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REV-OPOLY: An Immersive Augmented Reality Board Game Experience

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Abstract : Due to the current strict isolation measures during the pandemic, learners from all parts of the world are confined to their homes under the new norm. As a result, massive educational disruptions have occurred, causing education to be conducted virtually. In comparison to traditional learning, virtual learning requires proper redesigning of a course to overcome challenges particularly in content-related activities, engagement, and communication as learners may feel isolated during lessons. Due to these setbacks, the learners have demonstrated ineffective learning as well as a lack of interest and motivation to participate in virtual classes. To address these issues, it is hoped that the use of gamification will introduce game elements into the educational context while also instilling a sense of fun in learning. Thus, this research proposed REV-OPOLY, an interactive monopoly-inspired board game with augmented reality (AR). By infusing the board game with AR, it has opened up the possibilities of strengthening the process and experience in learning. REV-OPOLY enables interactive lessons by combining virtual and real environments while promoting valuable social skills for players through interaction and competition. REV-OPOLY concentrates on the emerging technology revolution, which is a part of the Computer Application in Management curriculum offered at Universiti Utara Malaysia. It consists of a board, player pieces, and cards that act as AR markers. Each of these can be scanned to reveal 3D characters or information in the form of 3D texts, images, animations, and videos. REV-OPOLY's AR only requires a connection to the Internet, and it supports any type of web browser. REV-OPOLY opens up a new learning experience for learners as an alternative to the typical learning method. The findings showed that the majority of the participants enjoyed and were satisfied with learning through REV-OPOLY. By using the nature of games as an informal medium to learn while playing, REV-OPOLY helps to assist and enhance learners' comprehension level while enjoying the learning process.

1. Introduction

When combined with an effective pedagogy, AR technology has the potential to promote inclusive education by presenting content, expressing knowledge, and engaging students in learning. It has the potential to promote innovative and cooperative learning environments, allowing for the achievement of learning outcomes through slightly different but effective methods [1][2][3]. Gamification with AR elements in the classroom provides learners with a variety of interactive activities and is capable of managing multiple learning paths. It prioritizes the visual aspect of the learning process. Gamification can also help students avoid procrastination as they are more likely to be engaged while playing an educational online app with a built-in short-term reward [4].

This paper proposed REV-OPOLY, which is an interactive monopoly-inspired board game with augmented reality (AR). By infusing the board game with AR, it has opened up the possibilities of strengthening the process and experience in learning. REV-OPOLY enables interactive lessons by combining virtual and real environments while promoting valuable social skills for players through interaction and competition among them. REV-OPOLY concentrates on the emerging technology revolution, which is a part of the Computer Application in Management curriculum offered at Universiti Utara Malaysia. This course is enrolled by students from a variety of backgrounds and programs such as Law, Communication, Business Administration in Logistics and Transportation, Entrepreneurship, Marketing, Public Management, International Business Management, and Human Resource Management. As a result of their exposure to the evolution of technology and future trends analysis in this course, students will be able to identify, present, and apply relevant technical solutions to various business and management situations.

2. Methodology

In this study, the Agile software development approach is used as it allows continuous iteration throughout the work process [5]. There are five main stages in this approach which are planning, designing, developing, testing, and deploying. In the planning stage, the objectives and research questions were identified through the preliminary work, which is to introduce a medium, an interactive monopoly-inspired board game with web augmented reality called REV-OPOLY, on the emerging technology revolution area to enhance and assist the student's comprehension level during learning [2]. This study concentrates on the designing, developing, and testing phases of REV-OPOLY.

Figure 1: REV-OPOLY graphical user interface

REV-OPOLY is designed to consists of a board, player pieces, and cards that act as AR markers. There are two distinctive outputs from this research, namely a physical board and an online board game (**Figure 1**). Depending on the players' preferences, they can choose the medium to play the game, either using the physical board or the web-based online board, REV-OPOLY.COM. Throughout this paper, REV-OPOLY.COM will be referred to as REV-OPOLY. REV-OPOLY has animated dice on the board. The dice represent the number of moves the player has after rolling the dice. There are also player pieces that can be moved on the board using arrows on the keyboard. This is done to imitate the traditional board game and to ensure that players are engaged rather than passively watching the game. The movement can also be coded to move automatically based on the dice values.

REV-OPOLY is developed using HTML, CSS, and JavaScript. Referring to the board, each item can be scanned as it represents AR markers, to reveal 3D characters or information in the form of 3D texts, images, animations, audio, and videos using the WebAR tool (**Figure 2**). REV-OPOLY's cards contain questions related to the emerging technology revolution. It is coded so that different questions will be displayed at each round. The sample answers for all questions can be viewed by scanning the AR image on the questions cards. REV-OPOLY's AR only requires an Internet connection, and it works with any web browser and does not require the installation of any software or applications. REV-OPOLY provides a new learning experience for learners as an alternative to the traditional learning method. By utilizing the nature of games as a casual medium for learning while playing, REV-OPOLY helps to assist and enhance learners' comprehension level while enjoying the learning process.
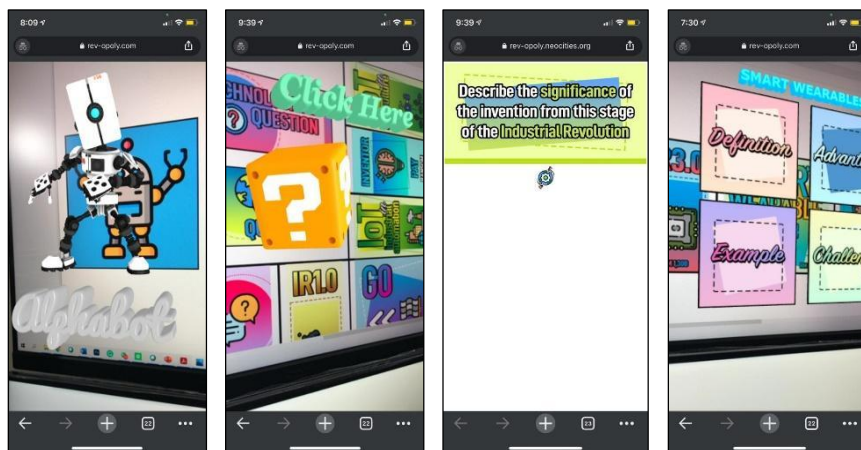

Figure 2: AR markers on the board to reveal 3D texts, images, and videos

In the testing phase, 100 undergraduate students that enrolled in Computer Application in Management subject in Universiti Utara Malaysia were invited to participate in testing REV-OPOLY. All the participants understand the basics of the emerging technology revolution topic as it has been taught during previous lectures. The purpose of this study is to enhance the undergraduate students' comprehension level on the topic through their ability to share, discuss and voice their opinion based on prior knowledge and critical thinking. The participants are then asked to complete a questionnaire on their experience in using REV-OPOLY.

3. Results and Discussion

The elements of gamification in REV-OPOLY can attract students' interest. REV-OPOLY helps to assist and enhance students' comprehension level on the emerging technology revolution topic. In the game, they are required to make explicit references to previous learning by applying knowledge and converting the knowledge gained into formal learning. REV-OPOLY can be used to substitute lecture slides or books in order to better understand the subject. REV-OPOLY encourages the players to engage, interact and have constructive discussions among them through the question cards. The majority of the participants, 86.28% agree that REV-OPOLY left a good impression on them. In terms

of learning, 88.24% agree that they felt stimulated to keep on playing REV-OPOLY to learn the emerging technology revolution topic.

In REV-OPOLY's gameplay, in order to purchase the technology, the player must answer a question from the question cards related to the emerging technology revolution on any of the spaces that the player lands on the board. Then, the player must answer verbally. Other players may agree with the given answer or share their responses and thoughts on the same question as a means of sharing knowledge. 64.71% of participants enjoyed REV-OPOLY's gameplay and 62.75% of them considered the overall gameplay to be well-designed. Sample answers for all the questions are provided as guidelines which can be viewed through the AR marker. 70.59% of the participants strongly agree that having AR objects in REV-OPOLY in the form of various multimedia types such as 3D and 2D images, texts, audios, and videos, helped them to focus and retain information better.

REV-OPOLY is marketable as an online board game that integrates AR in the player's pieces and cards. These AR parts allow updates of the game to be done without affecting the board. Even though REV-OPOLY focuses on the emerging technology revolution in the Computer Application in Management curriculum, the generality of this topic allows REV-OPOLY to be played by individuals who are interested in learning this topic in a more fun, casual and informal environment.

4. Conclusion

REV-OPOLY is a board game with augmented reality intervention in the area of the emerging technology revolution. REV-OPOLY opens up a new learning experience for learners as an alternative to the typical learning method. Using the nature of games as an informal medium for learning while playing, REV-OPOLY assists learners in focusing while enjoying the learning process. It can be used as additional learning tools or even substitute lecture slides or books to help learners understand the subject. The question cards provided encourage the players to engage, interact and have constructive discussions among them. REV-OPOLY enables interactive lessons by combining virtual and real environments in the form of three-dimensional text, image, animation, audio, and video. By experiencing this web-based augmented reality board game, the findings showed that the majority of the participants enjoyed and were satisfied with the new method of learning using REV-OPOLY.

Acknowledgement

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