Entelequia: The educacional digital game that supports the history learning

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ABSTRACT

This article presents an educational game called Entelequia (from Greek means Evolution) created by Virtual Reality to support the teaching and learning of History. This game shows how to demonstrate that teaching and learning can be acquired in a fun way and at the same time through educational Virtual Reality in an educational game. The development platform was the game engine Unity 3D. The environment worked in a playful manner, bringing interactivity, involvement and clarity about historical facts in the game.

Key words: Game, teaching-learning, history.

INTRODUCTION

With the computer evolution systems and notability in computer graphics and its use much more present in most houses as leisure and in most offices as a work tool, the computer graphics can't be put away when comes to educational learning. Technology is breaking walls when related to education. The introduction of distance education through the internet by live lessons or recorded ones and the management tools use on virtual environment for learning enabling interaction between teachers and students and tools’ availability.

It is important to recall that only this is not enough to ensure the subjects understanding students judge complicated and complex. Disciplines based on theory as History are more difficult for the students understanding once the traditional History classes don’t have a practical exemplification of what is being taught. Everything is based on historical facts with a large amount of information that can take the student to the disinterest point.

There are enormous difficulties on education it happens on private and public schools. Most of the times it is not possible to see the motivation coming from the students for learning mainly when the talking is about theoretical subjects like History.

According to Barros (2003), the difficulties can appear from organic or emotional factors and it is important to discover what is happening in the development of the educational process, realizing weather these difficulties are related to laziness, fatigue, sleepiness, sadness, agitation and others, considering factors that do not give the students the motivation for learning either.

Barbosa (2013) even says that the lack of interest coming from the students about learning is a constant complaint on teacher's conversation, however this is a directly fact linked to study areas from educational systems utilized and from each region feature.

Another important point according to Fiolhais and Trindade (2003) is the capacity of student's obstruction, in special the younger ones where this capacity of obstruction is reduced. As a consequence, many students can’t understand the link between History and real life and main influence of historical facts on this day.

This way, the utilization of Virtual Reality as a tool that helps learning History subject which pretends to increase this obstruction capacity, giving the student the allowance
to learn and build the connection that makes a link between History and the real world. And increase the interest of the student on the subject as a motivation form too.

The games by entertainment reach millions of people. It is an important reminding that during the game, the players show much more focused and motivated to overcome challenges. The games that have an educational finality permit an environment creation of Virtual Reality where the students interact with the study's object and also give the students permission for their on conclusion, learn with their own mistakes and be proactive on their decisions.

As Vygotsky quoted by Moratori (2003), the ludic influences a lot the intellectual development because the game's stimulation to curiosity, initiative, self-reliance, thoughts and concentration, giving the students a pleasure sensation when playing once they are having fun and are capable to dominate the situation. Cardoso (2003) says the games teach a lot faster than any other method.

According to the text above, the general goal of this article is to explicit elements that guide the development of an educational game made to complement the process on teaching-learning on History with focus on the most important historical facts of human evolution and its application for Fundamental Education.

**VIRTUAL REALITY**

Virtual Reality is one “advanced user's interface” which allows the user through three-dimensional environment to interaction, visualization and moves in real time (Kirner and Pinho, 1997). The vision sense usually is predominant on Virtual Reality, the other senses as hearing and tact, for example, it also can be utilized to enrich the user's experience.

Burdea (1994) affirms that virtual reality is one advanced computational interface that involves a real time simulation and interaction through multisensory channels.

As Kirner and Pinho (1997) says the user's interaction is the main aspect of Virtual Reality's environment and it is related to computer's capacity of reaction to the user action. The user's interaction and virtual environment together in real time permits the user an ability and intuitive knowledge that can be utilized for object's manipulation on virtual world.

Virtual Reality can be divided in two different categories of knowing: The immersive Virtual Reality and non-immersive Virtual Reality.

For Kirner and Pinho (1997), the first reality is disposed through direct vision. It is activated by helmets with special pair of glasses capable to give the user the sensation of being in the virtual world or in wall's projections. Beyond these helmets, it's also possible gloves utilization to give the user a better sensation of reality stimulating a tact sensation.

The second reality is the non-immersive Virtual Reality and it is associated to indirect vision that permits visualization on conjugated virtual and real scenes (Kirner and Pinho, 1997) based on monitors use. In this Virtual Reality's mode, the presence of interaction devices are present to better the user's interaction with the virtual environment and they are: keyboard, mouse, joystick, microphone and also output's monitors devices, TV's, projectors, speakers and earphone.

To Virtual Reality developing, the main base is the graphic computation that for Gomes and Velho (2008), consist on transforming data in images. From this concept, the graphic computation has becoming more complex until the vector's processing of third dimension with lighting processing and texture together. It permits information's visualization from many angles, as image rotation and different points of view notion.

**VIRTUAL REALITY ON EDUCATION**

Virtual Reality is a very present topic of study on education area. One of the most important application on Virtual Reality related to education are flights simulators that help commercial and air force pilots on training, now also present in driving schools to receive authorization to drive a vehicle that fits eight people maximum beside the driver – called "B Category" in Brazil.

This relevance has been a very important point on Pinho and Kirner’s (1997) presupposition who says the potential Virtual Reality is present in some exploration's environment, objects or some process that are unachievable only though pictures, books, movies or lessons, but achievable when there are manipulation and domination on the virtual target of study. He also emphasizes that there are two ways for the human being to know the world.

The first way is related to the first person’s knowledge experience about the world and their interaction. This knowledge type is direct, subjective and unconscious, which means we don't have the right notion when we got this knowledge.

The second way is related to another person's experience and its knowledge can be told by somebody else, been an objective, conscious and explicit knowledge, this person knows when really got the knowledge.

Interactivity’s idea on Virtual Reality is permitting one
third person to become the first, once the virtual environment’s user can interact with the study’s object and explore it as it really exists.

The magazine Revista De Biologia E Ciências Da Terra (2001) affirms that education is a discovery, exploration and observation process. This way, the particular quality of Virtual Reality can transform it in a very powerful instrument for all that seek for teaching evolution ways.

Cameo (2001) says many studies about Virtual Reality are happening, some of them are:

(i) Gorilla Virtual Project. Is an educational tool been developed by researchers from Computer Graphic Laboratory, Visualization and Usability and the program of Doctorate from Georgia Institute of Technology, researchers and workers cooperation from Atlanta’s Zoological Garden. On this project, the Virtual Reality will help zoological visitors to understand and appreciate gorillas’ behaviour.

(ii) REVIR Project. Also developed by Universidade Federal de São Carlos, aim at developing computational tools and programs for primary education.

(iii) Science Space Project. Developed by George Mason University, Houston University and Johnson Space Center – NASA together, have a purpose on vantages and disadvantages of Virtual Reality Education exploration.

RELATED WORK

Many commercial games were developed having history as topics. There are many of them and a good example is Age of Empires which is a strategy game in real time and has its titles based on historical facts since Ancient History, Roman Empire, Middle Ages, America and Africa Colonization Times (Figure 1).

Another game based on historical facts is called Medal of Honor, which the theme is the Second World War where the character makes spying missions and sabotage through Europe during the conflict to try to stop Nazi progress (Figure 2). Another title of this series also deal with conflict as Cold War and Afghanistan Conflict.

Assassin’s Creed is a game series based on real historical facts that mixes fiction in a sensational and consistent way. In between these historical facts broached by this game there are topics as Third Crusade, Italian Renaissance and Constantinople.

METHODOLOGY

The game’s development methodology was based on agile development’s process of Virtual Reality System (Mattioli et al., 2009). This development process is composed by five stages that involve repetition: requisite analysis, projects, implementation, valuation and implantation.

On analysis stage of requisite, it got virtual environment requisites and functional application. At this project point were made technology definitions about entrance and exists, as well as hardware and software devices that are utilized by user for interaction on Virtual Reality environment. At this point was also decided the objects, manners and interaction’s project between them.

On implementation stage was made by images obtainment and its preparation, scene construction, objects and characters so the virtual environment was constructed. During evaluation stage was noticed the system’s usability its performance and efficiency, in other words, if it can attend the project’s demand for identify and reduce the problems risks of interaction between the users and the Virtual Reality system.

At last the Implantation stage equipments and devices calibration were made on the projects phase considering constructive aspects on developed environment and psychological analysis of the system’s use.

Figure 3 shows the main activities of life cycle of an agile development of the Virtual Reality system and some of them are described in the figure.

The Spike’s architecture does the feasibility analysis implementation of new requirements from users’ stories and storyboards, to reduce the risks present on development area on domination, technology and its own system. The metaphor result definition will be utilized by the development team to represent the system.

The interactive application builds the central elements from several Virtual Reality systems (Mattioli et al., 2009). From these requirement is possible to define system’s usability. Some tests can be applied on interaction forms desired to define viability and forms validation of proposed interaction project.

On each iteration beginning, interaction’s activity planning allows choosing which user and storyboards stories will be implemented. When it’s found any problem on this activity a Spike is made to find the problem and possibilities of solution. In the Spike, implementation tests can be made to check found solutions.

This stage should be very flexible to accept some possible changes on requisites related to actual iteration and solve problems found during the development process. Activity’s developing begins after activity iteration planning. This activity has four features where two of them are analysis and project that are responsible on recognizing the simplest way to requisite’s implantation proposed on interaction plan.
Figure 1. The series' title *Age of Empires* is based on historical period since Rome Fall until Middle Age.

Figure 2. Game *Medal of Honor* based on Second World War.
The third and fourth characteristics are codification and tests which are interactivity implantation and tests execution for iteration proposal. As the system improves, virtual objects get characteristics much more close to the real ones.

On activities tests are made the developer and client’s tests. On this stage, are made interaction’s exhaustive tests looking for Virtual Reality’s efficiency and usability. In case is found some anomaly or bug, it goes back to development stage.

**System’s architecture**

The game construction has a central goal a virtual environment creation in three dimensions that reproduce history facts the player will interact with. This will increase the student’s interest on the subject due the playfulness and also for having an extra tool as support when comes to learn History.

For a better understanding on utilized architecture, there is below, in detail, the utilized structure of Figure 4:

(i) User: Responsible actor that manipulates a character during the game route;

(ii) Graphic Interface User: Responsible to allow interaction between user and the software;

(iii) Application Virtual Environment: allows objects visualization on scenes that can suffer any change coming from the user;

(iv) Menu: Main Menu performed when the application starts, showing an option for the game entrance, check interaction options and the exit;

(v) Character: 3D object representing a man that is going to be controlled by user during the game;

(vi) Contextual Video: Small video on game’s beginning stage to contextualize the player to historical period showed;

(vii) Phase Tips: Tips related to historical facts showed to help the player on the mission and its realization;
(viii) Conclusion: Checks if the user completed its mission, this way the user can proceed with another historical factor.

**Systems foundation**

The main tool’s functionality: encourage and increase the player’s interest in History subject. With spotlight to the content showed by the game, motivate knowledge’s search in a playful way and be a tool that really helps on History learning.

Using *Storyboards* was possible to develop an idea to game phases development, starting at the environment and the plot for phases conclusion. Figures 5 to 8 have a *Storyboard* that show some game’s phases.

The game starts on “Main Menu” that offer the player options to start de first phase or exit the game (Figure 9).

When the player chooses to start the game, an option is given to the player. It’s about the content that is showed on the phase that is been played, so the student will reinforce its knowledge by the video and experience what was exposed during the game (Figure 10).

Before the game starts, each player will be introduced to the game command the player will be able to execute actions that correspond to each phase, history moment showed as is exposed on Figure 11. Each phase has a different command set to avoid repetitive game mechanic.

First phase shows “Cave Man” period which aim is to get three tigers’ meat, at the same time running from and
trying to kill them using bees which beehives are fixed on some trees on the scenery. This way the player will experience the moment when the human being needed that meat for feeding itself and some methods to get it was necessary since the human being could not find food, as shown in Figure 12.

The second phase is already hunting tigers using a manufactured tool, in this case is an axe, after beating 9 tigers to complete the phase, demonstrates man evolution that learned how to make hunting tools to look for its own food and also learned how to defend against other animals.
Third phase is based on Ancient Egypt histories but now is necessary past through obstacles as holes, beetles and sarcophagus. Setting phase was made to demonstrate a very present symbolism on Egyptian culture showing marks left by this polytheist civilization and show man's culture evolution.
The others developed phases also reports another events as maritime victory where commercial civilization and cultural environment evolution are showed. An important game aspect is a chronological order of historical facts.

ANALYSIS OF RESULTS AND DISCUSSION

For game’s evaluation and tests realization were selected students from public school which History’s concepts told on this article are applied. To the teachers were applied contents with this game utilization and right after evaluation was applied a questionnaire so students could do the device perform evaluation and the alliance about what was learned on the classroom as it is on Figure 13.

According to the teacher, utilized method was extremely satisfactory. The same teacher made a point about technology importance and teaching-learning process. It was a very different and nice experience for the students when they understood they could play and learn at the same time. Another interesting thing was the efficacy on subject’s memorization that promoted a health discussion about classroom’s showed subject.

FUTURE WORKS

As a future work intention the plan is to transport the game to movable platforms as Android is it can be played on smartphones and tablets, making possible a better mobility for the player and even build a different strategy.
for the teacher and students’ work since this technology is been very utilized and scattered around the world.

On game evolution, the plan is to increase on details as: difficult selection on main menu, a graphic creation to evaluate player development and introduce more phases containing all curriculum program that belongs to fifth and sixth grade in junior school. History is a very large subject that provides many possibilities on educational games in many different gaming levels as action and strategy.

**Conclusion**

Studies prove that students have problems learning theories subjects as History. Certainly, deficiency on interactivity in school helps this to occur, so, educational game introduction can improve and stimulate students learning, it doesn’t replace curriculum program but is a very good tool support to improve the learning. The conclusion after all exposed is that Virtual Reality games can improve and assist satisfactory the teaching-learning process because the new students generation is widely involved on virtual world. This way, bringing together game and a specific History subject as example, can be created a virtual environment appropriated for learning no matter the grade’s student.

**REFERENCES**


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