228 business simulation games. In 2004 an e-mail survey of university lecturers from business schools in North America, which generated 1,085 responses, confirmed that 36.6% were current users of business simulators in their teaching activities (Faria and Wellington, 2004).

In the reviews on teaching applications of business simulation games it is important to analyse the role that technology has had and the different types of game if their evolution is to be understood. At the beginning, business simulation games were quite simple: few variables were taken into account in the decision-making process, only a small number of participants could take part, the number or products or brands was limited, and participant feedback almost non-existent.

As we mentioned above, the increasing availability of computer equipment in universities and business schools and ever-improving technology have been key factors in the incorporation of this tool into education. At present, simulation games are hosted in platforms, which

makes it possible to increase their complexity quite considerably. Some versions are more economic or even free, and can be installed in students' personal computers, which increases connectivity and speed of use. And it is also of particular importance that the problems of securely storing the data, which provides evidence of the learning process, have been greatly reduced.

4. TYPES OF BUSINESS GAME SIMULATION

As far as planning teaching is concerned, in the traditional curricula of formal courses, the syllabuses of the subjects are divided into lists of topics and it is assumed that the students will understand the complexity involved once they have studied them all. On the other hand, in simulated environments complexity can be introduced into the technological environment in such a way that students have to face up to complex activities and situations, which they have to resolve (Lehti and Lehtinen, 2005).

If the use of simulations games in teaching is to be fully understood, it is important to know the general features of the different types of game in existence. To this end, we would like to make particular mention of Wolfe's classification (1993) of business simulation games:

- *Top Management Games*. In these games the participants take on the role of the company's chief executive officer and accept responsibility for taking strategic decisions for the whole company
- *Functional Games*. In these games the participants take on the role of director of a functional area of the company (for example, marketing, production or accounts) and accept responsibility for more concrete, operational decisions.
- *Concept Simulation Games*. In these games the participants assume the responsibility for decisions in small functional areas (for example, specific decisions about publicity, sales management, personnel, etc.)

It is only to be expected that different game types will have different teaching uses depending on the aims and the competences that need to be acquired.

Depending on type, games can be central to a course or subject or merely be used as a support tool in combination with other methodologies. After analyzing 1,115 articles published over a forty-year period in the journal *Simulation & Gaming*, Faria et al. (2009) identified 304 articles in which business simulation games are used as an education and learning tool, and they highlight the following nine main reasons for use mentioned by teachers:

- The **experience** gained through business games. The opinions expressed by teachers and students suggest that participatory pedagogical tools make teaching experiences more memorable.
- The **strategy aspects** of business games. The games clearly incorporate strategic decisions. The complexity of the decisions has been increased by the technical advances of the programs themselves.
- The **decision-making** experience gained through business games. Nowadays games include a considerable number of variables, all of which are inter-related. This enables students to develop their decision-making competence. The main contribution of business games is that they clarify academic knowledge and make it possible for students to experiment with decision making and see the economic and business effects that their decisions have in different scenarios.

- The **learning and objectives** provided by business games. The use of business games and the results obtained by students while they play provide evidence of the learning process itself
- The **teamwork** experience provided through business games. Most simulation games involve teams, and teamwork is always more gratifying if all the members adapt to the role they have been assigned.
- The **student motivation** provided by business games. The use of business games provides feedback that is not provided by other pedagogical tools. For example, in case studies, students have a passive role in which they can learn from the strategies that a particular case shows, but they are unlikely to see the results of their decisions.
- The **application of theoretical concepts** in a practical way. Business games make it possible to apply theoretical concepts and if students do not apply the concepts as they should, they can rethink and thus consolidate their theoretical knowledge.
- **Active learning** by students during games. On other occasions we have discussed how important active learning is in the learning process. Business games are tools that allow active learning to take place.
- The **integration of ideas** provided by business games. Numerous variables interact in economic and business environments, and there are a wide variety of different scenarios, all of which can be portrayed in business games.

Of these nine reasons, the first five have constantly been repeating ever since business games first emerged. We should point out that one of our interests is to promote those tools that make active learning possible and, in the light of the results, it is clear that active learning is one of the main reasons why simulation games are used. We are convinced that including interactive virtual reality in simulation games will not substantially change the reasons for use but it will certainly make all areas more realistic.

It is very important to understand the main reasons why simulation games are used in teaching, but it is even more important to understand the real benefits that are expected from the use of these games in economics and business studies. Considerable emphasis has been put on the importance of anchoring learning through authentic activities and simulations by the prevailing education theories (Bransford et. al. 2000). Simulations, then, can be used to anchor learning through authentic activities, which help students to cope with complex situations and encourage collaborative work (Lehti and Lehtinen, 2005).

The possible benefits of using games and simulations in teaching and learning processes, as Siewiorek et. al. (2012) have pointed out, have been discussed in numerous studies which emphasise their advantages (Aldrich, 2004; Kafai, 2006; Keys and Biggs, 1990; Prensky, 2001; Wolfe and Crookall, 1998; Woods, 2004). Simulations and simulation games have been widely used in studies in the field of business (Burgess, 1995; Dickinson and Faria, 1996; Faria, 1990; Faria et. al. 2009). The literature provides interesting results that show that games and simulations are highly appropriate to university education with a professional focus. Simulations and games enable students to come into contact with complex situations that are typical of real-life processes.

Another important advantage of simulations is that they can be used as platforms for collaborative learning and the acquisition of negotiating skills (Susskind and Corburn, 2000). In many cases, games and simulations allow students to share experiences and use them as a

basis for more detailed discussion of problems and cases that need to be solved (Lehtinen, 2002). Having the chance to respond to real –or at least realistic– problems in controlled learning situations is also very important for training in leadership. Simulated environments can be used so that students can carry out activities that are very similar to the sort of activities they will have to carry out in professional contexts but protecting them from any serious consequences that their mistakes might have (Garris et. al., 2002). Therefore, the players can take risks, explore and try out new things. In a learning context, these experiences can be linked to theoretical models, making them easier to understand and interpret. Students need conceptual instruments to understand the situations they are faced with and their own behaviour in these situations. In this regard, Siewiorek et. al. (2012) point out that simulated games are an interesting way of learning leadership topics. However, as well as carrying out the simulation, it is important to have time to reflect and analyse the content that is to be taught because otherwise the learning outcomes will not be achieved.

Despite all these positive points, some features of simulations and games hinder their application in education. The main barriers to learning with simulations are the following: the availability of resources and the time required for preparation, the lack of fit between the simulation and the course syllabus, technical problems and the lack of information on simulations (Faria and Wellington, 2004). It should also be borne in mind that students do not always perceive the expected connection between the simulated cases and real-life situations and, if they perceive that the simulation is not realistic, they may lose interest and motivation when taking part (Adobor and Daneshfar, 2006).

5. FROM ASSIGNING THE BUSINESS ROLE TO DESIGNING THE AVATAR

Having discussed the historical evolution of simulation games and the main reasons teachers have for using them, we move on to discuss the new options provided by interactive virtual business games. The technological evolution that is available to teachers has led to a change in paradigm in the way in which business simulation games are being developed. The intelligent agents or virtual characters are now the protagonists of simulation games. Students can have the real sensation that they are in the place where the events are unfolding. What is more, as Gerhard et al. point out (2004), avatars are the embodiment of users in collaborative virtual environments.

As has been discussed with reference to the experiences of applying virtual simulation (chapter 3), the design and personalization of avatars is fundamental if students are to play a specific role in the game, and it is this process that they considered to significantly mark the beginning of the game.

The development of artificial intelligence and its application to avatars, which can even be made to transmit emotions, has provided a wide range of new teaching options. These new options give as much importance to the evolution of the process throughout the game as to the final results obtained. It is particularly interesting to point out the results obtained by Vogel et al. (2006), who used three-dimensional images in education. Their study showed that the use of virtual reality programs can be a useful aid for helping students to understand complex ideas.

Virtual simulation games in economics and business, in which reality is constructed by avatars, provide a wide variety of teaching options particularly as far as developing entrepreneurship, and economic and business management and planning is concerned. In our opinion,

in the field of business one of the most important competences is teamwork as companies are made up of human capital. In most professional situations we are required to work as part of a team and we have to adapt. Working on the composition of virtual teams, with the characterizations of the avatars that are to take part in the game, can be fundamental to the learning process.

6. CONCLUSIONS AND FUTURE REFLECTIONS

The incorporation of virtual simulation undoubtedly involves a change in the role of teachers and students. Teachers are no longer mere lecturers who provide notes that students must memorize if they wish to pass exams; they are now tutor-trainers who guide learning processes. Students must learn how to learn and not only listen; they must be able to work effectively as members of a group; they must know how to search for information that is relevant to the decisions that have to be taken and think critically about issues so that headway can be made and the objectives of the simulation reached.

However, the methodological changes being made to the teaching process mean that both teachers and students have to invest more time. Teachers have to do more work before contact with students when preparing the various activities, and they have to spend more time on monitoring the learning process and motivating students. Teachers must also draw up appropriate and detailed plans of the activities that are to be carried out as part of the subject, so that students can plan their time and fulfill the aims of the course.

These processes of designing and implementing new teaching methodologies need to be accompanied by a system that provides proof of learning so that the results of this sort of application can be assessed. We believe that these mechanisms of assessment are essential if we are to understand whether the methodological changes have the desired effect of improving educational systems and student learning, and if we are to detect which aspects are not working as we had predicted so that improved mechanisms can be designed. Likewise, systems need to be developed for assessing the learning process generated by the use of these tools. Since competences are only acquired gradually, graded scales of competence acquisition are required.

The inclusion of interactive virtual games in economics and business courses should help the student's learning process. However, we must take care that the complexity of games does not hinder the learning process: that is to say, that the technical complexity of games does not demotivate students and force them to drop out.

As Porter et al (2004) point out, in the field of economics at this point in time we have enough information to design simulation programs. However, if these simulation programs are to be used correctly they must contain supplementary material and clear instructions about how they are to be integrated into courses to guarantee successful use. Further study should also be carried out on the effectiveness and the validity of simulation games in the learning process. Although they are expected to be effective and valid, as yet there is little evidence in the literature that this is the case. Stainton et al. (2010) state that simulations must be designed with great care, and must take into account such essential criteria as complexity, the realism of the representation, the depth of the content and the method of application.

To date, business virtual simulation games have been used as tools for teaching a whole subject or part of one. Experiences and projects in which virtual simulation is the centre of

the process and not only a tool may provide more evidence on the learning potentiality they have.

We believe that in economics and business studies it is very important to continue using interactive virtual games, and that work should be done on developing international university experiences to create global economy scenarios in which interactivity among students makes it possible for them to develop specific and general competences and also intercultural ones. Technological advances, then, must be used correctly by teachers and always focused on students and their learning process.

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