Developing Serious Games: from Face-to-Face to a Computer-based Modality

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This paper introduces a methodology for the design of a collaborative Game Based Learning (GBL) model, used here in the context of a finance course in an onsite learning context. In this paper we discuss three releases of the Finance Assets Game (FAG), the teacher-led face-to-face model, the paper-based model, and the computer-based model.

Transposing face-to-face activity into a paper-based and then a computer based environment, while maintaining the learning experience and performance across these three modalities, poses challenges in the areas of instructional design and Computer Human Interaction (CHI). To carry out the task, we followed a progressive redesign process of the face-to-face FAG. First, a paper-based release was developed in order to evaluate the dynamics of the collaboration and then a computer-based release was developed including a synchronous communication tool (chat).

Based on our observations of this process, we aim to compare learners' performance in the paper-based and computer-based formats. The degree of acceptability and usability perceived by the learners is analysed according to results obtained using the Technology Acceptance Model (Davis, 1986). We finish the paper discussing a prospective modality of collaborative GBL for distance online learning contexts.

1. Introduction

Game-based learning (GBL) is defined as a form of student-centered learning that uses electronic games and simulations for educational purposes (Kiili, 2005). In this context, Collaborative GBL refers to the use of collaborative games and simulations for collaborative learning purposes. Collaborative GBL considers games as potential, informal and multi-sensorial learning environments and allows learners to construct understandings by interacting with information, tools, and materials as well as by collaborating with other learners within the game. Squire and Jenkins (2011) consider that games are a versatile pedagogical medium where students develop a firmer sense of how specific social processes and practices are interwoven and how different bodies of knowledge relate to each other. Games can provide an engaging context for learning in case they balance the learning objectives and the game challenge in order to generate an optimal learning experience for players (Kiili, 2005) they can also bring realism while reducing risk (Oblinger, 2004). From the students' point of view and according to Foreman (2003), active discovery is required such as analysis, interpretation, problem solving, memory and physical activity. All these actions can therefore result in extensive cognitive processing that deeply roots learning in a well developed neural network. The present situation of Serious Games (SG) entails considering ICT supported innovation in formal education, which is informed and driven by a multiplicity of interrelated factors like

new tools and pedagogies and collaborative approaches to the learning process (Popescu et al., 2011)

In the context of management education, Kim, Park and Baek (2009) consider GBL as a learning environment. This can foster the achievement of particular objectives of given educational content through game play. Students' attempts to solve problems are maintained throughout learning sessions. Also Dempsey and colleagues (2002), following Kolb's (1984) Experiential Learning Theory (ELT), define games as instructional tools that can be used to apprehend an experience system behaviour that will provide us experiential insight through Learning By Doing (LBD) methodologies. For instance, GBL allows training management skills by failing without the consequences of the real world. Management games should be designed to provide substitutes for direct experience, enabling students to perform real-time strategic analyses. Also according to Dempsey, management games use deep human inclination to play games as a source for highly motivated learning. We cannot forget that fun is an important factor due to which relaxation and motivation can appear in the learning process: while motivation fosters student's effort without resentment, relaxation enables learners to understand things more easily (Prensky, 2002). However, little theory and experimental studies have so far focused on collaborative GBL in management education.

Interesting initiatives such as the ENGAGE (2011) project workshops experiences are focusing on the promotion of GBL among the educative community. Students' lack of motivation and "non active" pedagogies are the most important subject of debate. As students love videogames, GBL appears as an alternative; it has already been tested and it has been proved to be effective within the appropriate conditions. As not all teachers feel comfortable with these new learning tools, ENGAGE aims to investigate which are the best games for educational uses and applications. The ProActive project (2011) aims to foster creativity and support flexibility of educators working in Lifelong Learning (LLL) through GBL. This project is interested in the creation of constructivist contexts. Teachers of Comenius, Erasmus and Leonardo programs are invited to design their own computer-based GBL scenarios. ProActive objectives are to create Guidelines on Creativity Enhanced by GBL, disseminate a database of learning games, and promote active learning within EU education.

Some research experiences in management education precede our study (Kim, Park & Baek, 2009; Mawdesley, Long, Al-Jibouri, & Scott, 2010; Tan, Tse & Chung, 2010; Tao, 2009) which we have considered before designing the FAG.

Tan, Tse and Chung (2010) studied both the performance and the acceptance among high school students for a simulation game in management that situated students in a seaplane manufacturing plant. Participants played in class, and they were distributed in teams of 2 or 3 students. Groups took individual and collaborative decisions in order to maximize the production line performance. Playing time lasted about 1 hour and a half, and the complete sample was of 41 students. The results, in authors' words, showed "positive feedback from students indicating that the PnP interactive game approach to classroom teaching is effective and feasible" (p. 115).

Mawdesley, Long, Al-Jibouri and Scott (2010) aimed to study if the inclusion of a collaborative simulation game used among engineering students improved the learning experience in an existing construction management module. Researchers concluded that group based presentations can be both popular and useful for the learning goals because they increased engagement through competition. Some negative issues such as plagiarism of the successful strategies could be also seen in this experience.

Kim, Park and Baek (2009) studied how to use a popular Korean commercial MMOPRG game with high school management students, in order to train strategy skills via metacognitive strategies. In the experience, game play lasted 45 minutes and students made a pre and post test to measure their academic achievement. Authors found that a commercial game in conjunction with metacognitive strategies can be an effective learning environment for increasing students' performance. Negative conclusions concern the changes in teacher's role in order to assure learning effectiveness.

An important experience is the one leaded by Tao (2009). It presents a general operational game (BOSS) which includes finance concepts and four difficulty levels. Researchers found out that collaborative decision making games are good training tools not just for business-major college students but also for corporate managers. Another interesting aspect from this operational game was that each group of students had to collaboratively complete each round in order to access the next one. In order to facilitate the players' usability and the learning interests during the game, and compensate the screen-by-screen perception during the use of the BOSS game, Tao introduced both graphical reports and visual performance data.

2. Designing the Finance Assets Games from F2F to computer supported collaborative game

We hereafter describe the design process of the collaborative Finance Asset Game (FAG) which evolved from an activity originally carried out face to face in class to a Computer Supported Collaborative Learning (CSCL) onsite game and hence putting together what Prensky (2001, p.5) considers "seemingly diametrically opposite worlds: serious learning in business and interactive entertainment".

The FAG is a game that evolved from the activity initially carried out face to face in class by professor Joan Massons, with more than 30 years' experience on finance teaching. It was done with the only support of a blackboard and the participation of the learners at the Finance subject in a management program at Esade Business School. This activity is developed within the "Introduction to Finances" course: the activity objective is to put into practice the content previously explained by the professor on the assets and liabilities, students must be able to properly distinguish between these two concepts. In this class activity the teacher asked the learners to give 20 examples of assets and liabilities and he would write them down on the blackboard for further discussion and, if necessary, correction. The activity would lead to discussion among the class where all face to face interaction would take place. For this reason, and because of the oral expression of the answers, the professor could not have a clear perception of the answers of each of the students of the group.

With the increased interest on online supported training in the last few years, the introduction of new technologies and the emerging trend on serious games, this face to–face activity was considered to be transferred to a CSCL environment. The objectives of the transposition into a computer-based system were multiple. On the one hand, there is an interest of the Business School in providing students with computer-based activities to complete their face-to-face course lectures. On the second hand, there is an interest on advancing on the assurance of learning according to the Bologna process and ACCSB standards (Marshall, 2010). In order to achieve these objectives a computer based collaborative game has been designed in two stages. In the first stage the game was designed in paper to be tested with participants in class with the objective of validating the design, methodology and dynamics of the scaffolding in 3 phases: the individual phase, the peer correction phase and the collaborative decision making.

The activity dynamics designed both in paper based and computer-based pursued the same learning objectives goals as the face to face activity developed by the teacher, that is, to understand and be able to distinguish whether a financial item is an asset or a liability.

For the design of the activity, 12 asset items were previously selected by the pedagogic designers together with the teacher. The concepts were put in two different panels to be distributed among the pairs. One panel with 6 concepts was given to one of the learners and the panel with the other 6 was given to his/her pair. The objective of this first part was to decide individually whether each of the items was an asset or a liability.

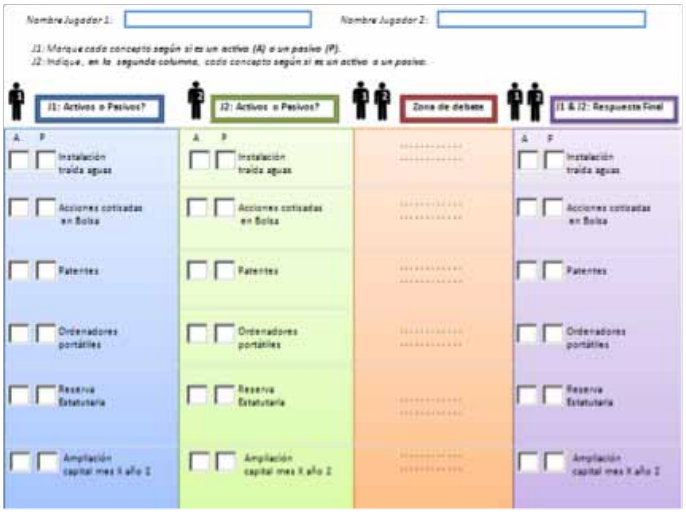

Figure 1: Paper-based Finance Assets Game

Once the panel on the paper had been answered individually by each learner, they would be swapped among the pair so that each partner could check his/her peers' items and classification and either agree or disagree with him/her and if necessary correct him/her. Next, the pairs would sit together to discuss all 12 concepts to finally reach consensus for each of the item through interaction. The discussion among the pairs to reach an agreement was done face-to-face in this paper-based release. Despite the success of the activity, only a limited part of the students wrote their discussion of the answers in the third phase on the onsite face-to-face context, preferring to orally discuss their final answers in the third phase (Usart, Romero & Almirall, 2011). The dyads' discussion aims to construct understanding together

Figure 2: Individual phase in the Computer-based Finance Assets Game

Figure 3: Peer correction phase in the Computer-based Finance Assets Game

by interacting and to take advantage of the numerous benefits of collaborative learning in terms of motivation (Järvelä & Volet, 2004) and the positive interdependence that is created when the learners should collaborate together to achieve better results.

The paper version of the game, tested in a corporative management program, corroborated that the activity dynamics was achieving the learning objectives and that it was difficult enough to be challenging for adult learners with little experience and knowledge on financial subjects. It also helped identifying two main aspects to be included on the game CSCL version.

Figure 4: Collaborative phase in the Computer-based Finance Assets Game

The following step was to transpose the design of the paper version to the computer-supported game design. Again, the learning objectives of the activity were the same but the dynamics of the interaction varied slightly by the interaction through a computer-based system. The main noticeable change implied in the CSCL version was that the 3 phases panel of the paper-based game evolved to a computer supported game with different screens for each of the three phases of the game: a first individual screen for the categorization of 6 finance items, a second screen for individual correction of the partners' 6 finance items, and a third one for the collaborative final consensus.

In the computer based version the learners access to the information and the activities progressively, screen by screen, as opposed to the paper version where all three tasks were visible from the very beginning. The fact of progressive display of the screens fostered the scaffolding of the individual and the collaborative dynamics. The scaffolding of the collaborative GBL dynamics in separate screens is supposed to reduce the students' difficulty to regulate their collaborative learning process (Azevedo, Cromley & Seibert, 2004) and reduce their cognitive load. According to Lee, Plass and Homer (2006) separating the content into more than one screen led the students to higher levels of comprehension and lowered the cognitive load associated to the use of the computer-based learning environment.

Another change introduced in the game was to provide each pair with a specific task-focused space for them to interact with the main objective of communicating to solve the task together. In the paper face-to-face version it had been clear to the observers that the discussions going on among the pairs in order to find agreement on the non agreed concepts were enriching and that they were worth analyzing to find out how the pairs had reached consensus. In this line Garrison and Vaughan (2008) point out that the discussion of the face-to-face classroom may become vapour whereas the written discourse of online classrooms offer permanency. Hence a synchronous communication tool (chat) in the learning platform was added within the game so that all the students could interact in pairs during the collaborative stage and their discussion was kept registered for further analysis or reflection.

The Computer Mediated Communication (CMC) through the chat is supposed to promote more task-related messages and help students to reach a higher performance in their interactions (Whalter, 1996). In addition to that, the chat application allowed the teacher to analyze the pairs' dynamics and the interaction going on for further research.

Besides, having the chat application allows learners to play the collaborative game without necessarily being physically in the same place which is a key element to be considered bearing in mind the changes in management education towards blended learning environments. Also it is interesting to highlight that the fact of having a specific task-focused space for them to communicate with the main objective of solving the task helped the couples to be task focused and to go straight to the point in order to fulfil the task, whereas in the paper version were the interaction took place face to face it was easier that they would comment also on other aspects.

3. Usability, Utility and Acceptability in Computer Learning Technologies

Transposing a face to face activity into a computer-based environment is both a challenge of instructional design and Computer Human Interaction (CHI) for maintaining the learning performances and the learning experience and efficiency. We focus in this section in the assessment of the CHI of the Finance Assets Game (FAG).

Computer Supported Collaborative Learning (CSCL) should be easy to use and useful for the learners in order to facilitate the learning objectives. Computer Learning Technologies should be designed for achieving a correct level of usability, utility and practical acceptability for enhancing their learning objectives (Fuentes, Romero & Serrano, 2011). The relationship between the usability properties and the learning outcomes has been studied by several authors (Laurillard, 2002; Parlangeli, Marchigiani & Bagnara, 1999). Well designed computer-based learning environments contribute to the learning performance. On the contrary, poorly designed environments could have a terrible effect on learning. For Redish (2000) it is necessary to design computer-based learning environments that allows learners to find what they need, to understand what they find and to act appropriately within the time and effort needed for the task.

One of the key elements in learning with ICT is *usability*, which is defined by Preece and colleagues (1994, p.14) as a concept "concerned with making systems easy to learn and easy to use". In the context of educational technologies usability could be associated to efficiency, learnability, memorability, and even, to learners' satisfaction (Tricot, 2007). For Allum (2001) teacher-designed spaces often fail in terms of usability. An environment must be easy to use and must support the learning activity in an efficient way. Usability is often associated with the functionalities of the Computer Learning Environments (CLE), specially the User Interface (UI).

Utility could be defined as a synonymous of relevance or efficacy (Tricot, 2007) of the CLE considering the enhancement of learning process and outcomes when using the CLE. A computer-based solution that is very usable but has not utility for the learning process must be avoided. Utility could be dependent on the learning activity context.

A third item that we can consider is the *practical acceptability*, which not only consider the usefulness and usability, but also robustness, cost and reliability of ICT applications.

Several studies have shown that user perceptions towards the UI of the computer environment are strongly related to apparent usability, and have an important impact on the overall system acceptability (Hassenzahl & Wessler 2000; Tractinsky, 1997; Schenkman & Jonsson 2000). Acceptability emphasizes the idea that we need to adapt a user centered approach to Computer Learning Environments assessment. The ergonomic criteria have a responsibility in the learning process and could be implemented among different people as a qualitative or quantitative survey, focus groups, heuristic rules, critical incident approach or other methodologies. Heuristic rules that we could take into account are related to the optimal extension of the learning ob-

jects and other files, the learning times (allocated time, time on task…) and the readability.

4. The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) aims to predict the users' acceptance of an Information Technology (IT). Based on the Theory of Reasoned Action (TRA), Davis (1986) developed a first release of the Technology Acceptance Model (1986) which deals more specifically with the prediction of the acceptability of an information system. The model is initially proposed by Davis (1986), and extended by Venkatesh and Davis (2000). TAM is widely used in different types of IT (Gefen, 2000; Gefen & Straub, 2003; Stoel & Lee, 2003), in general, or specific learning technologies, specifically (Abdalla, 2007; Carswell & Venkatesh, 2002; Selim, 2003; Stoel & Lee, 2003).

The purpose of the TAM is to predict the acceptability of a tool. Previous factor analysis lead to consider the acceptability of the tool to be influenced by two differentiated factors: perceived usefulness and perceived ease of use (Larcker & Lessig, 1980; Swanson, 1987). Perceived usefulness is defined as being the degree to which users consider that the IT system will improve their performance. Perceived ease of use refers to users' perception of the IT facility of use.

In addition to the TAM developed initially by Davis (1986), many variations have arisen with the objective to enrich the original model. In this study we consider specifically the Perceived Enjoyment (PE) in the use of the technology, because of the expected relation between the positive user experience in the use of the game and the PEOU. Considering also the impact of the self efficacy judgments of the users on their behaviour introduced by Bandura (1986), we consider the specific Computer Use Self Efficacy in the PEOU and expect a positive relation between the two perceptions according to Venkatesh and Davis (2000) and Venkatesh (2000).

Since the rise of educational technologies in last years several studies have examined TAM as a model for analyzing e-learning. Selim (2003) proposed to extend the TAM model proposing a course website acceptance model (CWAM). He observed the relation between perceived usefulness, perceived ease of use and intention of use in 403 undergraduate students. He observed that the students' intention to use e-learning technologies was related to their beliefs in the increase of the learning. Abdalla (2007) considered a sample of 518 undergraduate students using website courses based in the Blackboard Learning Management System (LMS). He observed the ease of use and the usefulness of technology influencing positively the students' attitudes towards the system and the technology effectiveness. Liu (2009) observed that the perceived usefulness and concentration influenced user's intentions to use the Wisdom Master LMS platform. He concluded that the acceptance of text audio video is higher because of its perceived usefulness and for its highest user concentration in the use of rich-media technology.

5. Aims of the study and hypothesis

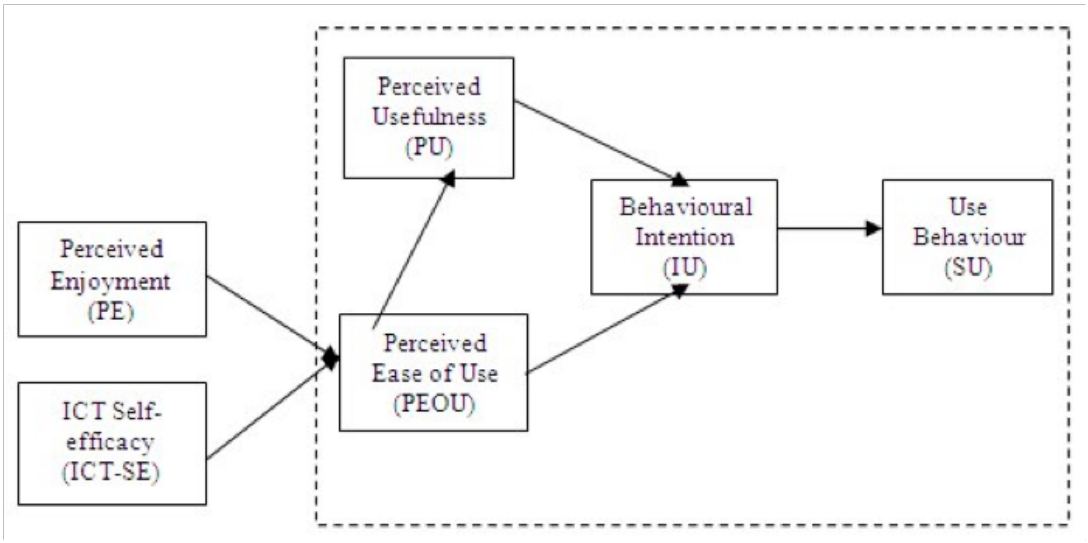

Figure 5: Technology Acceptance Model

Considering the differences that could appear in the perception and the real interaction when playing in paper-based contexts and computer-based contexts, we aim to analyze the students' performance in both contexts. We analyze these performances in each of the phases of the game (individual, peer correction and collective decision-making) for both contexts. We formulate a first hypothesis considering a better performance in the third phase of the Finance Assets Game in the computer supported context because of the scaffolding of the collective

display of the answers and the gradual process that has been produced by displaying one screen at each time (Tao, 2009). This first hypothesis can also be supported by the fact that the computer–based context includes a chat application with the specific objective of discussing the results in pairs and of reaching agreement. This tool allowed focusing all interaction on the task. Although groups collaborating in computer based learning environments often appear to be less effective than groups interacting face-to-face (Baltes, Dickson, Sherman, Bauer & LaGanke, 2002), communication tools such as chat applications can allow peers to interact in a more efficient manner by supporting the sharing knowledge and performance information (Engelman, Dehler, Bodemer & Buder, 2009). Furthermore, in the context of the computer-based context we analyze the Finance Assets Game (FAG) results in relation to the degree of the users' acceptability according to the results obtained using the TAM. We expect, from previous studies (Selim, 2003; Abdalla, 2007; Tao, 2009) the degree of acceptability to influence the process performance of the students in all the phases, and specially, in the third phase of the game, where the students working in dyads should use, in an intensive way, the input interface and the chat communication tool for discussing and agreeing in their decision making. A second hypothesis was formulated which considered better results in the third phase for those participants with a major e-learning self-efficacy according to their answers provided at the TAM.

6. Methodology

In order to measure the level of perceived ease of use and usability of the computer based game version, a TAM, in its Spanish version, was provided to the students participating in the experience. The TAM survey consists of 14 items or statements, each one has to be graded in a 7 point Likert scale and participants filled it after the gaming experience, through the online Finance class, designed in a Moodle LMS. In order to retrieve more information about the game and compare it with the previous paper version, two more questions were added to the survey.

Participants

The participants in this study were enrolled in an Executive Education general management course (MCDGE). The whole group was expected to take part in the game experience; so that they had been previously distributed into 10 pairs and recorded as players both in the game database and in the Moodle finance course. Finally, due to the non appearance of one student in the finance class, the sample contained 18 students (9 pairs) with an average age of 37.12 years (sd=2.56). For the paper-based version, 16 students in a PMD program were studied. The sample was divided into 8 pairs or dyads and the average age was 37.63 years (sd=1.24). The participants in the paper-based group had an average previous knowledge in finance of 5.50 (sd=1.08) and the computer-based group an average of 2.24 (sd=2.64).

Instruments and performance measure

In order to measure the level of perceived ease of use and usability of the computer based game version, a Technology Acceptance Model (TAM), in its Spanish version, was provided to the students participating in the experience. The TAM survey consists of 14 items or statements, each one has to be graded in a 7 point Likert scale and participants could fill it after the gaming experience, through the online Finance class, designed in a Moodle LMS. Two more questions concerning students' ICT level were added to the survey as to compare paper-based and computer-based versions.

Students' performance is measured as the scoring of the game, both for individual and collaborative phases. All the answers are recorded in a MySQL database for further analysis.

Procedure

Both experiences began with the explanation of the game. The teacher explained, step by step, how to play the game. For the computer-based version, it was also explained how to access the Moodle platform. Before the game started, a 3 question pre test implemented in the game interface was filled out by all students.

The participants then played the first and second phase individually. After that, the collaborative phase took place. Dyads collaborate via the Moodle chat and accorded the final answers. The whole game experience lasted about 45 minutes for the computer-based and 30 for the paper based experience. After game-play, students in the MCDGE program were invited to fill out the TAM questionnaire. All students completed the game and the tests successfully.

Following the first hypothesis, the independent variable (IV) studied in this article is the game context; paper based or computer-based. The dependent variables (DV) we aim to correlate

with these contexts are the performances for the three different phases of the game. DV were retrieved from the database logs. The results are introduced bellow.

7. Results

We introduce the results concerning the performance in paper-based version of the game and comparing them with the results of the computer-based version. Firstly, we show the results of performance across the different phases of the FAG (individual, peer correction and collaborative). We introduce thereinafter, the overall answers to the TAM questionnaire. Finally, we present the TAM model considering the relation between the factors in the computer based GBL.

Samples	Paper-based		Computer-based	
	m	*sd*	*m*	*sd*
Individual phase (/6)	5,13	0.89	4,50	0.79
Peer correction phase (/6)	5,38	0.72	5,17	0.80
Collaborative phase (/6)	5,44	0.73	5,39	0.81

Table 1: Performance in each of the phases of the FAG

In order to test the first hypothesis, we consider both contexts across the different phases. The measures of performance show slight differences in these phases (cf. Table 1).

The highest differences appear in the individual phase, where paper based group is performing higher (m=5,13; sd=0.89) than the computer based group (m=4,5; sd=0.79). These differences are reduced to non significant differences in the peer correction phase and the collaborative phase.

For the second hypothesis, answers are only related to the third phase of the computer-based game. Expected correlation between the performances in the third phase and TAM answers is studied. Furthermore, for facilitating the understanding of the overall results shown in the TAM results figure 6 below, we reversed into a positive scale the negative items. The reversed results are the ones concerning the following statements: "I would intend to play again", "The gaming experience was acceptable", "The gaming experience was pleasant", "The gaming experience was easy", "The gaming experience was beneficial" and "The gaming experience was positive".

Considering the factors of the TAM, we calculated the results for each of them (PEOU, PU, IU, SU), the external added factors considered by previous authors (PE and ICT SE) and the relation between them and the performance. Results of the correlation analysis are shown in figure 7.

From figure 7, a first significant relation between Perceived Enjoyment (PE) and Perceived Usefulness (PU) is observed; there is also a significant positive relation between Perceived Enjoyment (PE) and Perceived intention of use (PEOU). We finally observe a negative significant relation between Performance and user behaviour (SU).

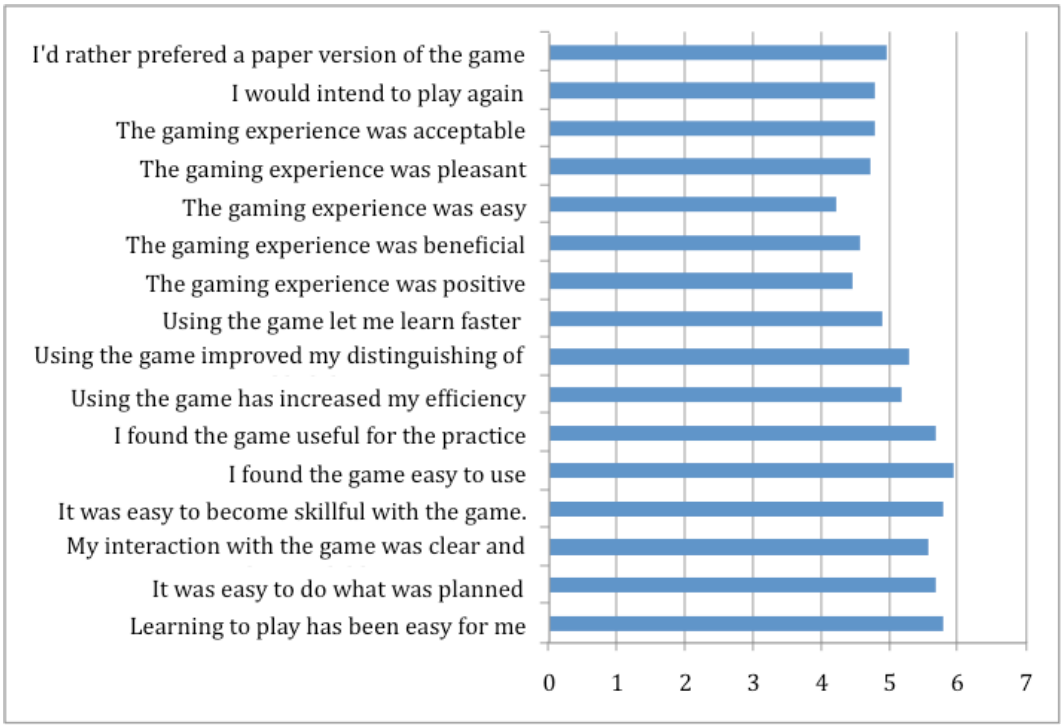

Figure 6: Overall results of the questions of the Technology Acceptance Model

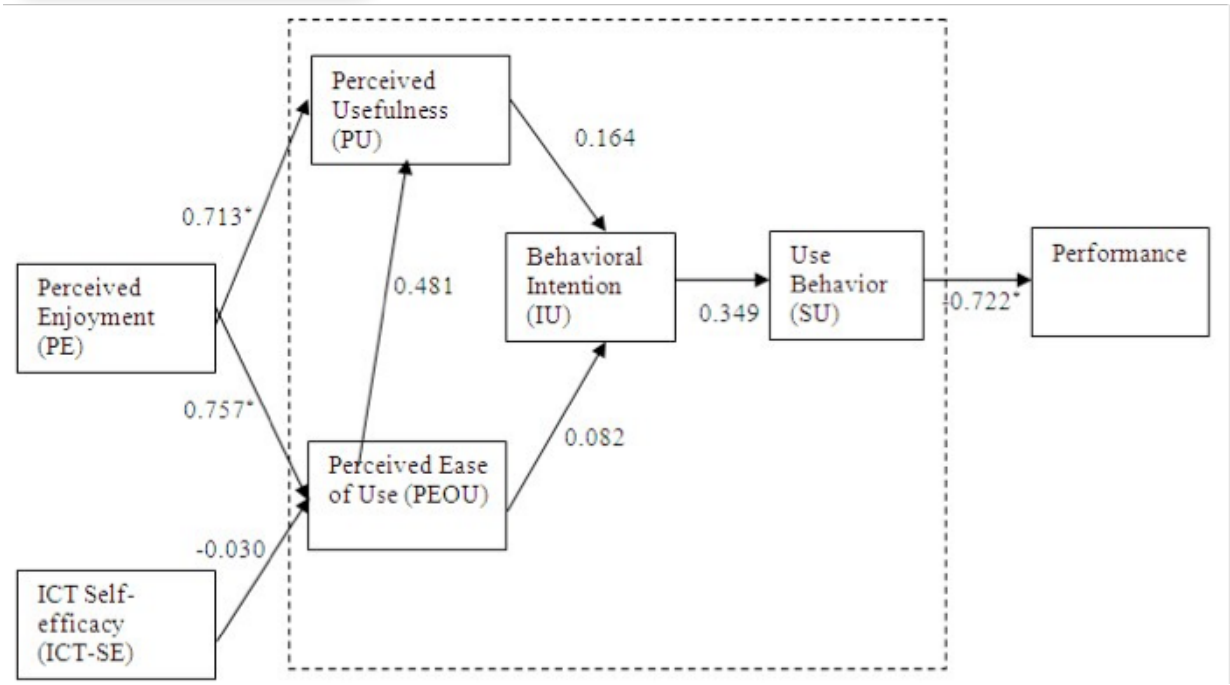

Figure 7: Results of the Technology Acceptance Model survey

8. Discussion and prospective

The study aimed to compare the learners' performances both in the paper based and computer-based collaborative GBL modalities. We consider Computer Human Interaction challenges of the transposition from paper-based to computer-based modality in the design of the collaborative GBL. The computer-based release should not only maintain, but also, enhance the learning experience. The usability, utility and acceptability criteria are considered in the computer design process. We analyzed the acceptability using the TAM (Davis, 1986). In the redesign process both the screen to screen and the chat functionality integration were introduced in the computer based release. Both the paper-based and the computer-based releases were tested in onsite contexts, considering the use of the computer supported collaborative GBL in online modalities as a prospective possibility.

The first hypothesis about the consideration of a better performance in the third phase of the FAG in the computer based context has not been corroborated by significant differences among the groups. Performances results in the computer based context were expected to be higher than the paper-based outcomes because of the scaffolding on the collective display of the answers and the gradual process produced by displaying one screen at each time (Stewart, MacIntyre, Galea & Steel, 2007). These results could be due to the differences in the previous knowledge level, which was higher in the paper based group. However, it has been observed that the evolution of the performance from phase 1 to 3, improves in a more pronounced way for the computer based version. We should consider the differences in the previous knowledge in the paper based and computer-based groups. These differences could help to understand the possible reasons of the observed evolution through the 3 phases of the GBL. In previous experiences, researchers pointed to various possible explanations for this behaviour, such as narration, interaction and rewards that could scaffold the process and therefore enhance the process of knowledge acquisition (Tao, 2004) Nevertheless, as few studies have encountered significant results among the relation between the scaffolding and the students' performance, we should consider this relation as one of the prospective lines of research in GBL.

The second hypothesis considered better results in the third phase of the game for those participants with a major ICT self efficacy (ICT-SE), based on previous results on this relation (Venkatesh & Davis, 2000; Venkatesh, 2000). We analyzed this hypothesis according to the participants' answers on the TAM questionnaire. Despite not having significant results, we observe a negative relation between Use Behaviour (SU) and Performance. The students using less the computer based GBL performed better. Therefore, the higher achievers interacted less with their peers than the other students. This behaviour had previously been observed by Fuchs, Fuchs, Hamlett and Karns (1998). We could consider these results considering the high performance students to have a lower disposition to communicate via chat interactions with their peers.

Despite some slight differences in the group performances in both contexts, none of the two hypotheses formulated initially could be corroborated by significant results. The fact that the comparison was made between two fairly reduced number of students (n=34) could explain the results as well as their level on finances was slightly different. For further research we aim to use the computer-based game with other learners in management programs and gather more significant data to be able to draw firmer conclusions.

Furthermore, although the relation between Perceived Enjoyment (PE) and Perceived Usefulness (PU) was not considered in the initial TAM (Davis, 1986), results show a significant correlation between these two items. A possible explanation for this result is that games in general and GBL in particular, are environments supposed to motivate and engage players (Prensky, 2001); therefore, enjoyment and usefulness are supposed to be enhanced in games. Nevertheless, further longitudinal experiences with the FAG have to be performed in order to study the stability of this result.

This results, together with the high degree of technology acceptance that participants gave to the FAG, lead us to consider the interest of the Computer Supported Collaborative GBL not only in the context of the finance and management education, but also in wider fields of study where the collaborative process could be scripted as an individual activity followed by a collective activity. Some authors have highlighted the importance of GBL for training skills and competences without the consequences of the real world. These environments enable students to perform real-time strategic analyses, following Fu and Yu (2008), a good game learning strategy of the present design could be to promote competition among players while permit them to work as a team in order to win a game. Collaborative pedagogies have been proved to be effective techniques to enhance learning performance in face to face learning environments. These management collaborative GBL contexts, in which individuals cooperate as a group or dyad and compete against other groups, produce a high learning performance (Ke & Grabowski, 2007).

Further research is needed in order to study the role of the communication tools in the FAG. The implementation of metacognitive tools, such as the chat application, aims to promote the explicitation and sharing of metacognitive processes among players. Allowing these knowledge sharing is important not only for computer based but also for face to face gaming activities; as some researchers have stated, these applications can promote and enhance the knowledge acquisition for both individual and inter individual processes (Engelmann, Dehler, Bodemer & Buder, 2009).

Taking into account the changes in management education towards blended learning programs, we should also consider the interest of the collaborative GBL not only in face-to-face onsite modalities, but also in online distance collaborative GBL.

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