An Interactive Multimedia Game "Let's Save the Water" for the Communities of Ecuador and Bolivia

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Abstract. Due to the importance of water, it is necessary to know how to preserve it, because this vital liquid is increasingly becoming scarce every day, heavily affecting the rural areas and communities of Ecuador and Bolivia. Based on Gamification and its main characteristics, it seeks to identify some ICT tools such as the interactive multimedia game that today represents a powerful means to reach children and can be used in classrooms to facilitate learning, as well as the development of skills and abilities to raise awareness of children being an important support to teaching-learning processes. The objective of this project is to contribute to the promotion of good water use through "Interactive Games Applied to Sustainable Practices and Responsible for the Efficient Use of Water", making use of the tools provided by ICTs. This multimedia project is an improvement initiative that incorporates various video elements, text, graphics, animation, and audio.

Keywords: Videogames · sustainable development · Water.

1 Introduction

This project includes two components: 1) Development of an interactive multimedia game, using the development engine Unity video games, Adobe Illustrator tool for creating images (sprites) and the programming language C# for mini-games platform to enlighten children about sustainable practices and responsible water use, combating pollution and waste of it, using the SUM methodology for its development, state diagrams and multimedia script for design. 2) In the first stage, an expository demonstration of the software is carried out to children between 6 and 12 years old, then in the second stage, the children perform individual tests.

With the development of these components, we will contribute to the knowledge on the rational use of drinking water, for the collective awareness of the

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city of Tarija - Bolivia (place defined for experimentation), encouraging a new way of learning and teaching in multimedia technological environments.

The environmental degradation is alarming today all over the world, one of the problems that contribute to this worrying climate problem is water scarcity. Water is a non-renewable resource, it has proven to be a source of life and all living things depend on it. Best practices in water use are unknown or are not given due importance in our midst. The leisure activity contributes greatly to the psychomotor maturation, enhances the cognitive activity, facilitates emotional development and is essential for the socialization of children vehicles. So the game becomes one of the most powerful ways that children have to learn new skills and concepts through their own experience.

This research is aimed at children who have a much more willing receptive capacity, wide acceptance of new technologies and video games as well as the ability to internalize tools and concepts that turn quickly in people with great influence at the time to inform and sensitize their families, friends and environment in general, because the change lies in the younger generation. For this purpose policies and strategies for the dissemination of efficient use of water and measures that allow their conservation arises, making use of ICT through interactive games that could achieve the interests of children and encourage them efficient water use, combat pollution of rivers, and identify sources of waste of it; through software developed in the Unity video game development engine, using the C # programming language and the Adobe Illustrator design tool for image creation, using the SUM methodology of video game development and the unified modeling language for the visual version of software architecture.

2 Metodology

The working of this project is based on the SUM methodology for video games, the same as that aims to develop quality games in time and cost as well as a continuous process improvement to increase its effectiveness and efficiency [18]. Seeks to obtain predictable results, efficiently manage resources and project risks, and achieve high productivity of the development team. SUM was designed to suit small multidisciplinary teams (three to seven members working in the same physical place or are distributed), and for short projects (less than one year) with a high degree of customer participation. The definition of the methodology is based on Software and Systems Process Engineering Metamodel Specification (SPEM) 2.0 a meta-model to describe processes and methodology developed by the Object Management Group (OMG) [4, 8]. An advantage of using SPEM is that its structure specifies the process of game development without mentioning specific practices, making it flexible and adaptable to each reality. To specify the methodology Eclipse Process Framework (EPF) [5] is used because it provides a extensible framework based on SPEM 2.0 concepts to define and manage software development processes. Video game SUM adapts the structure and roles of Scrum described by Ken Schwaber. This methodology is used because it pro-

vides flexibility in defining the life cycle and can be easily combined with other methodologies to suit different situations [15, 22].

The methodology used for socialization and/or workshop is based on experience model "learning by doing", thus achieving the motivation to be builders of their own knowledge. It involves direct evidence with users, where the setting is encouraged developed operating software, experiencing with the public to whom it is addressed [1, 16, 17, 20, 21].

3 Lifecycle

The life cycle is divided into incremental and iterative phases that are executed sequentially except the phase risk management that is performed throughout the project.

The five sequential phases include concept, planning, development, beta, and closing, as shown in Fig.1. Phases concept, planning, and closing are performed in a single iteration, while processing and beta consist of multiple iterations. The phases arise as adaptation game development of pre-game, game, and post-game having Scrum, where the first two coincide with the planning and development, while the third corresponds to the phases of beta phases and closing. This division is made since the beta phase has special features in the video game industry. The concept phase does not correspond to any stage of Scrum and added as it

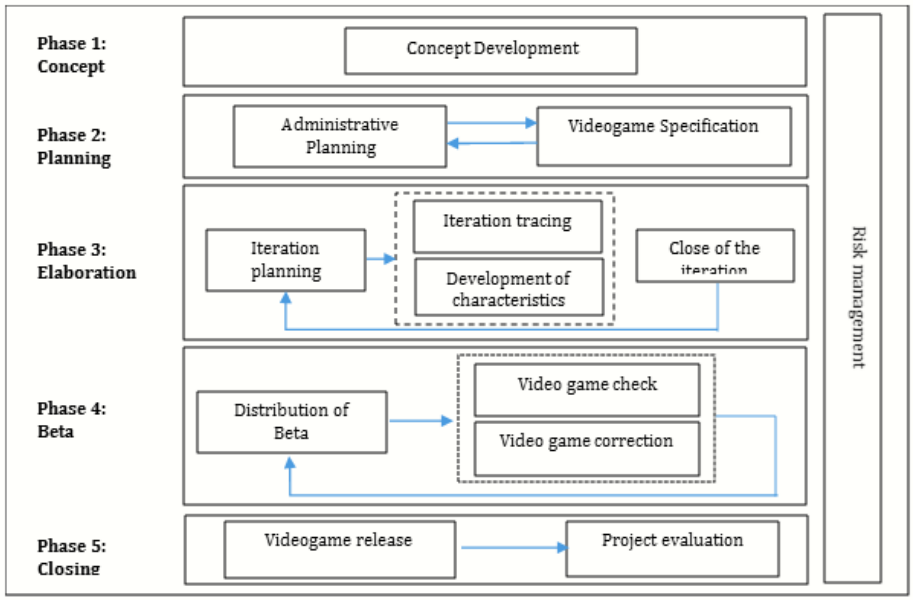

Fig. 1. Phases of the project

covers specific requirements for game development and use in local realities and the global industry is identified [2, 11–13].

The expected results are related to the contribution to raise awareness of the importance and care of water through interactive games applied to sustainable and responsible water use efficiency children from local communities in Bolivia and Ecuador practices (mainly). At project completion, a breakthrough in awareness to children on an efficient and responsible use of water and the technicians responsible for environment and regional education ministry is achieved, are trained in using the software.

4 Videogame

According to Frassca's definition, you can define a game as "any form of computer entertainment software, using any electronic platform and involving one or more players in a physical environment or network". Furthermore, Jesper Juule describes the requirements for a video game can be regarded as such, which are:

- Defined rules: The rules must be sufficiently well defined that can be programmed into a computer or sufficiently well defined that you do not have to discuss them every time you play
- It requires effort by the player: It's another way to say that the games are difficult, or that games contain a conflict, or are "interactive". It is a part of the rules of most games (gambling) that can influence the actions of the game players status and outcome of the game. Investment effort player tends to lead to a result since the investment of energy in the game makes the player is (partly) responsible for the results.
- Negotiable has consequences: In general, this means that every action must produce somehow a consequence, either as small as putting an object in the inventory or as large destroy an opponent and win a game.
- Varied number of shares This condition indicates that the actions you can take, the player are varied and not limited to a simple action, such as in chess, where you can move different parts and each part has a type of movement.
- Mixed resultsIn this case, it refers to a game must have different finishes or ways to end the game, you may be limited to winning or losing a game, or it may be so extensive as to have a different end to the story of a game.
- The results affect your motivation: The latter is related to the above condition, this condition tries to explain that all game results, should be able to somehow affect the player with either joy or defeat by beating or being beaten by an opponent, or something more complex like being touched by the end of the story of a game.

According to Simone Belli and Christian Lopez, video game genre designates a set of games that have a number of common elements. Throughout the history of gaming elements that have shared several games have served as a genre to classify those who have followed them, just as has happened with music or movies.

Video games can be classified as one gender or another depending on their graphical representation, the type of interaction between the player and the machine, setting, and game system, the latter being the most common criterion to consider [6, 7, 9, 10].

Among the various video game genres include: Beat them Up, Fighting games, first-person, third-person action, infiltration or Sneak, platforms, combat simulation, arcade, sports, racing, mental agility, education, adventure, music, party games (party games), online games, games RTS (Real time strategy RTS) and finally turn-based strategy games (TBS Turn Based strategy).

4.1 Playability

The gameplay is defined as "the set of properties that describe the player's experience before a particular system of play, whose main goal is to amuse and entertain in a satisfactory and credible way either alone or with other players, the definition of gameplay rests on the concept of quality in use. Playability represents "the degree to which players reach specific goals of the game with effectiveness, efficiency, flexibility, safety, and satisfaction especially in a playable context of use".

The gameplay has the following attributes: satisfaction, learning effectiveness, immersion, motivation, emotion, socialization.

4.2 Usability

Jakob Nielsen and professor of computer science Ben Shneiderman have written separately on a framework of system acceptability, where usability is part of the "utility" and consists of the following [WIKI01]:

1. **Ease of learning:** the functionality and system behavior, defines how long a user who has never seen an interface, you can learn to use it well and perform basic operations. How long it takes for the typical user of a community to learn how relevant commands are used to a set of tasks?
2. **Efficiency of use:**It involves achieve the level of productivity required, once the user has learned to use the system. Determines how quickly you can develop tasks. How long it takes a user to complete a set of specific tasks (tasks benchmark)?
3. **Hold on time:** When a user has used a system time ago, and has the need to use it again the learning curve should be significantly less than the case of the user who has never used such a system. This is of paramount importance for applications used intermittently. How well remember how users how the system works after an hour, a day or a week?
4. **Error rates:** The system's ability to provide a low error rate, support users to make few errors while using the system, and if they make mistakes easily help them recover. How many and what mistakes people make when running a group of specific tasks?
5. **Satisfaction:** It refers to the subjective impression of the system user. How much users liked the various attributes of the system?

4.3 SUM methodology for the development of the game "Let's save the water"

The methodologies used for game development are agile principles to be iterative and incremental, have frequent interaction with customers and be flexible to changing requirements. In particular, Scrum and XP are taken as the basis of SUM by the existence of cases of success and the benefits reported for game development [3, 6, 7, 9–11, 19].

The life cycle of the project "Rescuing Water" is divided into iterative and incremental phases are executed sequentially except for the phase of risk management is performed throughout the project.

Game: A game in which the character that identifies the project (the Avatar or main character) must reach the finish line having collected contaminants objects in the water and turn off the faucets of water pipes that are open and wasting water piles, all in a time limit.

History: There was once a boy who lived in a place where water as a vital resource is not valued, and this was polluted and wasted indiscriminately, once had a dream in which there were chaos and despair over the lack of water live. It was then that the child initiates the great mission of rescue water pollution and stop wasting it. He had to overcome many obstacles in the fight until he finally achieves the desired goal and saves water.

Mechanical:

- The child must avoid falling into the contaminated water.
- The child must identify objects water contaminants.
- The child must reach the stopcock to close the open pipes.
- You must close all water leaks before the end of the time set by level.
- The child should avoid that the trash contaminates the river.

Target audience: The video game will be suitable for children from 6 to 12 years old mainly, although they can play at any age.

Platforms: Unity is a multi-platform (cross-platform) tool, is one of the main features of this tool as it allows the realization of an application directed to various platforms, without the need to make the whole process again. The platforms which can be imported applications performed are: PC, MAC, Linux, web Player, IOS, Android, Blackberry, Windows Phone 8, Sony Play Station 4, Sony PlayStation Vita, Microsoft Xbox 360, Microsoft Xbox One.

5 Preparation

This video game called "Let's save the water" is designed and developed for an audience of 6 to 12 years, in order to promote good practices on the use of water as a vital resource in Bolivian cities and mainly considering the pilot the city of Tarija, whose main objective is to capture the main elements to be included to meet the requirements.

Fig. 2 and Fig. 3 present the scene menu screen and the scene instructions screen of the game.

Fig. 2. Scene menu screen

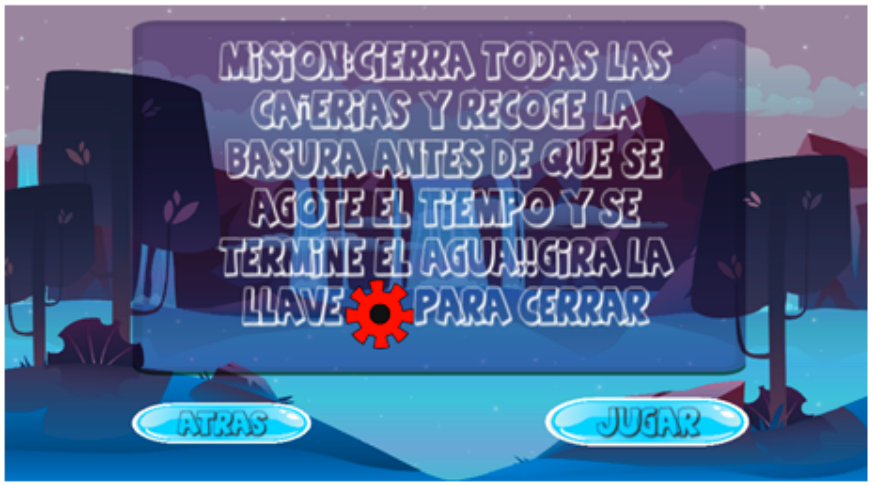

Fig. 3. Scene instructions Screen

6 Discussion

"Let's save the water" develops on a plane and both the elements and the character can move through it. Anyway, the scenario will present certain obstacles such as earth walls that cannot not be crossed by any entity.

In short, the collisions that will occur are:

- Character - Character
- Character - Scenario
- Platform - Character
- Mobile platform - Scene
- Character - Garbage

The controls are defined by the Movement: Keys up, right, left, left-click of the mouse or touch; the Interface: In this section, each of the screens that make up The Water Rescue is specified in detail, as well as the transitions between

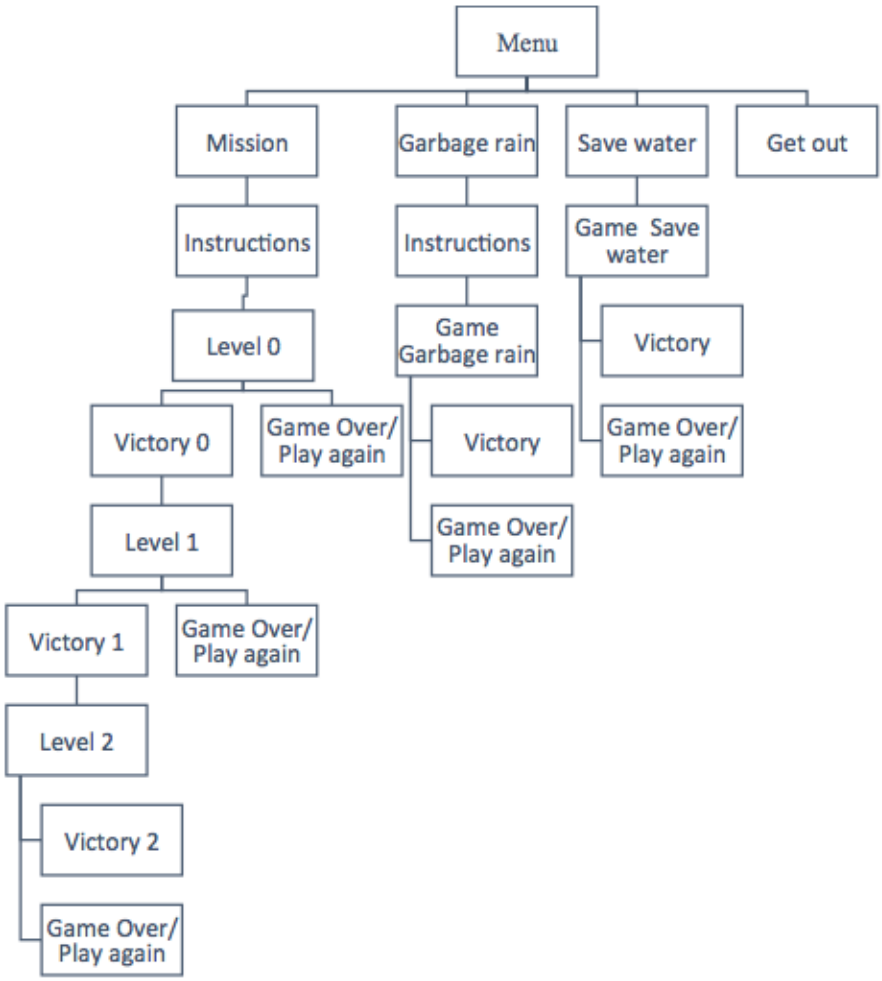

Fig. 4. Navigation Diagram

them as well as the utility of each GUI element (Graphical User Interface); Main menu, according to the sketch shown below:

7 Conclusions

Educational Software has been emerging to help improve cognitive skills necessary to analyze and use information [14], becoming an instructional resource currently used in the process of teaching - learning. This new learning resource widely accepted by children combines multimedia elements (integration of animations, sounds, text, and graphics), allowing the child to stimulate multi-sensory way and providing features that make its application possible in the area of education.

For the Unity game development was used, by which text files, images, sounds, videos and code files necessary for the creation of educational software they are linked.

Research conducted by the optimum level for the functionality of the project, and through the feasibility study determined could meet its viability and ultimately necessary to detect, and correct errors in the game software tests were performed.

In this paper, in order to contribute to the awareness of children about the importance of water through video games, water rescue project was developed, which incorporates three video games responsible for the efficient use for educational purposes about sustainable practices and water. Therefore, we conclude that the project performed satisfactorily complying with the general objectives and specific objectives posed.

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