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Using Video Games for Design Education: An Example of Developing Earthquake Scenarios for Home Environments

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Abstract: The heart of interior design/architecture education is design studios. As a design-based graduate program, the main objective of the International Masters of Interior Architecture and Design Program-(IMIAD) in Istanbul Technical University Graduate School is to produce new disciplinary information and knowledge for design (Cordan, 2017). Additionally, the main objective of the Interior Architecture Project III, which is the third design studio blended with the thesis studies in the IMIAD Programme, is to guide students in their study based on research-based design approach. In this study, one example was presented to explain how the research-based design process conducted. This study was based on developing a game scenario for experiencing earthquakes in an experiential box. The earthquake scenario was developed for a bedroom situation at home environment by using virtual reality and gamification methods. The educational use of video games through serious games helps designers and design students understand real situations and raise public awareness by experiencing them in virtual environments. Besides, the study will fill the gap in the literature by using video games as an educational tool in design to develop scenarios for natural disasters such as earthquakes, the study will help educators for developing new ways of teaching and students for solving design issues using video games. Different scenarios can be developed for different natural disasters and cases in the future for further studies.

Keywords: Awareness, Design studio, Earthquake, Gamification, Video games

Introduction

Earthquakes, which can happen anytime, anywhere, cause approximately 60 percent of the loss of lives due to disasters (Ministry of Interior Disaster and Emergency Management Presidency (AFAD), 2022). Turkey is in one of the most active earthquake zones, which requires a multidisciplinary study in architecture, design, planning, sociology and psychology because of its location. For this reason, it is essential to make our lifestyle responsive to disasters and create awareness about safe living. Being prepared for natural disasters is the most fundamental way to protect people against hazards and reduce possible risks.

Considering the panic effect of earthquakes in society, the main aims of this study are threefold: First, being aware and informed for reducing the risks occurring in natural disasters such as earthquakes in public; second, raising public awareness through video games, and third, using video games for educational purpose for design students and producing new design knowledge using video games. The declaration of 2021 as the Year of Disaster Education in Turkey promotes the feasibility of this study. Thus, this study focuses on using video games as educational tools to raise design students' awareness for reducing the risks occurring in natural disasters such as earthquakes. Accordingly, the research questions of the study are: 'What is the role of video games, specifically serious games, in design education for educating designers, design students and the public?' and 'How can we produce realistic design scenarios for reducing the risks of earthquakes using serious video games?' Thus, the study will fill a gap in the literature by using serious video games as an educational design tool to develop realistic scenarios for natural disasters, such as earthquakes.

Video Games as an Education Tool

The millennium and post-millennium generation's attention and interests have shifted towards digital resources which are shown as an alternative to primary sources that are accepted as reliable information and possible to interact with directly. As cited by Özer and Çatak (2021, 141) that "traditional instructional methods may be less effective in delivering ideas to the learners, whereas introducing gaming adds energy and interest to the learners" (Sardone & Devlin-Scherer 2016). Additionally, using games for educational purposes can be beneficial both for the learning and motivation of design students and for the public (Özer, 2021).

Video games have gained importance and captured the attention of educators to create new environments that permit learners to observe, experience, and interact individually or collectively. In other words, the computer games' ability to attract students' attention has become a subject of interest for educators in creating new learning, experiencing and interacting environments. Their aim is to create learning environments by using new interactive technologies that provide an opportunity to actively involve students in problem solving (Garris et al., 2002), to directly experience the physical properties of objects such as shape, size, distance, and time duration (Antonietti & Cantoia, 2000), and to engage with the task physically (Price & Rogers, 2004, as cited in Wrzesien & Raya, 2010). According to Ritterfeld & Weber (2005) "Video games also allow for interaction with and intelligent reactions by the system" (p. 401). Thus, this pedagogical approach also provided an opportunity to improve and practice new methods in the form and dissemination of knowledge (Varinlioğlu et al., 2019).

In this context, serious games, which are defined as video games in the literature, have also gained importance for educational purposes (Bayraktutan, 2009). Considering the process of gaining knowledge and skills, serious game types that serve different ages and groups can be classified in different categories. Preschool, K12 and Kids games designed to improve student's cognitive and problem-solving abilities, edugames also known as educational games or learning games specifically designed to focus on one component or topic of education. Social impact games or games for change aim to give a message about personal growth or emotion or political messages on a global scale (Özer, 2020). On the other hand, serious games have a primary objective of education rather than pure fun (Djaouti, et al., 2011). Serious games help players to discover through trial and error the purpose of the game and what to do, and to decode the game's rules. Thus, the game environment is explored, and the user gains experience with what the rules of the game allow them to do and how to react to inputs. As stated by Buratti et al (2021, 32) that "this explains the link between learning and technology." In other words, the player/user has an active role in the virtual world for gathering and processing data and dealing with the

decision-making processes and activities that lead the game scenario and narration processes.

Methodology

The earthquake scenario, which was experienced in a 3 m x 4 m (9 ft 10in x 13 ft) experiential box, was developed for a bedroom situation in a home environment by using virtual reality and gamification methods regarding serious video games. The minimum space required for room-scale setup was identified as 2 m x 1.5 m (6 ft 6 in x 5 ft).

The interaction with virtual reality (VR) objects takes place in the play area which also defines the virtual boundaries. Thus, a headset, a base station, and a controller that supports room-scale setup was used for experiencing the proposed design scenario. The developed game in CAD mode is based on the player/user experiencing the situations, which are before and during the earthquake, with one-on-one interaction. In the light of the information obtained from AFAD, the non-structural arrangements that should be made before the earthquake are provided for interior setting of the game. Thus, the player/user has change the interior setting with manipulation tools and rearrange the bedroom in accordance with the earthquake regulations.

A Design Studio Case: Developing Earthquake Scenarios for Home Environments

The heart of interior design/architecture education is design studios, which aim to find appropriate solutions to design problems at both graduate and undergraduate education levels. In other words, the studio is the main mechanism in teaching design for developing a student's skill (Tekeli, 2004, as cited in Birer, 2022). Due to ever-changing needs and facts, both locally and globally, educators need to imagine new learning and teaching methods for design education. As a design-based graduate program, the main objective of the International Masters of Interior Architecture and Design (IMIAD) Programme at Istanbul Technical University is to produce new disciplinary information and knowledge for design issues (Cordan, 2017). Additionally, the main objective of the Interior Architecture Project III course in the IMIAD graduate programme is to guide students in conducting their thesis study with an integrated design project through the research-based design, which "offer a creative environment not only for redefining and transferring architectural knowledge to avoid using existing clichés and templates but also a productive environment opens to the use of information from other disciplines" (Cordan, 2017, 17). Within this course, this study was based on the development of a serious game for experiencing an earthquake scenario, which was experienced in an experiential box, for a bedroom situation at home, for production of new experiential knowledge.

The hazards of earthquakes while inside the building, in the open area and/or in the vehicle show similarities and differences according to the locations. In this sense, it is possible to develop design scenarios with serious games for what can be done before, during and after the earthquakes. According to the proposed design scenario (1), the players from X and Y generations who constitute the user/player were chosen. As a game environment, the bedroom was used for considering the usage habits of those generations. In the experiential box, there is a bed, bedside table, cupboard, desk and chair as VR objects in the bedroom's interior (Figure 1).

Figure 1: *Interiors of proposed bedroom (produced by Merve Öksüz)*

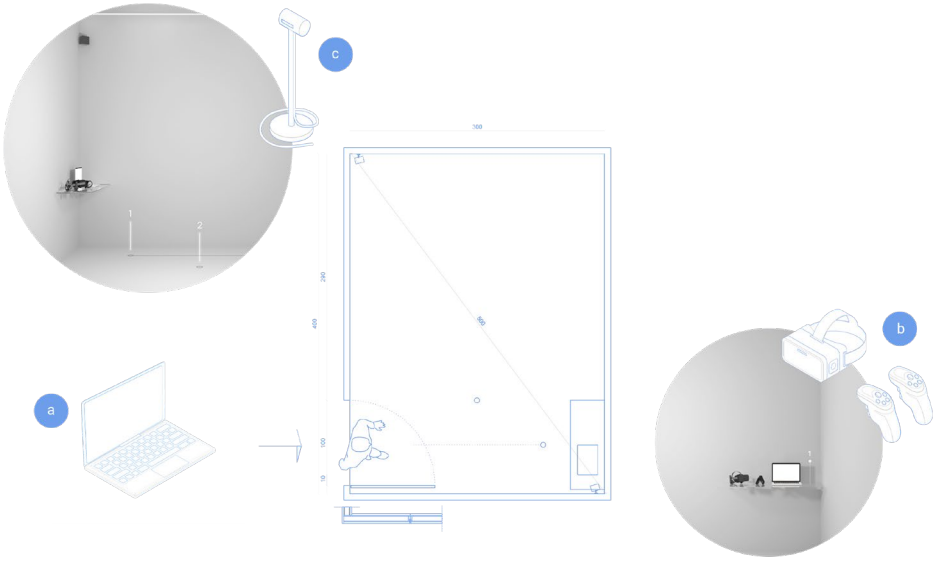

Figure 2: *Technical equipment and their location in the experiential box (produced by Merve Öksüz)*

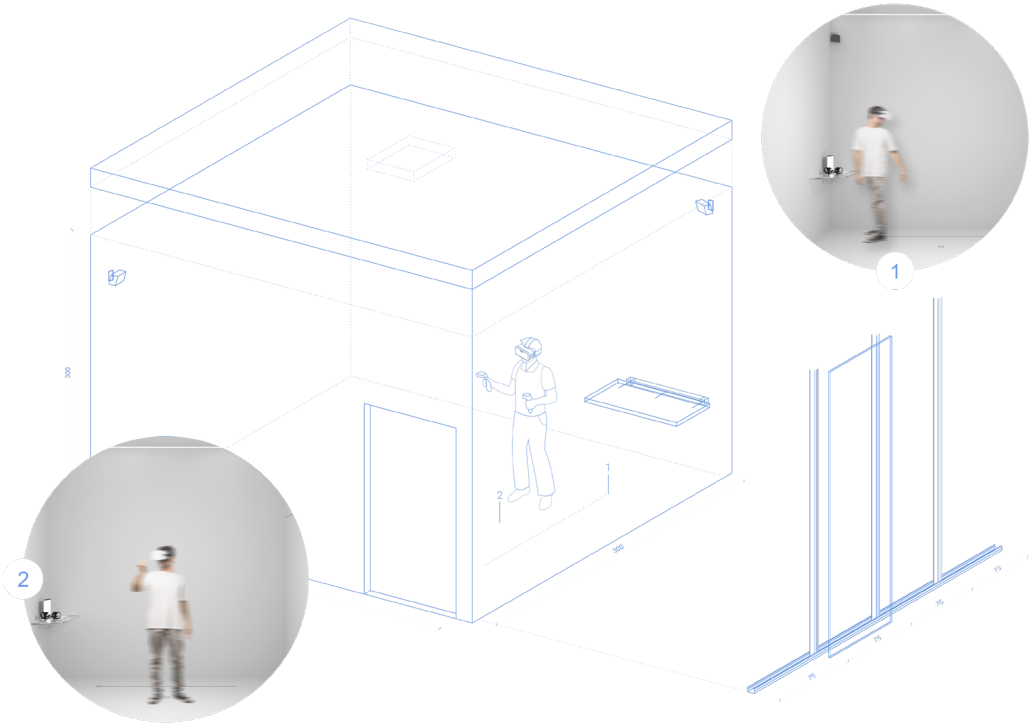

Figure 3: *Starting point of the video game in the experiential box (produced by Merve Öksüz)*

Figure 4: *Instructions for cabinet solutions against earthquake hazards (produced by Merve Öksüz)*

The first step of the experience was to access the technical equipment in the box (Figure 2) and then to reach the area determined as the starting point of the video game (Figure 3) with the guidance of the digital assistant that helped to carry out the tasks.

The user/player was provided to explore the space in order to be protected from the damages caused by non-structural components during an earthquake. In addition, the placement of daily life objects in the interior environment, what to do in case of an earthquake and solution suggestions were given to the user/player. Thus, users/players were informed that possible injuries and damages during an earthquake can be prevented by fixing or arranging furniture and other items. e.g.; beds should be away from windows that pose a hazard, such as broken glass. The user/player explores the space by moving around before the earthquake situation and reveals the defined problems by interacting with VR objects. For example, when the player interacts with the cabinet, the game informs the player about fixing the unsecured cabinet doors or offers options on how the furniture will be designed (Figure 4). Then, the player examines the best options to form the triangle of life and is also informed about key earthquake safety tips (URL-2, 2022).

While the game scenario provides a spatial arrangement for the triangle of life, which is the sheltered and protected area needed for a person's survival during an earthquake, it also presents information through boards about what to do before and during an earthquake situation (Figure 5 and 6).

Discussion

Designers can take a more active role in the process of raising public awareness of disasters and increasing their response capacity through sustainable and socially/culturally sensitive design solutions (Aman et al., 2022). In this sense, research-based design gains importance in terms of producing different forms of knowledge while solving problems on design issues (Cordan, 2017). In this study, an inquiry-based design approach over micro-learning steps (Tüker & Çatak, 2021) was used for problem solving: First, the game environment

Figure 5: *Information for preventing hazards against earthquake (produced by Merve Öksüz)*

Figure 6: *Information for solving problems against earthquake (produced by Merve Öksüz)*

(bedroom situation) was examined from the character's point of view. Second, the game is provided to inform the player/user about the game and the situation in CAD mode. Thus, the player/user is provided with the opportunity to improve the designs by changing the game environment, and manipulation tools or solutions are provided to rearrange the bedroom situation according to the earthquake.

Providing the player to manipulate the game environment with design tools increases the player's interaction with the game and facilitates the learning of knowledge through experience and involvement. In this sense, this study provides the users/players with the necessary information for survival of people through a bedroom scenario in case of an earthquake through serious video games as an experience and learning environment, and enables them to experience and internalize the information by offering various design suggestions. Additionally, the study enables design students to learn through experience and interaction in problem solving and increase their motivation. It also helps to generate new experiential knowledge through video games and to raise public awareness about natural disasters such as earthquakes.

Conclusion

This study has focused on serious video games used for educational purposes and to produce new experiential design knowledge through gamification methods and to raise public awareness. By analyzing the narrative and game mechanics of the serious game, a video game proposal was presented with virtual reality and gamification methods in an immersive experience. Thus, it was achieved that the educational use of video games through serious games helps designers and design students understand and experience real situations through video games. It can also be concluded that video games raise public awareness by experiencing them in virtual environments.

During the later stages of the study, the game proposal will be introduced to interior architecture students in a workshop to test the usability of the game and diversify its possible scenarios through experiments. Thus, the game

will be developed according to the obtained data from the design students. It is also intended to introduce the developed game to the AFAD, municipalities, and experts to develop public awareness strategies against natural disaster's hazards.

Considering the diversity of natural disasters, different scenarios can be developed for different cases that have already happened or may happen for different target groups. It is also critical to diversify scenario generation to see which gamification method will be effective for a particular target group. The fact that the exemplified case is limited to a home scenario, specifically for a bedroom situation, constitutes the limit of the study. The study results will help educators for developing new ways of teaching/learning and students for solving design issues using video games through experience and interaction. In addition, it will help authorities to find better ways to raise public awareness for natural disasters such as earthquakes.

Notes:
(1) This Project was proposed by Merve Öksüz as an IMIAD student under the supervisor of the Assoc. Prof. Dr. Özge Cordan as thesis instructor in the Interior Architecture III course in the fall semester of 2020-2021 academic year.

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