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Video game as an educational tool in primary school applying steam methodology

Videojuego como herramienta educativa en primaria aplicando metodología steam

Jogos de vídeo como ferramenta educacional na escola primária utilizando a metodologia do vapor

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Abstract: In recent years, pedagogical practices in Latin America have had to migrate prematurely towards digitalization, but in the absence of firm foundations, learning results have been unsatisfactory. Usually, the tools used by teachers are not practical and attractive, especially for students of early

ages. The project deals with the development of an educational RPG (role-playing game) video game which contains different levels that group the learning areas included in the STEAM methodology (science, technology, engineering, arts, math) whose story is based on the prevention of covid-19 by applying concepts learned within the respective school curriculum. Different strategies were implemented, such as gamification, formative process and feedback, which allow the deployment of skills, abilities and competencies that facilitate children to adjust interactively to their learning environments. For the validation of the video game, a checklist was made with the most important dimensions of an educational video game, which was solved by the teacher in charge and a survey was applied to the children to know their level of satisfaction with respect to the game and the current education. Finally, in accordance with the good results, it is evident that this type of action requires further encouragement for more in-depth research with multidisciplinary teams in order to implement these didactic tools in the curricula of educational institutions.

Keywords: Education, Gamification, STEAM, Pedagogy, Educational video game.

Resumen: En los últimos años, las prácticas pedagógicas en Latinoamérica han tenido que migrar de forma prematura hacia la digitalización, pero al no contar con bases firmes, los resultados de aprendizaje han sido poco satisfactorios. Usualmente, las herramientas utilizadas por los docentes no suelen ser prácticas y atractivas, sobre todo para estudiantes de edades tempranas. El proyecto trata sobre el desarrollo de un videojuego RPG (role-playing game) educativo el cual contiene distintos niveles que agrupan las

áreas de aprendizaje comprendidas en la metodología STEAM (science, technology, engineering, arts, math) cuya historia se basa en la prevención del covid-19 aplicando conceptos aprendidos dentro del respectivo currículum escolar. Se implementaron diferentes estrategias como la gamificación, proceso formativo y retroalimentación lo cual permite desplegar habilidades, destrezas y competencias que facilitan a los niños ajustarse de forma interactiva a sus entornos de aprendizaje. Para la validación del videojuego se realizó un checklist con las dimensiones más importante de un videojuego educativo, la cual fue solventada por la docente a cargo y se aplicó una encuesta a los niños para conocer su nivel de satisfacción con respecto al juego y a la educación actual. Finalmente, en concordancia con los buenos resultados, se evidencia que este tipo de acciones requiere un mayor fomento para investigaciones más profundas con equipos multidisciplinarios con el fin de implementar estas herramientas didácticas en los planes de estudio de instituciones educativas.

Palabras clave: Educación, Gamificación, STEAM, Pedagogía, Videojuego educativo.

Resumo: Nos últimos anos, as práticas pedagógicas na América Latina tiveram de migrar prematuramente para a digitalização, mas sem uma base sólida, os resultados da aprendizagem têm sido insatisfatórios. Os instrumentos utilizados pelos professores não são muitas vezes práticos e atractivos, especialmente para os alunos principiantes. O projecto trata do desenvolvimento de um jogo de vídeo educativo RPG (role-playing game) que contém diferentes níveis que agrupam as áreas de aprendizagem incluídas na metodologia STEAM (ciência, tecnologia, engenharia, artes, matemática)

cuja história se baseia na prevenção da covid-19 através da aplicação de conceitos aprendidos no âmbito do respectivo currículo escolar. Foram implementadas diferentes estratégias, tais como a gamificação, o processo formativo e o feedback, que permitem o desenvolvimento de aptidões, capacidades e competências que facilitam a adaptação interactiva das crianças aos seus ambientes de aprendizagem. Para a validação do jogo de vídeo, foi feita uma lista de verificação com as dimensões mais importantes de um jogo de vídeo educativo, que foi resolvida pelo professor responsável e foi aplicado um inquérito às crianças para conhecer o seu nível de satisfação em relação ao jogo e à educação actual. Finalmente, de acordo com os bons resultados, é evidente que este tipo de acção requer mais incentivos para uma investigação mais aprofundada com equipas multidisciplinares, a fim de implementar estas ferramentas didácticas nos currículos das instituições de ensino.

Palavras-chave: Educação, Gamificação, STEAM, Pedagogia, Jogos de vídeo educativos.

INTRODUCTION

Traditional teaching methods over time have not been evolving despite the tools that are currently available, what seemed like a format that was glorious, in modernity seems exhausted and more so in Latin American schools. This is due to the fact that students apparently do not want to learn and teachers do not know how to capture their attention, all of which makes up a series of problems (Schady & Elacqua, 2020).

In education centers, teachers should have the intention of creating or learning about new tools for teaching children that can provide feedback because

sometimes it is difficult to keep track of virtual classes (ECLAC-UNESCO, 2020).

One of the tools to capture attention are video games, which have been treated as entertainment, time dedicated to "distraction" but if we go further and include them in education we can make learning a totally voluntary activity in which behavioral patterns, communication, inventiveness, adaptability, critical thinking and persistence are learned unconsciously. Therefore, the aim of this article is to demonstrate that a video game is able to help children learn in a more novel and interactive way different learning areas through the application of STEAM methodology (Molina Carmona & Llorens Largo, 2020).

MATERIALS AND METHODS

The method used for the realization of the project was the STEAM methodology which is an educational approach that seeks to filter beyond the traditional barriers that separate the five areas cover it, to integrate them to the real world and to provide a personalized learning experience to strengthen the skills of students (Saiz-Mendiguren, 2019).

One technique used was gamification, which focuses communication and education on a new objective trying to involve people cognitively, emotionally and behaviorally (Ouariachi, Li, & Elving, 2020). In this article the Quasi - Experimental design has been used in order to carry out the research where we proceed to the selection of the group to be studied to which a variable is assigned. The people who will be studied for the management

of the application are children of basic secondary education in a synchronous manner, the tool used was Microsoft Teams (Manterola & Otzen, 2015).

The study was conducted through surveys directed to both teachers and students who made up the population, with the objective of obtaining a tabulation of real opinions in order to later proceed with the analysis of results and establish conclusions, the tool used was Google Forms. The sampling technique is used to select a set of elements from a population to represent everything that happens within it, this is due, in most cases, to the fact that it is almost impossible to test an entire population (López, 2004).
The following formula is used to obtain the sample quantity.

$$n = \frac{N * Z_a^2 * p * q}{d^2 * (n-1) + Z_a^2 * p * q}$$

Due to the availability of the school, the survey was conducted with the students of the 5th grade parallel "A" which has 39 students ranging in age from 8 to 10 years old who will be our population.

RESULTS

Video game evaluation results

Educational video games can be evaluated by means of dimensions and criteria that allow assessing the most important features it should have. Therefore, the video game was evaluated according to the necessary characteristics and scored from 1 to 5, with 5 being the highest score and 1 the lowest. The results can be seen in Table 1. In summary, it can be noted

that the ratings are above average, but there are still aspects to improve based on the ratings.

Table 1. *Checklist of educational video game criteria*

Criteria	1		5
Game title		X	
Accessibility			X
Availability			X
Language			X
Communication objective		X	
Brief Description		X	
Existence of a narrator			X
Global History		X	
Representation and role of the character		X	
Representation of the environment		X	
Dimension / space / scale	X		
Dimension / temporality		X	
Terms used		X	
Presence of important concepts	X		
Message frame		X	

Results of the evaluation with users

In order to obtain the results, two surveys were made to the 39 students, the first one consisted of 3 closed questions to learn more about the reality of the current teaching-learning methods and the use of video games by the children, while to evaluate the satisfaction of the video game a survey was made with 4 closed questions and 4 open questions with which the following results were obtained:

Results of the current reality survey

Table 2. Do you like the way you are taught?

Features	Frequency	Percentage
Yes		51%
No		31%
Maybe		18%
Total		100%

Source: Created by the authors

Of the 39 children surveyed, 51% responded that they are satisfied with the form of teaching they receive, while 31% do not like these teaching methods, and the remaining 18% are undecided in their response. With this, we perceive that half of the class is satisfied with the teaching they receive, while the other half does not like it at all.

Table 3. *Do you use video games?*

Features	Frequency	Percentage
Yes		64%
No		28%
Maybe		8%
Total		100%

Source: Created by the authors

The second question consisted of knowing if the children use video games, 64% answered yes, 28% said they do not use video games and 8% use them infrequently. With this we confirm that most of the students have used video games frequently and a smaller percentage do not use them.

Table 5. *Do you think your school should use video games?*

Features	Frequency	Percentage
Yes		64%
No	1	
Maybe		33%
Total		100%

Source: Created by the authors

As the last point of this survey, they were asked if they would like their school to implement video games as a teaching-learning tool, to which 64% said yes, 3% said no and 33% said no.

that they might like. So you can see the children's interest in video games as a school tool.

Results of the project satisfaction survey

You can see how well the video game was accepted by all the children. They liked the fact that the game is easy to understand and fun. However, an observation made by most of the children is that they would have preferred the game to be for the mobile platform, since it is more accessible there. As a second question, the liking for the topics covered in the video game was questioned, of which 69% felt comfortable with it while 31% expressed a low interest in the topics. Based on this, we obtain that a large part was interested in the topics covered.

The subjects covered, while a smaller part felt low attachment to it.

In the third point, the ease of the missions was questioned, in which 51% expressed that all of them were easy to understand, while for 49% some missions were not easy to understand. Thus, practically half of the students understood the missions easily, while the other half had problems with some of them.

Fourthly, they were asked if they would like to try more educational video games, 87% said yes and 13% said no. With this we know that most of the children liked the video game of this style, so they would like to try others, while the other children do not feel interested in trying more video games of this style.

Question 5: What did you learn to watch out for the virus in the video game?

In this question, the children agreed on the learning that the game gives to protect themselves from the virus, with most of the answers being the use of a mask, distancing themselves from other people, washing their hands and using alcohol.

Question 6: What did you like most about the video game?

In this section, it was found that what the children liked most about the video game was the theme and the robot that gave them feedback, and they also expressed their liking for the design of the worlds and the missions.

Question 7: What did you like least about the video game?

Among the responses to this item, it was learned that what the children liked the least was the final mission, as well as the short duration of the video game and that it is only for computer, most of the children use only mobile devices.

Question 8: What would you like to see improved in the video game?

As for what could be improved in the videogame, the children responded that editing and character selection should be added, as well as increasing the

number of levels, improving the final mission and adding compatibility with cell phones.

The results obtained after conducting the surveys are similar to those of "Pokémaths" which is an educational video game created in RPG Maker by the brothers Javier and Borja Martínez Lozano, which arose due to the need to create a digital resource with which children feel comfortable, which is how it was decided to take advantage of video games as a learning tool and where it was possible to obtain as results of the project a good reception by teachers and students, as well as significant results in the feedback of the subjects (Moreno, 2020).

The same occurred with the "Matprot" project, which was carried out in 2021 and is based on the creation of a video game due to the need to have an interactive resource to improve teaching-learning in the area of mathematics, the results of which showed that the video game was well received, demonstrating that it improved students' skills and abilities (Cortez Carrión, 2021). When analyzing the current reality we realize that children are accustomed to the teaching they have been receiving throughout their time of study, even so, we can highlight that they would like to implement new forms of teaching as in this case are the video games.

In the statistical results section of the video game there is a good acceptance by children who are used to playing on their mobile devices or surfing the internet looking for something related. The story is related to the city where they live, in a certain way children feel identified with the character.

The survey also revealed different improvements for the video game such as the final battle, characters, outfits and that being only for the Windows

platform does not make it so versatile, since many would have preferred to play it on their cell phones.

In general, the video game would meet the objective of being seen as something more than entertainment, to be related as something educational. Having a good impact for this generation where more and more options are presented and in education they remain in the traditional.

CONCLUSIONS

It was possible to implement all the areas that make up the STEAM methodology through a video game as an educational resource that attracts the attention of students in a different learning environment. Through surveys it was demonstrated that video games would help to obtain a greater interest in education in children and thus innovate in teaching methods with the aim of having a more meaningful learning.

It is evident that school children are more interested in a video game than in traditional education, so the creation and implementation of role playing is an excellent alternative for teaching in different learning areas, thus achieving a different way of educating.

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