Game Design Evaluation Study for Student Integration

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Abstract. This paper presents the evaluation of a serious game project, where the primary goal was to develop a set of collaborative game levels on a virtual campus, in order to help the integration process of newcomer students to the university. The global activities that can be performed by the students were designed for a group approach in a controlled virtual environment. For the present work we have selected Second Life for the implementation of these collaborative "game levels". A prototype evaluation was conducted to collect results with a sample of university students. With this data, some conclusions were extracted in order to delineate future developments.

Keywords: Student integration, virtual worlds, second life, serious game development, game design, collaborative games, group dynamics, problem solving.

1 Introduction

The integration of newcomer students to the university can be an overwhelming experience, especially for individuals with a more introverted personality and in large courses which, in extreme cases, can even lead to the abandonment of the course. In an attempt to help in the process of student's integration, the Faculty of Engineering of the University of Porto (FEUP), in Portugal, has provided several activities organised in a preliminary mandatory course named "Projecto FEUP" with 2 ECTS [1].

Having in consideration the huge impact and constant evolution of online communities, social networks and virtual worlds for collaborative activities, the use of these realities in the context of student integration seems like an interesting option. Although several technologies have been analysed for this project, like for instance Unity, UDK, Torque and XNA, the Second Life "metaverse" appears to be a more flexible and fast way to implement our needs in the context of virtual simulations and simple multiplayer games.

Recently, with the creation of the virtual place of the University of Porto in Second Life, an additional opportunity to reinforce this multitude of approaches has emerged. A new project was designed and implemented, in a parcel of the private region (island) of the university, in order to create a virtual space for students to meet and

interact with each others, through a set of specific digital game levels that need to be played in team.

Another important goal is to promote common experiences between newcomer students and promote their communication and collaboration. To achieve that, each student should create their own avatar with a name and personal characteristics and complete a series of challenges – in future editions of the course, these challenges may even be beneficial to the final grade (as a reward mechanism) - possibly there will be no penalisation associated, that is, there will be other ways to get the same points of grade with other activities.

With all this in mind, the core task of this project involved the development of several collaborative game levels with very simple and specific objectives. The best approach to implement a suitable interaction design and adequate game mechanics in this work is not obvious, but a survey on some works that are related with the area of team integration and collaborative game design helped to shape the structural concept.

In this paper we present a preliminary evaluation of this game, conducted with students. In section 2 we present related work and in section 3 we describe the concept of the game. In section core we discuss the evaluation of the game and, finally, in section 5 we present conclusions and future work.

2 Related Work

A project called eScape [2, 3] studied and analysed the adequate implementation of puzzle games in a virtual multiplayer environment. The experiment was applied to a total of six groups of four players, where each one was in an isolated room. It also collected the interaction player data trough the use of several methods. The conclusions that resulted from this work provided a better perception and knowledge in multiplayer puzzle design and collaborative gaming in general.

Another project named EduTeams [4] was initially developed as a case study, becoming afterwards a commercial product. The main goal was to broaden the core skills of students in elementary and secondary schools, including teamwork, communication, planning, problem solving and logical thinking. The result was a multiplayer system with several team based activities. During the evaluation of the case study, teachers reported some benefits in classroom as they perceived that some students were more motivated, more extroverted and better aware of the importance of teamwork.

3. Game Design – Ideas and Requirements

The project is codenamed “FEUP Adventure” and its main purpose is to be a “lightweight” experience generator for newcomer students at FEUP.

As the whole purpose of the exercise is to provide amicable experiences to users, it follows naturally that the game should be played in teams of humans, in a cooperative and adversarial environment. Other parts of the “Projecto FEUP” course team

students into teams of 6 to 8 players and these teams should preferably be kept and used to enhance "team-effect".

One of the problems of the project was the high number of students that should be integrated under the virtual platform. Each year FEUP has more than 800 newcomer students, so, coping with such high numbers is a requirement and as such games should have several rounds and or different levels to foster all *vs*. all experiences. Naturally, levels should have at least variety and preferably increasing complexity in order to create stimulating challenges.

Another strong idea is to have some kind of reward mechanism: in similar projects, some reports state users tend to lose focus and just wander around when there is no reward or competition involved.

It was also considered that joining "Projecto FEUP" and "Aventura FEUP" with the previously existent Second Life island branded with the University of Porto (U.P.), was interesting in order to foster both activities and to allow for the necessary basis for development of the game. Naturally, the development platform should have near real time response and some kind of physics engine or at least interactions should be easy. The 3D part and the persistent world were considered optional.

It was also considered that fostering communications was interesting and students should preferably (but not mandatorily) seated in the same classroom. As with other "classes", timing is of the essence and timing constraints should be in place, also in order to cope with the very large number of students.

Another idea is that not all students would be familiar with these technologies and that a small trial area (that would not break the novelty) would be interesting. Users should thus have an area to test physics outside of the gameplay.

As with many other games, it was considered that teams should change sides in the games and that the games should, of course, be balanced and equitable. Circumventing game rules and un-ethical behaviours should be avoided and punished in the game rules.

Also due to the large number of students involved, preferably, little or no supervision should be needed. There may also be in-game supervision for remote players.

3.1 Game Concept

The proposed solution to cope with so many students is to set up the games into groups of 4 teams. A competition between teams is used to reinforce the focus on the tasks ahead, where a classification system is implemented and rewards are available accordingly with the results.

Three levels were found to be an adequate number for the test purposes at hand. Each level needs to be played by two teams (acting team and opposite team), and the three different levels are played with distinct teams, assuring that all teams will face each other (as depicted in table 1). For example, initially, team A will oppose team B and simultaneously, team C will play against team D.

Table 1. Team Distribution by Level.

	Teams
Level 1	A *vs*. B C *vs*. D
Level 2	A *vs*. C B *vs*. D
Level 3	A *vs*. D B *vs*. C

The proposed virtual space has three game rooms and a free practice area (Fig. 1). The levels are based in physics, moving objects and orienting the avatar of the player's character. There will be no flying available in the parcel due the nature of the levels, and therefore, the practice area will allow the students to become more aware of the interaction with the avatar and test the actual game mechanics before the game begins.

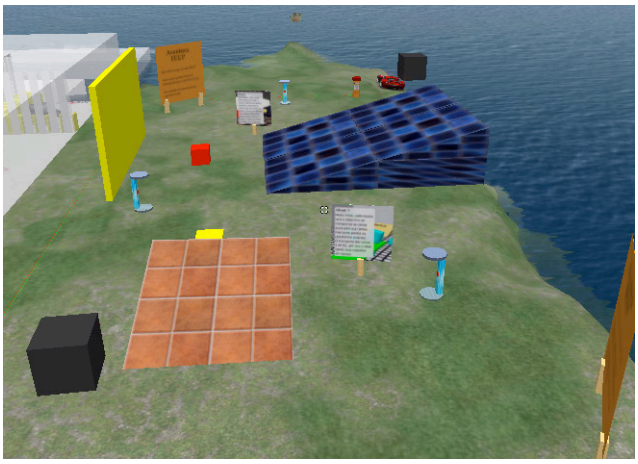


Fig. 1. Practice area in the FEUP Adventure game.

3.2 Proposed Game Levels

Each level is composed by a specific set of rules and objectives, designed to promote the creation of collaborative and adversarial experiences. Levels are to be simple but allow different strategies, still demanding human communication, thus promoting interaction among colleagues.

The game at Level 1 is called "Crate Carrier" (see Fig. 2) and is a 6 *vs*. 6 player level, where the objective is to score the most points possible during a limited time

(e.g. 5 minutes). Each team will score points by carrying crates over their ramp and dropping them into a moving platform. To ensure a balanced game for each team, the position of the objects is symmetrical and in the beginning all team members will start on the top of their ramp. The crates were designed to be heavy objects, hard to move and control singlehandedly. To score points is also required synchronisation between the players, as they must all push together at the exact time the platform passes underneath. This level offers several strategies that can be adopted by the teams, but players can not stand in the opponent ramp.

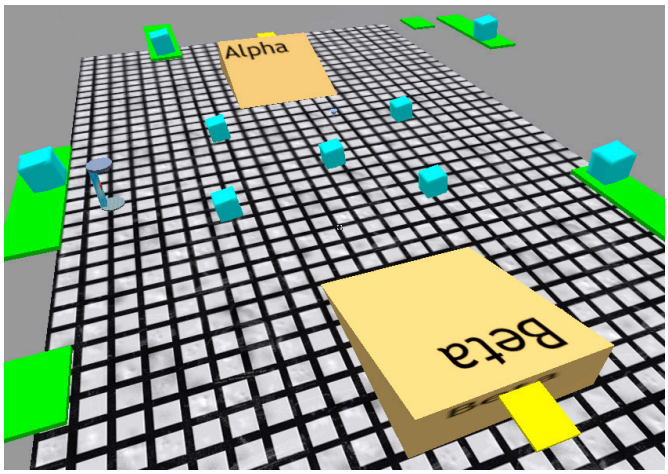


Fig. 2. Map for level 1 of the FEUP Adventure – "Crate Carrier".

Level 2 is called "Sliding Spheres" (see Fig. 3) and it is proposed that four players of a team play and the objective is to score the points during a short limited time (e.g. two and a half minutes). Each team will score points by direct falling spheres trough a ramp into a large target. Each time a sphere hits the target the team will be rewarded with one point, but there will be two members of the opposite team that will try to catch the spheres with a block. The block wall can only be moved along the sideway of the ramp, in this case, only to the right or left. If any spheres touch the block wall, it will disappear. The spheres will appear in intervals of five seconds and the two teams will be present in the same room, with four players in the respective team ramp and two players on the other ramp trying to catch the enemy spheres.

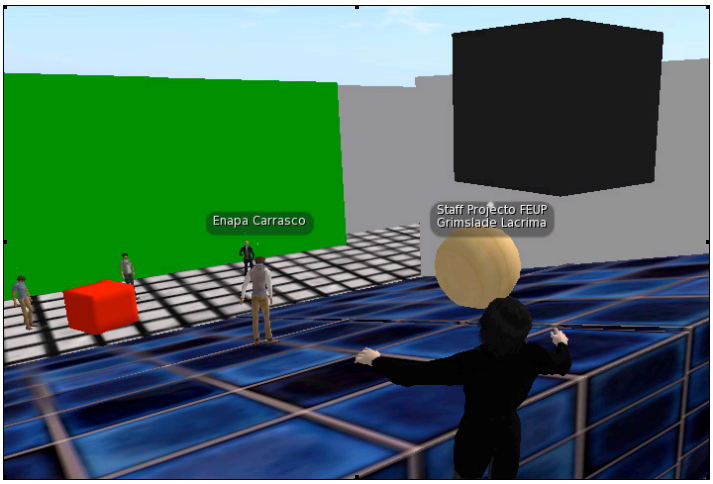
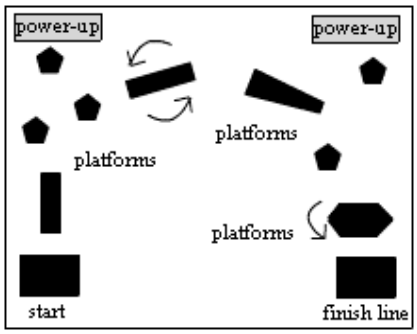


Fig. 3. Map for level 2 of the FEUP Adventure – "Sliding Spheres".

Level 3 is called "Jumping Platforms" and was initially conceptualized to be a more complex level (see Fig. 4), but technical limitations related with the avatar translation restrained some of the initial ideas. Essentially, the game consists in a large room with several objects that work as platforms and obstacles. Each team will be represented by four players and the objective is to reach the finish line by the same four players the soon as possible. In this case there are no points, only time. The timer will stop only when the last team member reachs the finish line. Due to the nature of the game, it will be needed one session by team, in opposition to the other levels where one session abridge the results for two teams.



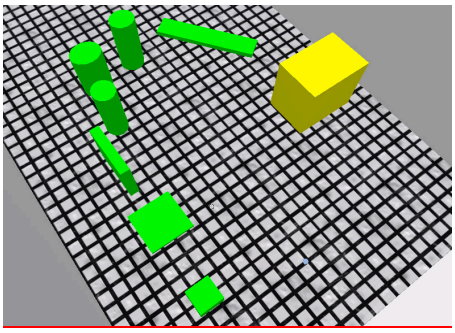


Fig. 4. Conceptualized map for level 3 - "Jumping Platforms"

In related work projects there are also reports that some students tend to use some disruptive behaviour during gameplay. It's necessary to consider that students may use the game mechanics to completely counter the active team tasks. For example, a single player could be on the top a ramp and easily prevent any coordinated work by the other team. To avoid this, students' avatars can not cross adversary ramps or

platforms. The game has to be well balanced in order to avoid too much frustration, especially when a team is working together.

4 Evaluation

The prototype evaluation was made with a sample group of 12 students during the initial weeks of their first lecture year. No grades were associated with any gameplay. The operations were implemented in classroom with the supervision of assistants; each one had the task of monitoring and collecting student's behavior during gameplay. Students were organized in two teams for testing the idealized game levels in practice and in the end a final inquiry was submitted by 11 students.

The previous experience in games and virtual worlds by the sample population of this study was very important for data analyses and eventual conclusions. As showed in figures 5, 6 and 7, although the great majority of students had no previous experience under the SL platform, a significant percentage play games in general and game genre preferences by the sample population were broader.

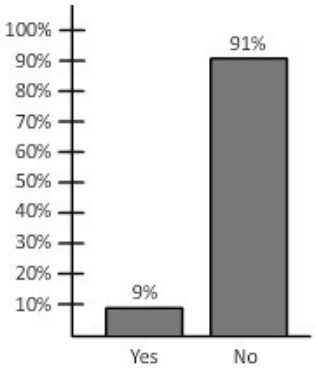


Fig. 5. Students previous experience in Second Life platform before the game.

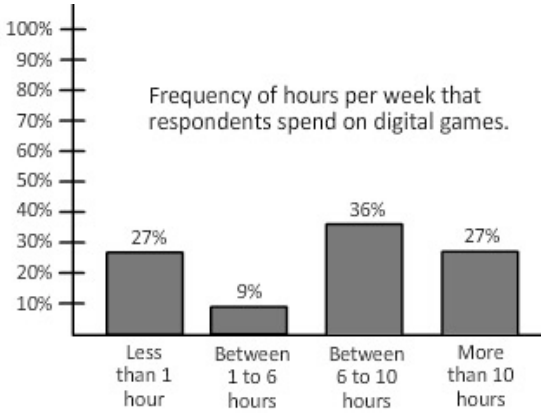


Fig. 6. Frequency of hours per week that respondents spend on digital games.

The first process involved the student's adaptation to the Second Life virtual world, before starting the game itself. Although students had low overall experience in Second Life platform (Fig. 5), the observed platform interaction and student feedback provided the idea that, in general, this adaptation was easy and fast.

The following step consisted in distribute the students in two teams (Alpha and Beta) and that process, under the pre-established method, consisted in the use of Second Life Groups. This approach revealed to be lengthy, resulting in about thirty minutes to setting all up. Probably a better solution would involve the use of wearable virtual objects, thus reducing the team setting up duration and eventually differentiate better the members of each team during gameplay.

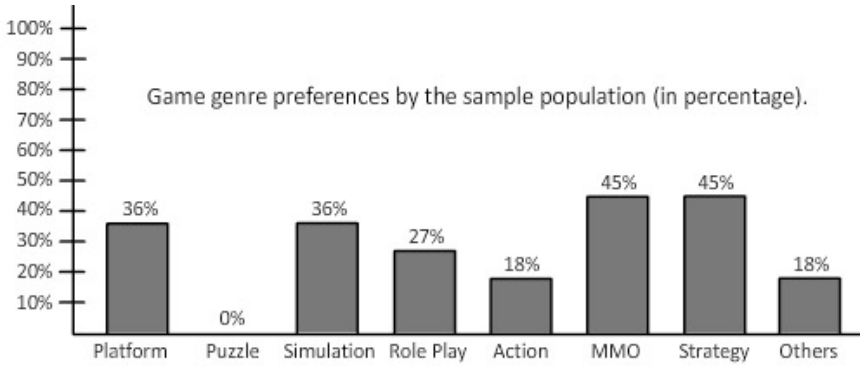


Fig. 7. Game genre preferences by the sample population (in percentage).

Before the games begin, the students were able to practice and understand the games rules and objectives in the training area. This stage occurred normally and students didn't present major questions or problems at this point. The inquiry proved that fact, as student feedback indicated a good understanding of rules and game objectives (Fig. 8).

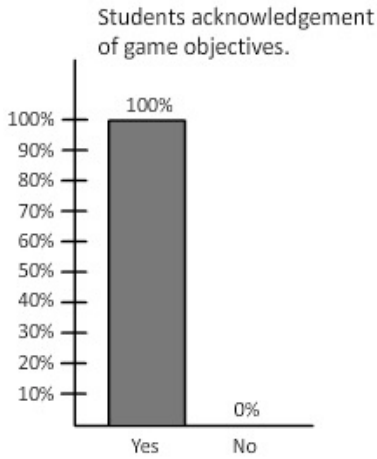


Fig. 8. Students acknowledgement of game objectives.

During the course of the game some observations were noticed:

- As expected, there were clearly initial attempts of disrupting the opposing team game. The foreseen solution of expelling players from the opposing team area worked and players give up those strategies. Although in terms of game design this could be a possible option for a team strategy, we believed that operations of that nature could eventually ruin the experience in-game, preventing an already hard objective of being ever accomplished and therefore make the majority of the team efforts useless and frustrating.

- Teamwork and communication were observed and the data recorded by mediators showed the occurrence of 109 attempts of communication between teammates during the first two levels and 54 were registered by students themselves on the third level (as a parallel activity).
- Only 8 occurrences of communication between opponent team members were registered.
- External signs of fun and frustration were detected, where in total 90 occurrences of fun and 50 of frustration were recorded. In this case, 88% of the frustration signs happened in level 3 (Jumping Platforms Level).
- Only a single student didn't reach the third level finish line and there were no objective attempts by their teammates to aid in someway. All other students that had finished the course were distracted or doing other activities.

Although the game objectives were essentially understood by the students, a few questions emerged during gameplay (Fig. 9). Good indicators were observed in the inquiry as it shows that students felt an overall need to communicate during the game (Fig. 10), reinforcing the notion that these game design approaches could promote communication between players.

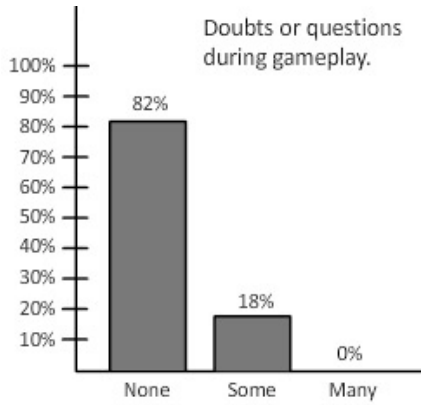


Fig. 9. Doubts or questions during gameplay.

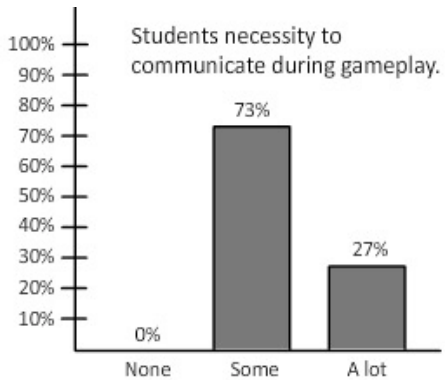


Fig. 10. Students necessity to communicate during gameplay.

On the other hand, the majority of students didn't acknowledge the help of teammates (Fig 11) and only a single student recognised the existence of team leader during the game (and was incapable of identify him afterwards) (Fig 12).

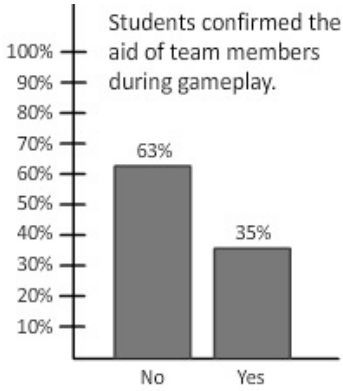


Fig. 11. Students reports on aid by teammates.

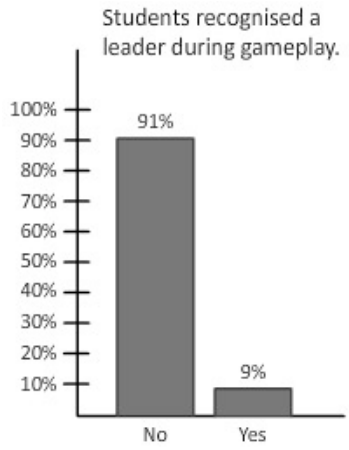


Fig. 12. Students reports on leader recognition and team support.

Although the preference in terms of level was well distributed (figure 13), the third level (Jumping Platforms) was considered by the vast majority as the hardest or as the most frustrating (figure 14). As we ponder a little more on this matter, some factors may have contributed to this result. First of all, the end result of the level was far away from the initial concept and the objective was more centred in the skill of each individual than in the efforts of teamwork. Besides that, there was needed some level of precision in the jumps, and the used engine may not offer an adequate performance in that interaction process.

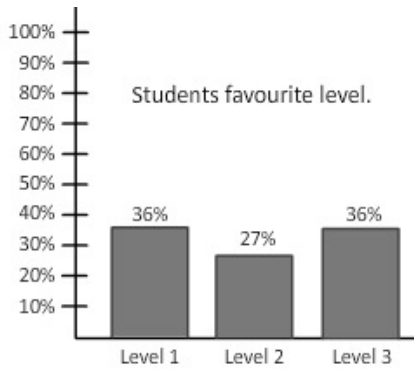


Fig. 13. Students favourite level statistics.

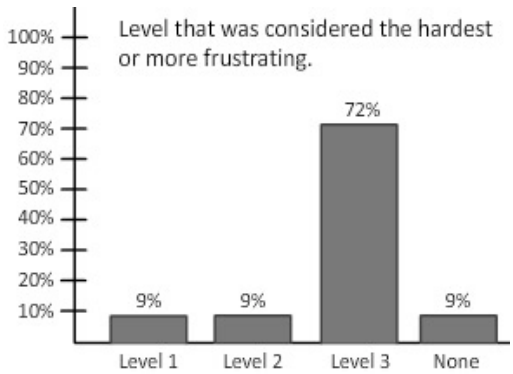


Fig. 14. Level that was considered the hardest or the most frustrating for the students.

During observation it has became clear that the system response to a jump was significantly affected by latency and further analysis may be needed to determine if the cause derives from network performance, processing performance, the engine predefined action or a combination of the three. Nevertheless, the third level was still the favourite for 36% of the students, demonstrating that being more difficult also could mean being more challenging and appealing.

A rating scale questionnaire ("Likert" style, from 1 meaning complete disagreement to 5 meaning complete agreement with statment) was also conducted and the students response to the questions is showed in the Table 2:

Table 2.

Questions	**Average** (agreement level: 1 .. 5)
"Did you like to play this game?"	3.73
"Were you able to play it well?"	3.69
"Was the end result satisfactory?"	3.77

5 Conclusions and Future Work

After analyzing the data gathered in the evaluation process, some results, conclusions and thoughts for future works have risen.

First of all, the proposed game mechanics proved to be a plausible option for promoting communication between team players. This is an important factor in this project objective, as we advocate that communication is a key element in social interaction, relationships and therefore student integration in universities.

Observations related with teamwork tactics and teammate support fell short to expectations. Probably different strategies are needed to improve this result. It was obvious for us that students were not very focused in the tasks ahead and players' indifference to a teammate with difficulties should be prevented. We believe that an objective reward system could be useful to this situation and force a higher level of commitment during the game, when either to help during the game tasks or by simply offer moral support (very significant for the project objectives).

Independently of whether or not is important to promote leadership within the integration process, the proposed game design proved to be very inadequate. In this case, we believe that a game design more centered in players with different roles/abilities should be more suited for this goal, instead of having players appear equal in their traits.

The student sample also demonstrated an easy adaptation to the platform and the game levels, but this could not be the case for students with less experience in playing games.

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