

# Digital Game for Teaching and Learning: An Analysis of Usability and Experience of Educational Games

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**Abstract.** Desbravadores is a 3D game, available for web, which is about History. The game is in first person, with focus on survivor, where the player is a time traveler and needs to save old artifacts, which was lost in our history. To achieve this goal the team proposed an artifact whose interface simulates a time machine, able to take students/players to meaningful moments of different historical periods, immersing it in a realistic environment, initially in 3D and future in “virtual reality”. Both are educational games for awake the interest of Brazilian students and be an interactive tool for teachers in classroom. This study set out to investigate the gameplay and usability of these two games, grounded on the concepts set out by Huizinga, Preece, Rogers and Sharp, and by observation the interactions that users engaged on laboratory tests.

**Keywords:** Educational games · Usability and gameplay · User’s experience · Interaction · Desbravadores · Fun · Playfulness

## 1 Introduction

Educational games are designed specifically to teach people about a certain subject, expand concepts, reinforce development and understanding of a historical or cultural event, or help in learning some skill while playing. Educational games can have various configurations, from board games, card games or even video games. These games, in short, are intended to pass to the children some ethical foundation or life values. Can be presented in different ways, and depending on their primary context, can be used even by teachers in schools. According to the researchers DR Godden and Baddeley AD neuroscience, learning from training is usually specific to the trained skill and training of the context [1]. However, in areas such as education, it is of greatest interest that learning extends beyond specific training. For example, it is more important that a student learns to use mathematical reasoning to solve various problems outside the classroom, rather than just knowing how to use certain mathematical operation in visas

contexts in school. Importantly, these cognitive benefits from playing video games can be purchased by anyone, even in adults who have no previous experience with video games. One mechanism that has been adopted by teachers is the use of multimedia and computer games to stimulate and engage the student's participation in the construction of knowledge collectively.

Professor John Buck, Atlanta, United States that saw the game *Angry Birds* a perfect tool to teach the laws of motion of projectiles to its students, the method makes children absorb more quickly the two great movement of ideas of a projectile: the horizontal component of the movement is constant speed, while the vertical component with respect to acceleration [2].

Another example is the 3D computer game to teach physics. The game's plot is in the style of adventure, discovery and rewards. The character aims to survive the many traps around the stage and this will have to solve physics problems. The setting is a castle, where the player will undergo different spaces as secret rooms, basement, etc. [3].

Another application example is the game "Legends of Alkhimia" developed by Learning Laboratory Sciences of the National Institute of Education of Singapore. The digital game supports the chemistry curriculum for high school and students learn the subject through research, conducting chemical experiments, while working as chemical apprentices [4].

The need to prepare the new generations for its intensive use, keeping that critical skills in reading the data coming from the reality that has always been dear to the traditional education quality, given that, in our day, we can see the declining interest of students to interact with the teacher in the classroom, when organized according to the traditional "banking" in which the teacher passes a content through alphanumeric characters for the student to learn by reading and exercising sectioned activities by subject, either math, history or biology. This mismatch has brought problems in the teacher/student and in the dynamics of learning in the classroom. The possible "remedy" offered by modern communications technologies, has just not working because often, it is the teacher who does not dominate, be it technology, is the instrument of language.

In a classic definition of what are games, they are presented as a voluntary activity or occupation, performed during certain limits of time and space, to rules freely consented and obligatory, accompanied by a feeling of tension and joy, as well as an awareness of be different from everyday life [5].

The game is older fact that culture as this, even in its less stringent definitions, always presupposes human society; but the animals do not expect men to initiate the playful life. It can be argued that human civilization has not added essential characteristics that human civilization has not added any essential feature of the general idea of the game. The animals play as men. (Huizinga 2005, p. 03).

For Vygotsky (1991) addresses the role of games in learning and child development, emphasizing the role of the game in the child to the extent that it enables the creation of a next development zone (ZDP) - level of development, in which children think and solve situations with the help of others, to later solve alone - providing the construction of knowledge and interaction between individuals [6].

To improve the education of future generations, the researchers of this article, built a recreational educational game and Interactive at denominated history area

Desbravadores, to understand what it takes to identify why educational games not work in schools, the game was developed and tested with fun concepts, effective in use and provide the user a pleasant experience. Recalling that without the concept of fun there is no game [7].

## 2 The Game Desbravadores

Desbravadores is a 3D game in first person, available on the Web only to the Portuguese version, developed by the researchers of this article. The story is set in the future and the past, the player itself is the protagonist of the game, the player's objective is to travel in space and time, to collect ancient artifacts that were lost throughout the history of humankind. For now the game has only one phase that goes on in the Paleolithic period, this phase is survival, where the life of Player Points decrease every second, the player will have to explore the 3D environment and figure out how to find food and water, roots and fish in order to restore hit points while performing missions to the natives of the time, asking for the player to collect stones and twigs to create a fire, having accomplished all missions, will be given the player the location of lost artifact. The player at the same stage as the Homo sapiens learns hunted, collected food, made fire, dressed, and how was the environment in which they lived (Fig. 1).



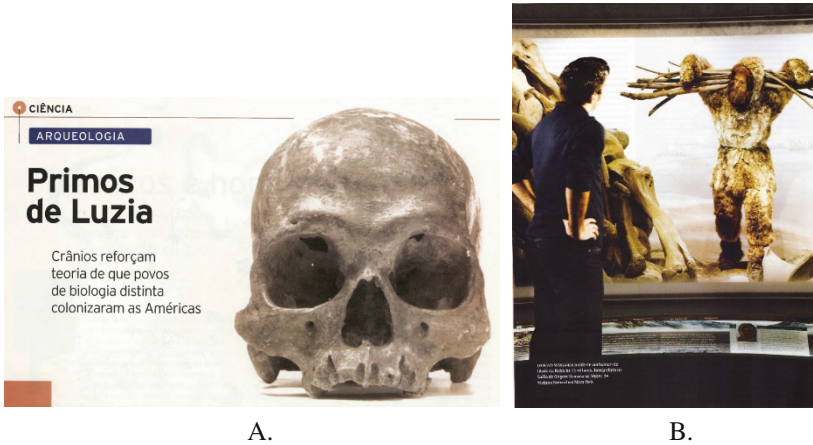
**Fig. 1.** A. Game level select, only the Paleolithic stage is available [8]. B. Scene where the player finds a Homo sapiens group [8].

The time traveler uses a helmet with artificial intelligence that helps him all the time, giving tips, identifying and classifying some living beings to translate words, gestures and able to communicate also has the hit points of the player, the hours of the day, battery of his flashlight, and indicates the easiest routes to the player achieve your goal. His clothes also disguises to be similar to the identified individual and let the traveler run faster.

## 3 Methodology Used in the Games Development and Test of Usability and Gameplay

Initially for the development of the game Desbravadores, we use the brainstorm technique for discussion and definition of thematic and visual elements of the artifact,

involving undergraduate students in history and students of state schools Almirante Soares Dutra, Aníbal Fernandes, Nobrega Liceu and Oliveira Lima. As a result, we chose the first content given to the 1st year of high school students is the Paleolithic, we also believe in artifacts, items and possible characters and enemies to the game. After choosing the content did research with references (books, magazines, internet). For image production, copyright animations, which fully demonstrate the environment in which they lived Homo sapiens, and interactive approaches to teaching and learning used in other games (Fig. 2).



**Fig. 2.** A. Magazine shows possible locations where Homo sapiens lived [9]. B. Picture shows customs (clothing, physiology and items for survival) of Homo sapiens in the late Paleolithic [10].

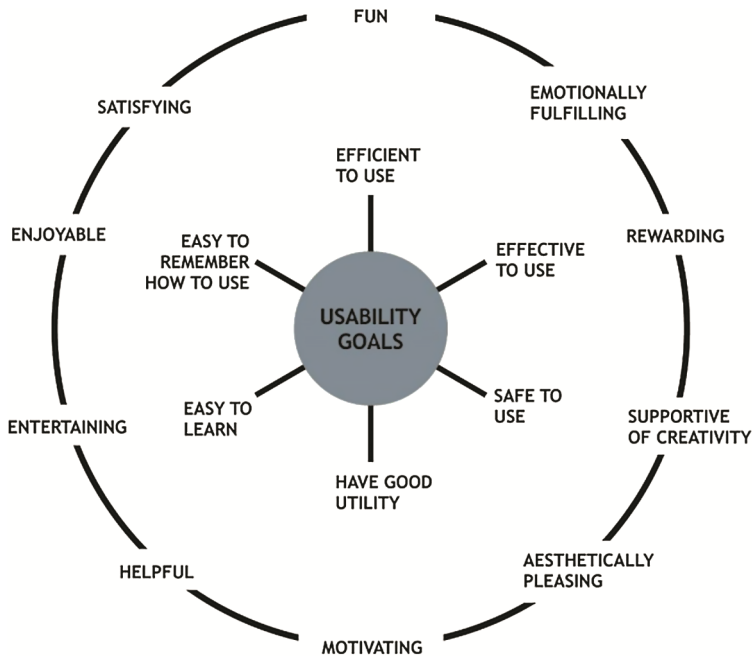
To begin developing the game need to understand what would leave the playful game, which according to Huizinga, “the game is tense,” that is need to have tension and awaken pleasure through fun. Based on this knowledge we implemented several factors that lead the player to have a quick wit, and at the same time have fun while achieving complete it, after giving fun in the game is to complete the challenge, and the harder the better the satisfaction after complete it.

Within the context of the discipline of history, use of usability and gameplay testing to validate the proposed analogue of the game prototype, in order to understand which elements would be required to use and which to delete, always thinking about what students should learn. Then we think of a mechanical easy and intuitive game where the player will have to explore a 3D scene to be able to find collectible items, consumables, accomplish missions and escape of animals.

In another time after the creation of the digital prototype, we conducted three tests with different schools to ascertain the dynamic version of the digital device, error correction and interface elements adjustments and phase of difficulty, until the game was ready to be used by teachers in the classroom.

For further study of usability and playability of an educational game, the concepts of Jennifer Preece diagram (Fig. 3) [11] the user experience goals were used as basis.

The goal was to understand specific criteria and explain the quality of accomplished experience.

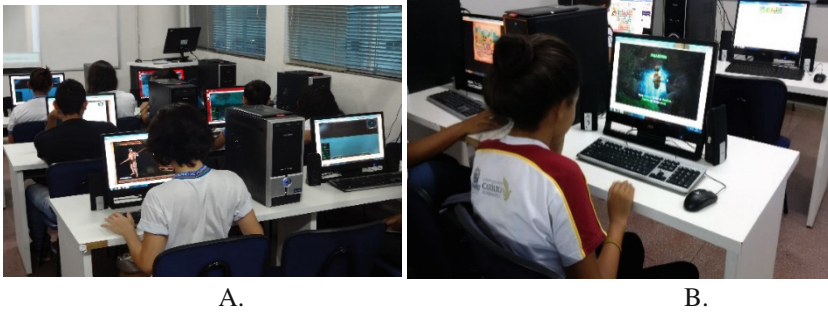


**Fig. 3.** Diagram Jennifer Preece on usability goals and user experience. (Source: [www.sharritt.com/CISHCIExam/preece.html](http://www.sharritt.com/CISHCIExam/preece.html))

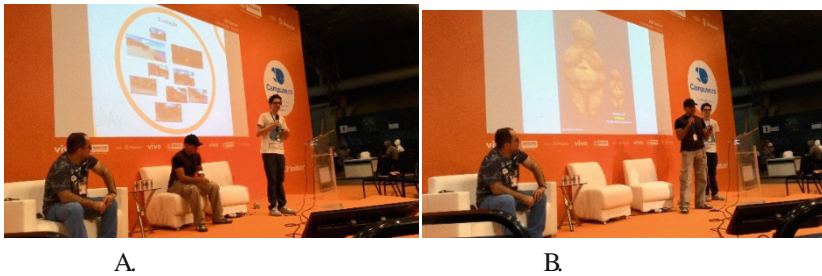
As for used usability goals, they are connected in the user's perspective as: easy to use, efficient and pleasant. As to the objectives focused on user experience, they refer to how you will feel in human-computer interaction, considering subjective aspects as satisfaction. This interaction aims to develop projects for the application of concepts of Preece and Huizinga, based on the observation of experiments and tests with users (Fig. 4).

In the end, we observe the environment and dynamics of the classroom between teachers and students during the interaction with the game produced. The game left many questions and curiosities that are not explained, and it is up to both the students ask the teacher as the teacher take your questions. I managed to get the attention and curiosity of students making the best learning school.

At another time after the conclusion of the game and the tests we gave a lecture at the Campus Party Recife 2015 event, on how we developed the Desbravadores project idea from beginning to end of its development, explaining the methodology used, game mechanics, arts and animation, the lecture was called "Games and Education, unraveling prehistory through 3D application". After the end of the event, our talk was chosen among the best of the games that took place on Mars stage, the website of technology and entertainment BitBlog [12] (Fig. 5).



**Fig. 4.** A. Nobrega Lyceum school students testing the first game. B. School Student Almirante Soares Dutra completing the game for the second time



**Fig. 5.** A. Raffaele Rennan the microphone explaining the evolution of the game had. B. Eduardo Galdino was made explaining how the concepts of the characters and artifacts

## 4 Findings

After the third gameplay testing with students, thirty boys and twenty-two girls. We get more data through a questionnaire that they responded and an observation test while playing.

A total of fifty-two students, thirty-two responded that move the player was the easiest part of the game, and the other ten explained that in the beginning it was difficult, but then took the practice. 37 % said it was somewhat difficult to interact with other characters in the game, they did not know where to find him. 87 % found it very easy to understand what the Homo sapiens wanted, but 8 % were not reading the text box on what the natives wanted and this resulted in the loss of countless times game. In a matter of difficulty to locate and collect the items in the game, almost 100 % said it was average, for when the game resumes and the player does not take the mission, he is not allowed to collect the items. Twenty-one boys said it was easy to find the right way to complete your goal, and said they knew interact in a 3D environment due to other games, eight girls said it was a bit difficult because at first did not pay attention to the map and ended getting lost, after watching the map failed to understand the correct way, twelve girls and two boys they said it was very difficult, these students could not find the way because

it does not pay attention where they were going, nor was guided by the map, and when they found out could be guided by the map, it was too late and ended up losing the game.

31 % of respondents were undecided about collecting items at the wrong time, but after several attempts realized it was not the current goal, then left for another approach, and after a certain time everyone knew what to do, but could not reach the goal of time. In this first stage of testing few students already played other games like this, and it said that the game is easy and managed to complete their goals. Most said that the game is difficult, because they could not complete the time, or were confused about why not pick up one item at the time he wanted.

In the second step tests the game had been simplified so that it became easier to be played based on the results obtained in the previous test. In this second test took around five boys and ten girls. Only 48 % have had experience with similar games. Even with no initial explanation of the observers about the game, all the students realized that the game is linked to prehistory and who can identify the habits of characters linked to fishing and survival, but lacked a bit of context in addition to the graphic display of game. Some girls were not used to move the mouse to play, but still managed to finish the game when they realized what was needed. With regard to learning one of the boys said that the game brings only references, but does not provide any information that might add the historical knowledge of the period. In relation to the objectives, I think that encourage going through each move a lot with the reasoning, we can actually see how the ancient people lived, it is as if we live it all, teachers could bring to the classroom is a good way to learn having fun says a girl. 20 % of boys said they want more risk in the game, more action and asks to put more enemies, another suggestion for improvement was to collect certain items, open more details about the raw material and what was its significance for prehistoric peoples. In this test the same criteria as the previous were also asked, so that we can balance and approve, that we correct mistakes and difficulties of students as, difficulty in moving, interact with characters, understand the context of the statements, locating items in the game, find the correct path for the purpose, mini map, all were corrected and simplified, 93 % of students have had no more problems and managed to complete the game.

Finally, the third and final test conducted, we ask the fifty-two students of the first test, played again the game so they notice the improvements we put in the game. In the first test few students were able to complete the game, and many were frustrated and afraid to try to play other similar games, but this time 100 % of managed to finish the game, who failed before were very excited, and we were congratulated by students and teachers with such evolution we did.

## 5 Final Remarks

Given the above, the Desbravadores game intended to develop a relationship of science, technology and innovation by building educational playful artifacts in a fun, interactive, motivating and challenging for construction of knowledge directed to knowledge of the history of the area through multidisciplinary study and interaction between students of the Degree in History of UNICAP, alumni Rennan Raffaele and Eduardo Galdino also UNICAP,



and high school students from state schools Almirante Soares Dutra, Aníbal Fernandes, Nobrega Liceu and Oliveira Lima. The proposal was to develop at least one game to be used in tablets provided by the accessibility program to the Government of Technology of the State of Pernambuco, to assist the dynamic between teacher and students of history discipline, providing interactive content to be made available in these portable devices.

After production and phases of game tests We believe we have achieved our goals through the results and experiences with the target audience, we note an evolution not only in the game but also in ourselves about how the whole design aspect, research, development and balancing of digital games in the education sector, through that experience we finally feel like true game Designers, although we are still at graduation when the first stage of the game was complete.

The work performed leads us to the effective participation of experience in a research team, directed both to the acquisition of knowledge as to the actual production of functional digital educational materials for PCs and tablets of Pernambuco Government, the Web and Windows platforms. Allowed us, map the difficulties and the biggest challenges in the task, which will enable the continuation of the research project, with the support of undergraduate research fellows, including new technologies, and new areas knowledge. We concluded that to bring students of pedagogical teachings, the game needs to be more than a teaching tool used by the teacher with student, it must become part of everyday life for the student to learn in and out of school, educational games need to be inevitably entertaining, without fun, there is no pleasure and learning.

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