



Designing an earthquake preparedness training curriculum by playing in a virtual reality environment

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Abstract

Iran is one of the most earthquake-prone countries in the world, and many students and teachers have suffered physical and psychological damage related to this natural phenomenon. The gaps observed in the earthquake preparedness curriculum indicate the necessity for a change in its curriculum. To reduce these effects and consequences, a new curriculum is needed. The present study aims to increase understanding of earthquake preparedness due to observation of unsuccessful experiences of previous training in preparedness training. If the earthquake preparedness curriculum changes substantially, their current problems will be lessened. In order to improve the quality of existing training and to provide flexibility in the field of general software training, virtual reality games have been developed. Research data were collected using internal and external

documents. The approach used in this study was qualitative and descriptive-analytical.

Keywords: *Serious Game, Virtual Reality, Earthquake Preparedness.*

I. Introduction

Curricula in any educational system, in accordance with social and educational needs, are inevitable in the face of change. Curriculum changes can be divided into two major groups: superficial and substantive change. In superficial change, a change is intended that, regardless of the depth and approach of the curriculum, refers only to the different model and type of products and procedures available in the educational



system. Whereas the substance of change is a change that reflects the structure and depth of the curriculum and aims to bring about a new order and organization in the curriculum or educational system. [1]

The authors of this article decided to propose a method with regard to the location of the Himalayan alpine earthquake belt and the opening of the Red Sea floor as well as the death toll from the earthquake of 620 and the death of 12,000 in the Kermanshah earthquake in 2016. New ones have been added to the curriculum in order to compensate for the weaknesses of the current curriculum and its improvement. [2]

The unique capabilities of computer games make them suitable options for educating individuals, especially students, in a variety of areas, including dealing with critical situation. [3] With the development of computers and graphics hardware, there is a new perspective on games in education, where they can be used as learning technologies, where players are given the opportunity to learn seriously. [4] The game components ensure curriculum balance. [5] Games can provide players with a sense of reality. [6] Play is a purposeful and competitive activity involving some kind of conflict [7], which takes place within the framework of agreed rules. [8] A set of values are created by playing games, values that are not usually given to learners in formal education. This leads to a new pattern of learning. [9]

Stebleton points out in 2004 that a game allows players to apply different strategies and skills to achieve victory, so playing a role in education. When people start to ask, "Will the computer change the way of learning?", There is an important question about the role of serious games in education. Video games are not just entertainment. They allow students to develop a set of skills that no other method can provide for them [10]

Serious games can use gameplay to provide a solution to any subject in any training process. [11] In summary, some of the important benefits of serious gaming are as follows: Increasing learner motivation, increasing complementary learning through engagement and enjoyment, potential for broad participation, use of participatory learning, Effectiveness of Learning through Experience, Sustainability, Empowering Innovation, Entrepreneurship and Entrepreneurship, Problem Solving, Risk taking, Continuous Improvement, Quality Orientation, Effort Value, Mathematical Skills, Analytical Skills, Planning and Organizing Ability, Strategy skills, technical competence, information management capabilities, independent learning. [12] Smart gaming teaching systems allow users to learn at the speed they set by adjusting teaching and learning strategies to

suit their needs. [13] 21st Century students are expected to become familiar with IT skills as one of their occupational requirements today. This is a big challenge, and so the curriculum must work to meet that expectation. In virtual reality games, a player using a headset can enter a completely virtual environment and interact with that environment. The main way these hardware works is visual and auditory stimulation. [14] The combination of virtual reality with the e-learning system is a very powerful combination that can be used for a variety of educational purposes. [15]

Today Virtual reality and video games are new and effective options to overcome the limitations of traditional approaches to education. This emerging technology allows users to improve their preparedness for situations such as earthquakes and fires by displaying scenarios drawn from reality. [16] One of the most important components of the virtual environment is its visual environment, which, through special displays or images, displays a real visual experience in front of the user's eyes. The user feels that he is in a three-dimensional environment. This feature makes the virtual environment more realistic. In the virtual environment, the user can hear the audio transmitted to him via the phone. Changing the sound quality and also dividing the sound waves between the two earphones helps the user to feel the sound so the virtual reality has no audiovisual flaws. [17]

To date, several games have been designed and used to deal with natural disasters, including earthquakes. One of these games is the "Haiti Earthquake", which was created in 2010 after the devastating Haiti earthquake, and players were able to evaluate their knowledge to cope with such conditions by choosing different roles in the game, while also knowing They increase the necessary action under similar circumstances. "Disaster Relief" is another game made in 2014 by a Chinese team in which people in different crisis situations could test their knowledge of how to deal with such situations. Another of these games is "Earthquake Safety Ways" designed for children and aims to teach safety tips and increase children's readiness for earthquakes. So far, none of the three games have had any impact on player behavior.

II. Earthquake Preparedness Curriculum Using Virtual Reality Play

The syllabus provided by this software included goals and content (enhancing readiness and learning behavioral skills), empirical teaching method, and earthquake preparedness evaluation. The purpose of this software is to familiarize with the meaning of the earthquake, to understand the importance of earthquake preparedness, to know the behaviors right before the



earthquake and when it occurs (preparing the environment and its safety, proper asylum practices, earthquake-appropriate behaviors). Acquiring the skills and abilities necessary to protect oneself and those around them (identifying safe places, identifying potentially hazardous objects, self-management), acquiring physical space during an earthquake (overcoming inherent fear, controlling the excitement during an earthquake, protecting vital parts of the body).

The name of the game is "Classroom Earthquake Game" and is for people aged 15 and over with the help of Unity Three software. This game is produced in 2018 in Iran. The story of the game is set in an environment where an earthquake strikes Mercury IX, a situation in which the general public feels terrified. Minor damage can occur in important buildings that have been specifically designed, such as hospitals, fire stations, but will not cause significant damage to ordinary resistant buildings and non-resistant buildings will see very severe damage. Underground pipes break. Although not only the magnitude of the earthquake is significant and the amount of energy reached to any point on the earth's surface in the earthquake and the degree of damage depends on factors such as soil sex, this software addresses a general discussion in this area.

Physical Space This software is designed with the modeling of the classroom environment of school classrooms in Iran, which has been able to adapt to educational locations in other countries. In this environment there are rows of benches. In front of them is a blackboard and a desk on which there is a computer. Next to the rooms there are large lockers, which are places for teaching aids. On these cupboards are pots that are at risk of collapsing during the earthquake and have been considered to enhance the understanding of the danger in this environment. The classroom has large windows that not only transmit light into the room, but also because of the shielded glass, the risk of falling can be an important reminder of earthquake preparedness. Gluing glass, finding first aid kits, moving dangerous objects, proper asylum, and saving lives are the things that earn points in this game. In addition, at the end of the game, the player can see his or her survival percentage on the blackboard.

The teaching method in this software is active learning, which results in direct interactions with the virtual environment. The person receives appropriate feedback for each right or wrong behavior within a very short period of time and realizes the outcome of their behavior. He was allowed to curiosity and manipulate the presented environment to complete his learning. There is no limit to her learning time. Learning is shaped by one's self, IQ, ability to adapt to the environment, and even

one's emotional backgrounds drawn from his or her own subconscious memories. The method of learning is practical and analytical. One of the purposes of presenting this software is to provide educational content not entirely theoretical and to allow the person to be involved in a practical situation. Since traditional and traditional methods are instructor-driven, the designers of this software have sought to develop a new student-centered approach.

Over time, new games have been fun, intuitive and intellectually appealing, giving players a sense of reality. As the game was supposed to imitate reality, it was designed, taught, simulated, and the actual environment was designed by the designers. Although games always appeal to people and provide them with fun and joy, the stress and fear of dying are also the underlying emotions of the game.

This game focuses on the difference between educational games and games made for educational purposes. Classroom standards and educational requirements are within the range of common school facilities. The game offers players a continuous, intelligent, seamless and integrated experience. Although games are known for entertaining people, their performance is a little out of reach. Video game literacy requires mastery of significant cognitive skills. Video games need to develop parallel processing or multiple thinking skills. Serious games are interactive technology applications that are well beyond the traditional video game market. The analysis and visualization that each person has in this setting is unique and relates to individual memories, life experiences and personal characteristics. Such an understanding of earthquakes is never taught in school.

In this game the learning is according to the person himself. Designed game is a purposeful activity within the framework of the rules that the individual himself plays the deciding role in the game. The game is consumer-centric, and the target audience engages in activities designed to have a subjective or innovative background.

In earthquake shapes of conflict, the set of obstacles that the player must overcome to overcome is presented. These cases teach the player to put into practice what they have learned previously. The rules are the set of instructions that describe the relationship between the player and the environment and the players must learn the rules before the game begins. The purpose of the game is a predetermined final situation that gives the player the meaning of victory by achieving goals. These goals are in the form of pre-earthquake and in-earthquake training that educational planners have incorporated into the virtual environment software suite. It is an important enjoyment



of the game. Using simulations increases the potential of higher-order learning, such as analytical and conceptual skills.

Some of the most important game elements used in this software are:

A - Points: The player earns points in the earthquake game for observing safety principles and performing appropriate action.

B - Stages: In this game there are two training stages anticipated based on the experience of different people. The first stage is in the first room and the second stage in the second room. At the discretion, there is no restriction for the player to enter the next stage and the player will start the next stage with his / her desire to reach the desired learning level.

C - Victory badges: In an earthquake match, the chance of surviving is the same as the badge of victory that reduces the player to repeat or increase confidence during a real earthquake.

D- Standings (Scoreboard): In this game, the class board is designed for this purpose, which shows the chances of survival and environmental safety ratings.

In the artistic part of this software it is very careful that the simulations are real and the environment looks quite natural. The design of the computer, windows, cupboards, ceramics of the room, the entrance, etc. has been done with great care. When a dusty earthquake strikes the room, it is so natural that in some subjects it causes a cough. The sound of the siren also gives a natural sense to the aftermath of the earthquake. Fear is the most genuine feeling that comes to mind when using this software.

The final evaluation of the software is in the form of a scoreboard, displayed on a blackboard, to judge a person's performance and to inform them of the safety measures he or she has taken.

In general, the following goals have been considered in the curriculum design of this software:

- Increase the level of motivation for learners compared to the traditional method.
- One learns in this environment that life and moments are forward and sometimes there is no way out. Standing and confronting and behaving intelligently is part of life. During the use of this software one learns to stand up and deal with a logical accident and disaster management tactfully as the earthquake escapes further damage.
- Repeating the game will pay more attention to performance details that seemed less or less trivial in the past. It may not

seem necessary to move the pot, but the individual is aware of the danger of the earthquake, and changes his view of it.

When using this software one finds the value of trying to achieve the primary goal of saving your life and preserving your surroundings.

- Increasing analytical skills is another consequence of using this software, prioritizing behaviors leading to a secure environment is very important.

- Strategic skills for proper asylum and increased chances of survival, ability to locate, select, arrange, relate, evaluate and evaluate are also expected outcomes for this software.

Independent learning without the need for a training coach is one of the benefits of this game, which reduces many costs.

III. Virtual environment of earthquake game software

There are two practice rooms in this game:

A- The first room (entrance to the game) is a place to practice with the virtual reality environment. Due to the need to work in a virtual reality environment and to learn how to control the virtual environment, this part of the game is essential. In this game, the audience is trying to secure the environment in earthquake conditions and after facing the real earthquake trying to save their lives and avoid high risk behaviors.

How to work with the game controller category is presented in the first part of the software, with the help of the avatar who is the same person trained, able to use tools, drop them, remove objects, interact with them, move around and etc.

In the first room there are various objects that can partially respond to the curiosity of the player, allowing him to enjoy the game by moving and dragging and dropping them. In this room, the exercises are fun and there is no earthquake, only the interaction with the space provided by the instructor is learned and the game designer does not set any time limit for the player. The player enters the second room or classroom upon request.



Figure 1: Pre-earthquake training area

B- Second Room (Classroom)

In the classroom is a blackboard with a start button on it. There is a stopwatch that counts down the player's recollection of how safe the environment is. Surely after this time the earthquake will begin.



Figure 2: Physical classroom environment before an earthquake

There are guides in the various classes where the player moves around them and earn points by acting on them and learning how to secure the earthquake environment. For example, learning to secure windows, sheltering in the right places, caring for first aid kits, paying attention to breakable items, avoiding shredding valuable items, and so on. Most importantly, it teaches that it is not the right thing to do during an earthquake. He has to stay in a safe place and manage his own behavior and that of others. Properly performing each activity is accompanied by listening feedback and earning points.



Figure 3: Pre-earthquake preparedness and immunization training environment

As the earthquake time approaches, pre-earthquake training ends and the timer warns of an earthquake. The player is required to seek appropriate asylum, release the environment and save his life.

At this moment, the simulation earthquake occurs on approximately 7 Richter, falling ceilings, moonlight and other objects that have not been fixed in place yet, and the room is filled with dust. Then the siren, ambulance and alarm sounded.



Figure 4: Earthquake class image

At the end of the game, the chalkboard shows the person's chance of survival and the immunization score. The player can be aware of his / her ability in this area and know the extent of his / her knowledge in earthquake preparedness. If desired, he or she can practice the game over and over again to achieve the desired level of learning.

IV. Research Methodology

The approach used in this study was qualitative and descriptive-analytical. It has been the site of Iranian software development, inspired by earthquakes in the country and inspired by the style of buildings and classrooms in schools and universities. It took almost six months to design and build software. The study population included various levels of



earthquakes in Iran and their severity as well as the extent of their destruction and damage in the areas of educational facilities, facilities and equipment provided in schools, types of practical training and maneuvers. Research data were collected using internal and external documents and purposeful samples were selected.

V. Conclusion

Games are known for entertaining people, but their performance is a little off the mark. They are often viewed as trivial and of no educational value beyond eye-to-hand coordination [18]. Games are usually made in the form of commercial packages, not in the form of special education games. The difference between educational games and games made for educational purposes must be understood. Traditionally, players have to learn the rules before starting the game, but today there is a quick training method to get started. The purpose of a game is a predetermined final status that gives the player the concept of victory by achieving the goals. [19]

In today's world, many of the potential dangers can be identified and experienced with the use of serious games used in the context of virtual reality. He learned the ways to deal with natural disasters and prevent their consequences without spending a living and financially.

Research has shown that students in the serious game environment are more likely to enjoy playing and simulating than the traditional approach to learning. The introduction and use of games and simulations demonstrates the potential for enhanced learning processes that have traditionally been associated with higher-order learning such as analytical and conceptual skills. [12]

Skills and abilities that usually make serious games sustainability, teamwork, solidarity, innovation, creativity, problem solving, continuous improvement, energy efficiency, mathematical accuracy, initiative, goal achievement, result orientation, flexibility and work with the environment.

Teaching serious games is important for two reasons: First, it facilitates the learning process, Secondly, because training guides users to accomplish their goals during the game, and Third, because it provides a monitoring mechanism to prevent users from behaving inappropriately. Serious games can use gamification (using game thinking and game mechanics in a non-game context to engage users and solve problems) to provide a solution in any training process in any subject area, because serious games are suitable for learning. It is actually appropriate for the content to be taught.

Because of the competitive advantages that gaming technology offers over simulation technology, serious gaming simulators can guarantee their future in the future. [6] They do not want to replace schools, but instead they provide us with a new way of teaching in a much more powerful way.

The future of learning may transcend simulated worlds. Although video games usually do not transfer any learning, using the right method can be a very powerful tool for transferring information. Consumer demand and industry centrality have been key drivers in game development. Also, during the test phase, the game must pass an industry jury to analyze its accuracy.

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