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Game-based learning with role-playing elements using RPG Maker MZ

Aprendizaje basado en juegos con elementos de rol empleando RPG Maker MZ

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Abstract

In this work, the influence of the introduction of role-playing game elements, such as the customization of the avatar and an adaptive level of difficulty, is studied to configure a game experience more adapted to the needs of the students. The student's point of view on these elements are also presented..

En este trabajo se estudia la influencia de la introducción de elementos de juego de rol, como la personalización del avatar y de un nivel de dificultad adaptativo, para configurar una experiencia de juego más adaptada a la necesidad de los estudiantes. Se presentan también las opiniones de los estudiantes sobre estos elementos.

Keywords: Role-playing games; game-based learning; escape rooms; competencies.
Palabras clave: Juegos de rol; aprendizaje basado en juegos; escape rooms; competencias

1. Environments

Game-based learning (GBL) and gamification elements are becoming increasingly popular in education (Ang 2020,Charlo 2020, Batzogiannis 2018, Gordillo 2020, Boyle 2016). Learning through games offers students a motivating gaming experience that is related to the social aspect of games (Gordillo 2020, Jimenez 2020, Connolly 2012, Ebner 2007). Among the main positive consequences, the promotion of positive emotions and collaboration, the improvement in the assimilation of concepts and the creation of an attractive and dynamic environment stand out (Menon 2020, Moeller 2020, Kapoor 2007).

These techniques can be implemented in isolation, or in combination with other teaching methodologies to strengthen the skills and knowledge desired (Hussein 2019, Hainey 2016, Hamari 2016, Huang 2020). The creation of educational games offers the opportunity for a much more interdisciplinary approach when proposing challenges and problems (Ang 2020, Batzogiannis 2018, Connolly 2012).

Educational Escape Rooms (EERs) have recently attracted the interest of the educational community. EERs are problem-based activities, in which the goal is to escape from a closed room by solving problems or puzzles (Zhang 2017, Warmelink 2020). EERs could be implemented in a large range of academic settings, and have shown significant success in fostering transversal skills, such as teamwork, critical thinking and communication (Lopez Pernas 2019, Gordillo 2020), or improving the learning process and motivation (Charlo 2020, Zamora 2019, Zamora 2019b). EERs, and escape rooms in general, establish a narrative and storytelling that serve as the guiding thread of the activity (Nicholson2016). The narratives that can be used are extremely varied and can be adapted to almost any context (Gordillo 2020, Batzogiannis 2018).

The choice of the theme of the EER implies the adaptation of the problems that must be solved to escape. There is a wide variety of puzzles and quizzes that can be implemented in an EER (Gordillo 2020, Nicholson 2016, Phan 2019). Face-to-face EERs have been proven to improve the positivity of these activities and promote motivation and joy (Pozo 2022). On the other hand, when the EERs are implemented digitally or virtually (dEERs), they can be easily implemented and still promote the motivation (Makri 2021, Jimenez 2020, Ang 2020, Hussein 2019) ,

EERs generate a large number of positive emotions in students, such as joy or interest, which, as a consequence, promotes the teaching-learning process (Charlo 2020, Gordillo 2020, Huang 2020, Ang 2020, Sanchez 2017c). There is evidence in the literature that a positive emotional performance is capable of improving the academic qualifications of students (Nicholson 2016, Huang 2020, Hussein 2019, Mellado 2014, Sabourin 2014), and especially the motivation of the STEM students. Furthermore, the acquisition of complex scientific ideas is significantly improved when they are introduced through recreational experiences, (Jimenez 2020, Huang 2020, Sanchez 2018, Ninaus 2019, Villacencio 2013, Villacencio 2016).

The computer game industry has inspired some GBL elements on many occasions. Nowadays, to avoid abandonment, video games divide their beginning into learning stages of progressive and adaptive difficulty, introducing the basic movements and techniques necessary to reach the next step successfully. These techniques smooth out the learning curve. Once the player has overcome these challenges, he is considered to have the necessary skills to start with more complicated objectives.

Another exciting technique, especially in role-playing games, is the customization of the avatar in the game. This feature has also been introduced in action games so that the game adapts to the player's characteristics of choice. This character customization before the start of the game has proven to be very appealing, as it considers the players' preferences or abilities. In the latest role-playing/action games, the customization of character characteristics is an

essential part of the design.

These techniques, incorporating a progressive and adaptive level of difficulty and the customization of the game avatar, can be included in GBL techniques. They can improve student motivation and be more inclusive in the teaching-learning process. These techniques could be done by personalizing the tests based on the chosen avatar and its characteristics and skills (gender, strengths, weaknesses, area of expertise, etc.).

At the beginning of the activity, the student should choose the avatar that best suits their personal preferences or their characteristics and skills. Later, they would face the problems of the educational game with problems adapted to that profile. Focusing on personalized problems can reinforce the student's chosen skills and allows teachers to know which are those that the student considers less developed. Activities can also be planned to strengthen the characteristics that have not been chosen or use this information to generate playgroups combining specific features to improve group dynamics.

This work aims to evaluate the influence of these techniques on the elements of games developed both in educational digital games and in small digital educational escape rooms (dEERs) in the subject of Mathematics I of the Aerospace Degree at the Higher Technical School of Design Engineering of the Polytechnic University of Valencia. This paper also presents the elements that can be integrated into the development of games that can be used as a GBL element in the educational field.

2. Methodology

The implementation of digital educational escape rooms, or individual game elements, has been carried out using the RPG Maker MZ tool (RPG), which is designed to develop Role Playing Games (RPG). This software provides a graphical interface that offers all the necessary elements to create an RPG in two dimensions (see Figure 1).

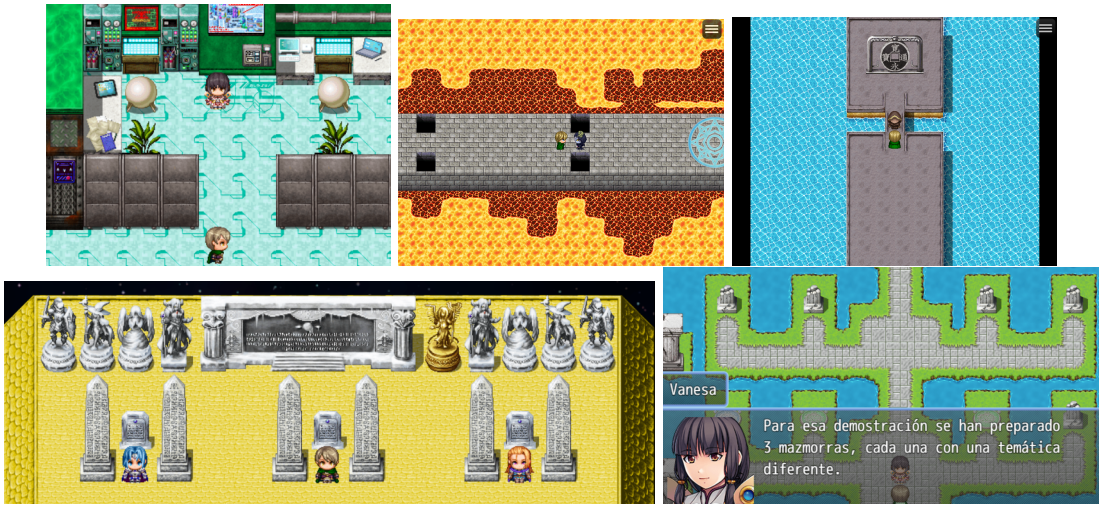

Figure 1: Screenshots of a game designed for a class activity.

RPG Maker's digital library provides many graphical default assets that can be implemented. It also allows creators to implement their code and plugins to customize the game with more options. It also offers the possibility of implementing the game on different platforms and operating systems. In addition, the games created on this platform can be employed in the educational fields. Games can be designed so that students can practice individually outside the university environment, to complement the activities that are programmed in a flip-teaching or

b-learning methodology or as a playful element in class, individually or in groups. For this last strategy, several games are designed with the different profiles chosen by the students, and the achievement of each of the games allows finding a part of the final "key", which ends the game. In this case, the tests require a platform to unify the results. At the Polythecnic Unisversity of Valencia PoliformaT, a corporative platform for education, is used.

The primary mechanism of the game is the resolution of puzzles presented through the interaction with Non-Playable Characters (NPC characters) or through elements of the platforms. In the interaction, the NPC character poses a challenge or a riddle that the player must solve to continue with the game. The nature of the puzzle or problem posed may vary depending on the skills to be developed or the concepts to be reinforced. The generated dialog box allows the text's introduction, where the riddle will be raised (see Figure 2).

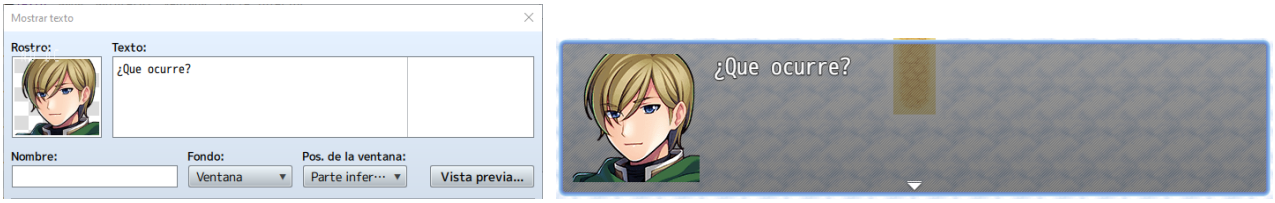

Figure 2: Example of interaction with NPC characters. On the left the interface to write the text, on the right the visualization on the game. NPC is obtained from RPG Maker MZ library.

In a collaborative game implementation, the player chooses a character from those predefined by the creators of the game. This allows the student to choose between several profiles that will have different characteristics. These characteristics will determine the type of tests you will face during the activity.

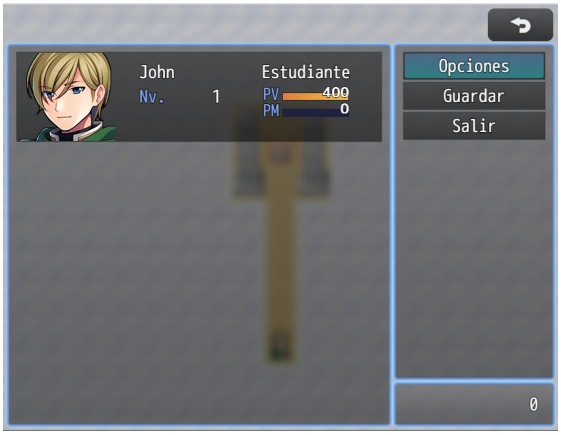

Figure 3: Two character features (source RPG Maker MZ library).

Upon passing the quizzes in the game, the characters increase one the characteristics of the avatar (Figure 3). This can be a motivating resource or an additional test of the activity (for example, passing tests until reaching a specific number in a characteristic).

Each time a player faces a challenge, a record of the attempts to solve it is saved, so that help can be implemented to facilitate the resolution in case of failure. This information would detect weaknesses in knowledge or certain skills and offer a way to correct them.

Finally, to collect students' opinions, a questionnaire was designed ad hoc, validated by subject area experts. The reliability and consistency of the questionnaire were checked by employing the Cronbach's α (0.8). Respondents were students from the Higher Technical School

of Design Engineering (ETSID) of the Polytechnic University of Valencia (UPV), enrolled in the subject Mathematics I of the 2021/2022 academic course. The questionnaire was carried out through Typeform and PoliformaT platforms. It consisted of 10 Likert-scale questions and it was completely anonymous and optional. A convenience sample was used for the purpose of the present study. The questionnaire was completed by a total of 25 students. The analysis was carried out with SPSS software. Excel software was used for the graphs derived from the data.

After the questionnaire, some students were interviewed, who volunteered to answer some questions related to the experience. An interview guide was developed based on the questionnaire items. Interviews consisted of ten questions and lasted about 15 min. Only 25 students volunteered and were interviewed at the Higher Technical School of Design Engineering (ETSID) at UPV. Detailed notes were taken during the interviews, reporting the answers and comments of the students.

3. Results

The use of GBL techniques has positive consequences on student learning. Several studies can be found in the literature on the improvement of motivation, concentration and knowledge acquisition when these techniques are applied (Gordillo 2020, Menon 2020, Charlo 2020, Ebner 2007, De Marcos 2014, Papastergiou 2009, Shute 2015, Um 2012). In this study, the introduction of some elements of role-playing games is proposed and an attempt is made to evaluate whether or not they improve the motivation of the students and the acquisition of knowledge.

The opinion of the students on whether the choice of the avatar and the tests to be carried out improves motivation has been very positive: more than 77 % of the students agree with this statement (see Figure 4). Although the implementation of the games is at an early stage and many more development paths should be added in the game, the positive opinion seems to indicate that it is an important element for the students.

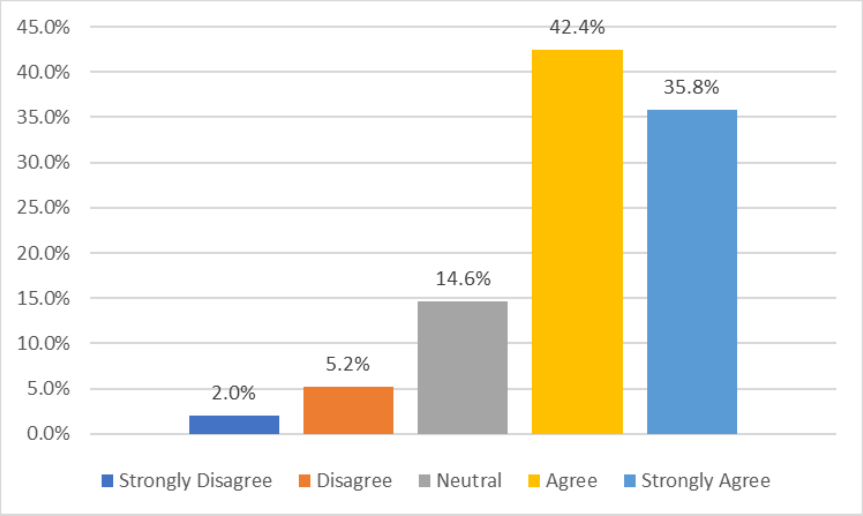

Figure 4: Students' opinion on whether avatar selection improves motivation.

When the students were asked about if they think that the adaptation of the questions and problems to their avatars' characteristics improved the experience, the answers were still very positive (see Figure 5). 80 % of the responses agree or strongly agree with this affirmation and only 8 % disagree or strongly disagree.

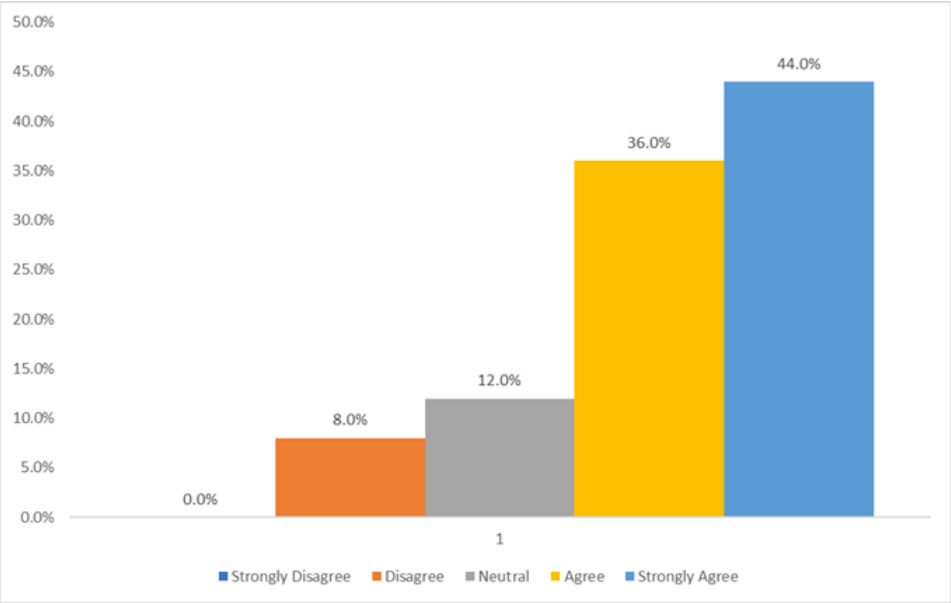

Figure 5: Students' opinion on whether avatar selection improves motivation.

The results regarding whether the adaptive difficulty improves the experience and motivation are not so positive. Only 20 % strongly agree or agree with this statement. The vast majority is neutral (approximately 50 %) and approximately 30 % disagree or strongly disagree. When students have been asked about these opinions, most of them responds that the gaming experience suffers if the initial tests are too challenging, despite being offered an opportunity to reassess competence or knowledge. The strategy that the authors have thought of is to include a plugin that changes the questions based on the avatar characteristics chosen by the student on the initial level of knowledge, so that they are more progressive during the game. Finally, in relation to the acquisition of knowledge, the students believe that the game has significantly improved their knowledge of the subject. More than 60 % agree or strongly agree that the game has helped them in the acquisition of knowledge, and only approximately 8 % think that it has not helped them (Figure 6).

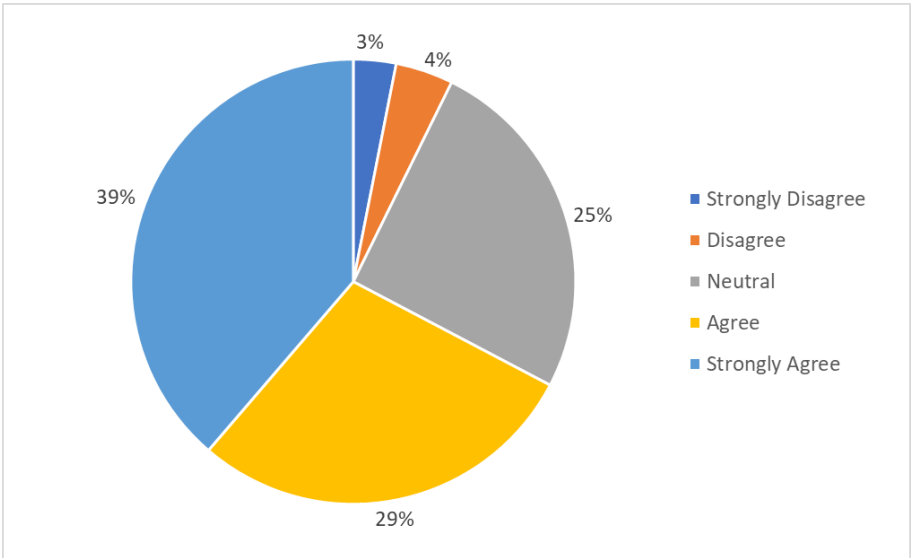

Figure 6: Students' opinion on whether the game improves the acquisition of knowledge.

The students were also asked if they feel that dEERs were somehow beneficial for the improvement the competencies such as group work or critical thinking. The responses are shown in Figure 7.

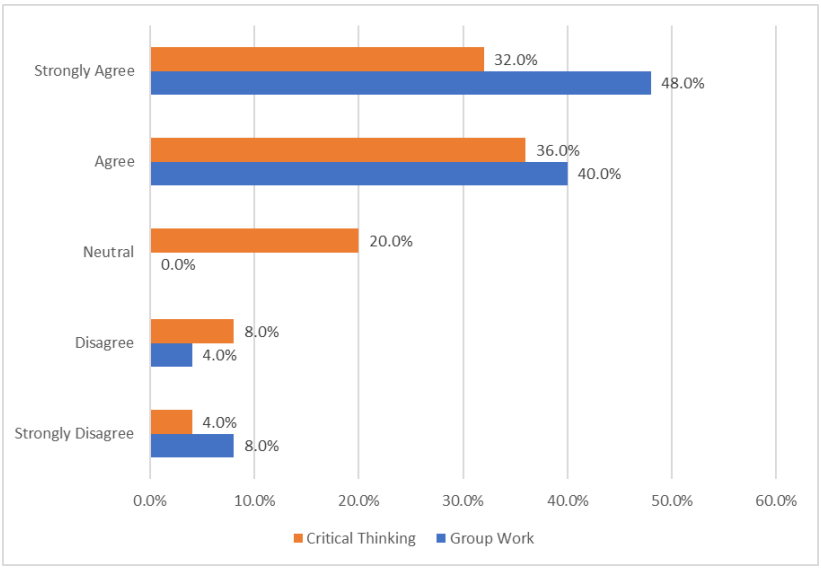

Figure 7: Students' opinion on the improvement of group work and critical thinking skills.

The students were also asked if these dEERs were beneficial to strengthen the theory and practical mathematical skills, employed in the subject Mathematics I. The answers seem to indicate a positive perception on the benefits of these type of activities: 48 % strongly agreed, 40 % agreed, and only 8 % strongly disagreed or disagreed (see Figure 8).

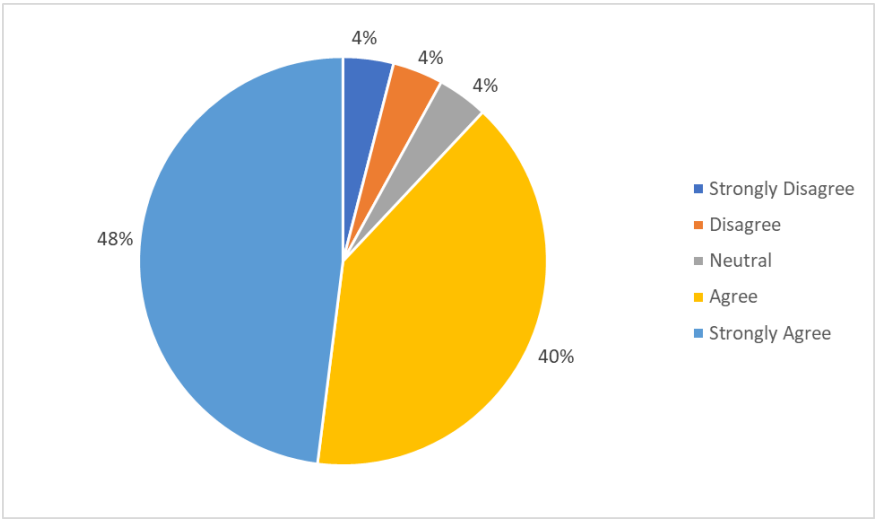

Figure 8: Students' opinion on the improvement of theoretical and practical mathematical skills.

4. Conclusions

The use of game elements in the educational field is having positive consequences on the learning process, and motivation in students.

The use of avatar characterization techniques in digital games and an adaptive level of difficulty are elements that players find motivating. The customization of the game experience seems to be important when developing activities, not only from the point of view of motivation, but also from the point of view of acquiring knowledge or monitoring the evolution of students.

The feedback obtained from these games can be interesting in the design of educational strategies and in the planning of future activities that reinforce the deficiencies detected.

Acknowledgments

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