Application of Games as Learning Tools in the Preservation of Streams in Amazonas

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Abstract

This paper presents the use of games as a strategy for teaching the principles of environmental education, focusing on preserving the rivers and streams of Manaus, polluted daily. The research is qualitative, using indirect documentation for data collection, based on articles and websites that address the subject. After the survey were listed the main points about environmental education, water pollution and how to use digital games for environmental awareness. The concepts were applied in the construction of a game prototype that warns about the importance of river preservation and how to avoid pollution. The aim is to achieve this through the simple and dynamic language that games can offer, while at the same time alerting about this environmental cause, focusing on children from six to ten years old, because they have more interaction with the games and are in their age of critical opinion formation. Research has found that water is an important resource, but it is still not preserved as it should. Nevertheless, the combination of gaming entertainment with environmental awareness concepts has proved to be a good alternative to combat the problem.

Keywords: *Defense in River; Water Pollution; Preservation; Environmental Education.*

1. Introduction

The growth of cities occurs increasingly rapidly in the contemporary world, which implies a significant expansion of the urban environment over the natural environment. And with so many people and population increase, the greater the number of waste produced. According to data from manaus Prefecture of July 2019, cleaning actions in manaus streams remove 887 tons of garbage per month from streams, including packaging, plastic bottles, bags, organic remains, among others.

Despite all existing ways to prevent these debris from harming the environment, the human being performs dumping mostly directly into the soil, atmosphere and rivers.

Because of this, working on environmental awareness is necessary, which is done through Environmental Education, whether in schools (formal education) and in other sectors of society (informal teaching). Environmental education aims to lead to engagement regarding the principles of sustainability through processes through which the individual and the collectivity develop values so that there is the preservation of the environment. For this, everyone needs to be aware of their role in ensuring sustainable growth.

Despite the importance of environmental education, both in formal and informal education there are obstacles that basically consist of teaching methods that do not efficiently affect the individual, especially younger age groups. In view of this, it is proposed the use of digital games to increase the methodologies applied in the classroom. With the technological advancement and dissemination of games among children's audiences, it is possible to use these forms of entertainment as drivers of teaching in environmental education and a means of disseminating in the individual in critical thinking training the notions about preservation of natural resources.

Environmental pollution covers various ecosystems. In this work, the focus is on contamination of rivers, and so it is necessary to highlight this particular theme. Without water there is no life and without it many of the daily human activities can not happen. From bathing to food production, water is present. And the water used in all these processes is precisely the fresh water, found for example in rivers, lakes and glaciers. Fresh water is the most used, but the one that is in the smallest amount of the total volume on planet Earth, which is composed of 97.4% of water resources and of this number, only 2.6% is freshwater.

For this pollution framework to be reversed, a global engagement is needed and for this, every contribution corroborates the preservation of rivers, which every day lose liters of drinking water. One way is the use of games in environmental education. Through a direct language, simple and with entertainment from the universe of games this can be a tool of awareness, especially of children, between six and ten years of age.

2. Development

2.1 Environmental Education

According to the National Curriculum Parameters, environmental education can be understood as "the processes through which the individual and the collective build social values, knowledge, skills, attitudes and competencies aimed at the conservation of the environment, as well as common use of the people, essential to sound quality of life and their sustainability" [BRASIL, 1997].

It is observed that the application of any proposal to solve environmental problems needs to start in each individual and be part of general thinking. This is reinforced by Santos et al [p.29, 2013], when he states

that "solutions to environmental problems will only be possible if there is involvement and participation of the whole society along with the support of consistent public policies".

This connection between all these sectors is related to another characteristic of environmental education, it must be interdisciplinary. The environment concerns education, politics, economics, family, culture, among others. According to Medina and Santos [1999] apud Santos et al [p.31, 2013], "EA is not only highlighting the environmental issues that are already in the contents of various disciplines, or adding environmental components to the materials, giving priority to natural sciences, is in the it is to build an environmental knowledge that if all disciplines, through a social process of knowledge production.

In EA it also takes innovation to engage people, uniting to traditional forms of teaching other strategies that can draw society's attention to the subject. In this sense, it is necessary to present environmental education in two means: in formal and informal.

Formal education is one that occurs in the school field. According to Reis et al [p. 51, 2012], "environmental education in school education is understood to be developed within the curricula of public and private educational institutions, encompassing: I - basic education; II - higher education; III – special education; IV - vocational education; V - education of young people and adults".

The application of environmental education within formal education has its relevance Despite this, it faces some mishaps, which according to Reis et al [p. 54, 2012], consist: in the search for methodological alternatives that converge the disciplinary approach to the indisciplinary; in the barrier of the curricular structure in terms of content workload, evaluation, among others; and in raising teachers' awareness, in the face of new challenges and reformulations that require work and creativity.

Environmental education enters the informal environment. According to Reis et al [p. 51, 2012], it comprises educational actions and practices aimed at raising awareness of the collective on environmental issues and their organization and participation in the defense of the quality of the environment, which can be done through the means of communication, school, universities, NGOs, ecotourism, among others [REIS et al, p. 51, 2012].

However, awareness in the various social segments also encounters barriers. According to Reis et al [p. 57, 2012] in Brazil there are not many investments for the implementation of work in environmental education in non-formal education.

In federal conservation units (parks and reserves) there are few educational programs, since most of the few resources are used in the supervision and not in the education of the population. This is mainly due to the lack of documentation of well-developed projects, and that demonstrate the effectiveness of these work when compared to their costs [REIS et al, p.57, 2012].

Despite these obstacles, today the tools are many. With this, technological advances stand out. With the technology increasingly present in society, especially among children, it is understood that uniting an environmental cause to the technological universe of games is an effective and efficient way to generate awareness. Because while searching for fun the player dynamically and simply absorbs learnings to preserve natural resources.

In this work, the problem discussed is the pollution of rivers. The choice is due to the need to discuss the theme that affects the largest watershed in the world, highlighted by the Amazon River, which among several locations passes through Manaus, where the environment of the game that will be presented at work

takes place. Before entering the application of games in the educational area, it is necessary to explain the subject of water pollution that among environmental problems contains in itself a number of issues that deserve own attention.

2.2 Importância da Água e Poluição

Approximately 71% of the Earth's surface and 75% of the human body is water. The use of this resource is also wide, whether for cleaning, food preparation, drug manufacturing, among other options, water is present. And for all these applications one specifically employs fresh water.

Freshwater comprises rivers, lakes and dams, infiltrated into the spaces of the soil and rocks, clouds, living beings and glaciers, where they are concentrated in greater quantity. Of the total water that makes up planet Earth, approximately 97.4% is salty and is in the oceans. Only 2.6% is sweet, and only 1% is usable, since the rest is in solid state and is not accessible.

These numbers and the relevance that fresh water plays in the maintenance of life and daily activities attest to the need to preserve the water resources of lakes and rivers. However, human society moves in the opposite direction as it dumps every variety of pollutants into waterways, reducing the amount of drinking water on the planet.

According to Barbioti and Campos [s.d., p. 1], "water pollution is the introduction of chemical, physical and biological materials that spoil water quality, and affects the body of living beings. This process ranges from simple paper bags to the most dangerous toxic pollutants, such as pesticides, heavy metals (mercury, chromium, lead) and detergents."

According to Oliveira and Molica [2017, p. 12], all natural ecosystems have an ability to decompose to a certain limit the organic matter generated by human activities, but when the entry of effluents is greater than this limit pollution begins to transform that environment. "Surface waters are largely polluted because of untreated sewers and garbage that are thrown every day into their beds, leaving water in some cases so contaminated that it is neither used nor to be treated again" [OLIVEIRA E MOLICA, 2017, p. 12].

According to the authors, Brazil holds in its reserves 12% of all water in the world, and the Amazon holds 80% of all water in the country. In this scenario, the Northern region, which holds more than 50% of the water throughout the country plays a significant role in water preservation, especially if it is considered that in the region passes the largest river in volume and extension in the world, the Amazon River. However, according to the figures presented by Oliveira and Molica [2017, p. 13], the region needs more enforcement measures to further avoid river and affluent pollution.

According to the Ibge National Basic Sanitation Survey (2008), only 55% of Brazilian municipalities have a sewage collection system, with the largest number of municipalities located in the Southeast region (95%) and the smallest in the North region (13%). In relation to the treatment of domestic sewage, the situation is even worse: only 27% of Brazilian municipalities treat their sewage, most of these municipalities are located in the Southeast region of the country (47%) and the smallest in the North region (8%) [OLIVEIRA E MOLICA, 2017, p.13].

In a booklet of the National Water Agency, the federal agency presents recommendations that can help combat pollution of rivers and other sources of water and avoid waste, such as the reformulation of products

to produce less pollution; reduction of the use of toxic materials for pest control; modification of equipment or technologies to generate less waste; implementation of improvements in the areas of training, maintenance and home management to reduce leaks. [National Water Agency, 2013, p. 51]

The above initiatives can be quite effective for preserving rivers, however, if there is no awareness of the population and companies so that they apply this knowledge in daily life there is no way to make significant changes.

If the issue of the importance of water resources is understood and the need to encourage environmental awareness in society is understood, it is necessary to go to actions.

Following the thought of innovation as an important point to disseminate environmental causes presents here the video games or games. It is believed that they can be of great value for awareness and dissemination of ideals of preservation in society as a whole, in this case, more specifically in the environmental education of children within the school environment, which are the target audience of the game created.

2.3 Jogos Eletrônicos na Educação Ambiental

Previously, the need for innovation in environmental education was highlighted in order to create engagement with environmental issues in the individual. The alternative presented this is the union between technology and knowledge. With this hook, it gives a highlight to children, who handled the technology offered in a natural way, whether through smartphones, tablets, computers, smartTVs, video games, among others.

The proximity to these equipment for a long time was and is still seen as something harmful. But the mere fact that they represent entertainment does not mean uselessness. This is discussed by Nogueira and Galdino, which justifies the use of games in education by attracting students to participate in the construction of their knowledge, in addition to modernizing learning.

It is possible through video games to motivate and increase the productivity of students, in addition to bringing them closer to teachers. "Today's young man grew up playing video games and games are part of his reality. It is sought, then, to present the games as an exit to minimize the distance between the student, the teacher and the school" [NOGUEIRA And GALDINO, p. 2, s.d.].

Based on this, the game DEFESA IN RIO was created, set in the city of Manaus and aims to make the player help in cleaning the polluted streams in the city. In the match, the player will be alerted to the importance of preserving rivers and the role he plays in this process.

It is believed in good receptivity with DEFENSE IN RIO since, because it is a game is seen as a form of entertainment. The style employed in the game is cross-platform and so can be used in the classroom in a playful way, since access to smartphones is wide. Therefore, uniting technology with environmental causes proves to apply in the teaching of the preservation of rivers, which can be followed by several other projects outside this subject.

The Rio Defense app prototype is a game created in the tower defense style, i.e. the player must prevent enemies from traveling the map, using means of defense such as traps or obstacles to delate/destroy them. The game takes place in a forest where a river crosses it. The tower defense style has been applied so that the river is the place to be protected, garbage and waste are enemies, and characters as agents of cleaning filters. These are the means of defense to protect the river.

Figure 1. Game home screen

The game starts when the player presses the "play" button.

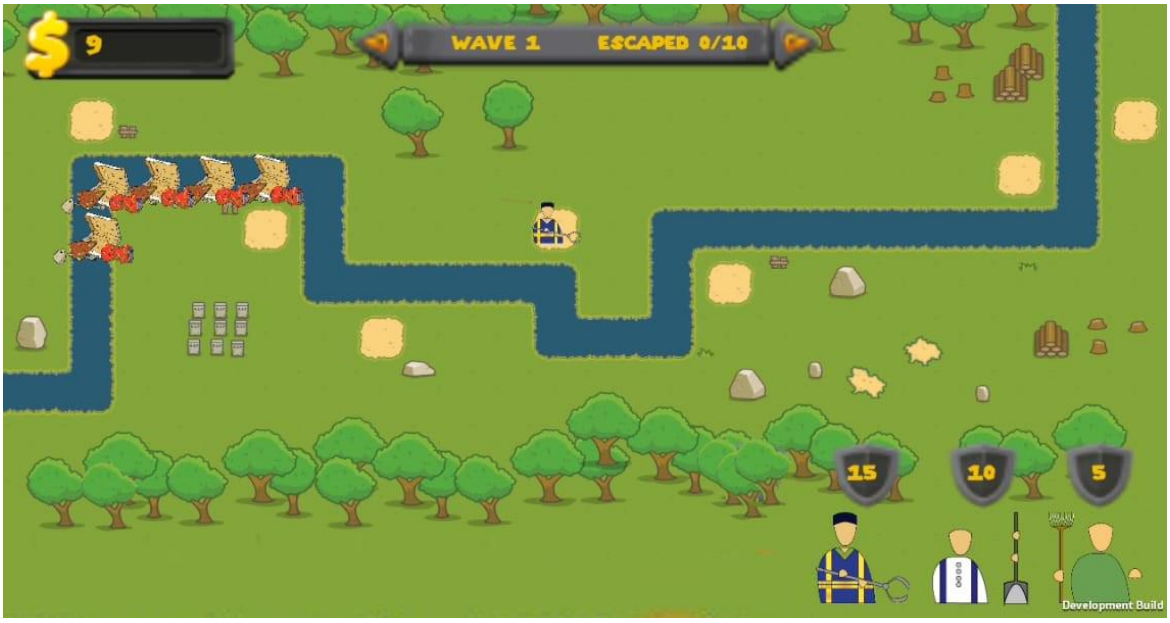

Figure 2. When the player starts the game, the trash begins to travel through the river from left to right

After the garbage begins to travel through the river, the player needs to position his defense characters in strategic points, to prevent the garbage from reaching the end.

Figure 3. Increased player score

It is noted that with each garbage collected the player receives a score (game money). With this, he can acquire different types of characters.

Figure 4. Stage 5 of the game with a larger number of garbage

With the course of the stages (waves) of the game, the amount of garbage increases, making the match more difficult.

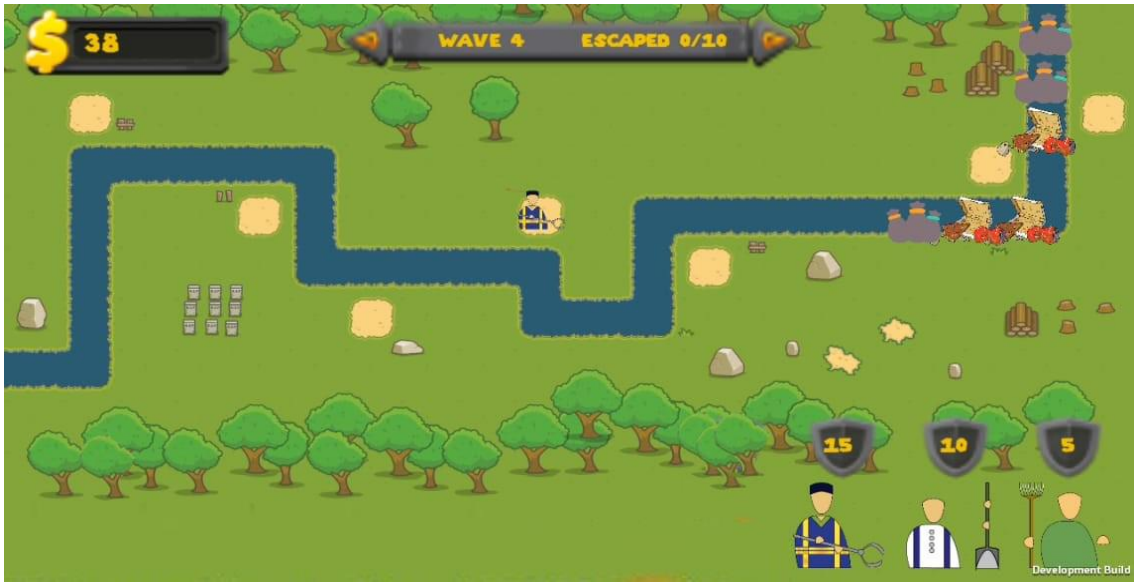

Figure 5. Leaking waste

The game counts the waste that was not collected, in a total of a maximum of ten.

3. Methodological Procedures

The methodological procedure adopted in this work began with research on websites and articles that deal with pollution, environmental education and the use of digital games as environmental awareness tools. Data collection was done through indirect documentation, using sources that discuss materials from other references on this subject. The research is qualitative and is based on the interpretation of bibliographic content for the application of the concepts learned in the development of the game and debate on the importance of preserving the environment.

The choice of the public of six to ten years occurred because there is a connection of this group with digital games and to disseminate in the individual while the importance of environmental preservation is still new. For this reason a prototype of gambling was created, in a beta way, which aims to guide the public to combat pollution in rivers and thus contribute to environmental education.

4. Final Considerations

Based on the theoretical survey of this work, it is observed that although fresh water is the one that exists in the smallest amount on the planet and is one of the most important for the maintenance of life, society constantly contaminates rivers and lakes in actions of complete neglect to the environment. It was found in the data presented that the preservation of the fauna and flora of the Amazon region is threatened, with the decrease in the amount of drinking water and destruction of ecosystems with pollutants of all kinds. Even with this scenario, society mostly insists on environmental losses without worrying about the replenishment of the natural resources exploited.

To combat this situation, it was found that it takes a commitment from society as a whole. It is known that the Northern region is one of the largest freshwater holders in the country, but also one of the most polluting.

In this sense, joining the other actions that exist for the preservation of rivers, the present work built a game, so that it acts within the aspect of awareness, which was aligned with the environmental problems exposed and relevant to the environmental awareness, important but poorly valued today.

DEFENSE IN RIO used this series of aspects raised during the research and in a simple and direct way introduced to the children's public this cause. Combining entertainment and environmental causes proved to be efficient, as the strategy of reaching out to the public proves accessible and completely applicable. In addition, it is observed that this means of awareness can be used in games with other topics that also want to contribute to reflection and actions for other causes. This contribution to combating river pollution and other projects for purposes similar to this may arise is therefore left.

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