

Monopoly-based Game with Augmented Reality Intervention in Higher Education

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ABSTRACT

The gamification intervention is a pedagogical approach of learning activities that introduces game mechanics in a non-game context to drive the learning outcomes. In the era of technology and recent advances, the education system has evolved significantly, by adopting many software, tools, and gamification elements to learning. This concept paper will discuss how board games could be developed based on the typical gamification mechanics, specifically adopting the concepts of Monopoly. The application of board games with Augmented Reality (AR) elements in learning among undergraduate students is a new approach that can be taken in the classroom. By implementing AR into any gamification-based intervention, it gives the player better immersion and a different experience than they are used to. This study proposed that any subject in Higher Education will be better understood through the elements of gamification using board games. Additionally, the utilization of gamification in the education context exerts the element of fun in learning, through motivation and enthusiasm.

Keywords: Gamification, Augmented Reality, student-based learning.

I INTRODUCTION

In the new era of technology, the teaching and learning of undergraduate students in higher education should be suited and represented following the development of IR4.0 to achieve better learning outcomes in their core subjects. Many instructors are reluctant to include activities in the form of games, be it online or offline (during classes) in undergraduate courses, as it is time-consuming and seems difficult to accustom to new methods of teaching and learning.

For instance, courses such as Computer Application in Management that is offered in Universiti Utara Malaysia (UUM) as one of the program core courses, involves students from different backgrounds and programs of studies such as Law, Communication, Business Administration in Logistics and Transportation, Entrepreneurship, Marketing, Public Management, International Business Management, and Human Resource Management. These programs require a certain level of understanding and competency from the students in basic knowledge of

the latest technologies as these technologies are used as intermediary means to assist in many management-related applications, which are popular among professionals in their respective fields.

Thus, upon completion of the course, students are expected to be able to describe basic knowledge of computer technology and the evolution of it concerning the current Industrial Revolution 4.0 (IR4.0). Students will be able to classify, present, and apply the appropriate technological applications into different business and management situations as they have been exposed to the evolution of technologies and future trends prediction. Thus, it can be said that the subjects of Computer Application in Management can be quite a challenge to keep up with the exponential pace of technology change that rolls out in quick succession, impacting all aspects of professional organizations and society. Knowledge and Information Technology (IT) skills need to be developed to cope with the growing demands for the latest technology skills. It requires a lot of reading, research, and the ability to predict technology trends to stay relevant. Currently, Computer Application in Management uses a mixed-method between teacher-centered and student-centered in teaching and learning. However, it is difficult to discuss the rapid changes of technologies without much interest from the students to delve into the matter by themselves. Students are restricted from having the opportunity to get hands-on experience dealing with many new technologies such as the use of sensors in the Internet of Things (IoT) and smart campuses which have not been implemented in UUM due to many constraints. Learning the concepts and theory, together with hands-on approaches can enhance the students learning experience especially in the area of technology.

II LITERATURE REVIEW

Gaming has evolved to the point of being used as an approach to learning in various disciplines. By 2020, it is estimated that there are 2.7 billion gamers around the world (Gough, 2020). This high number shows that games can be used as an effective means for learning with great potential as it is more appealing to millennials and generation Z. A survey that was conducted by Adobe Education Creativity Study (2016) found that 93% students consider that it is essential to adopt technology as part of learning as they rely on technology for interconnectivity and

access to information which can be more interactive with the correct tools. Games are one of the tools that can be used to attract the interest of the new generation in learning as it can utilize traditional and technological-based learning through the infusion of classic games and technologies. Games are engaging as it modifies the learner's behavior to reach the desired experience such as finishing game levels or achieving higher scores (Powers, 2016). It can capture attention, engage in a target activity, and influence behavior. There are two different methods of utilizing games for education, through gamification such as adapting the concepts from classic board games as part of the learning process or game-based learning such as role play and simulation games.

Simulation games have been validated as effective teaching and learning tools (Anderson & Lawton, 2009; Faria, 2001; Faria et al., 2009; Hofstede et al, 2010). Simulation games may also improve social problem-solving skills, as proclaimed by Ahmadi, Mitrovic, Najmi, and Rucklidge (2015). In their study, TARLAN was developed as a simulation game to teach social problem-solving skills to ADHD children. Their results show that simulation games can be beneficial to ADHD children or children with social skill deficits. Additionally, simulation games also provide dynamic interaction, competition, and novelty which can boost learners' attitudes (O'Neil, Chen, Wainess & Shen, 2008). Pellas and Vosinakis (2018) found in their quasi-experimental study that students from the experimental group performed significantly better, both in measures of problem-solving and algorithmic thinking; where they were able to gain a greater understanding of skills related to Computational Thinking for developing, implementing, and transforming their solution plans into code based on their computational problem-solving strategies.

Technical subjects such as Programming can be complicated and difficult to learn. It is important to learn computer programming as we are shifting priorities towards the use of automation and interconnecting technologies. This helps to equip students and graduates to be ready for the IR4.0 workplace. Most professionals in the labor force are required to master programming skills, which is a highly sought skill of university leavers. Thus, institutions of higher education have begun offering programming courses as an extension to their major programs. However, several of these major programs are not computer-related (Ortiz, Chiluliza, & Valcke, 2017) which causes a major setback for students with little or no background in Information Technology (IT). Thus, these novice learners of programming may experience certain problems while attaining programming terms and contents. Due to these setbacks, the students have shown ineffectiveness in

learning, showed very little interest in the course, and lacked motivation (Khaleel, Ashaari, & Wook, 2019). To combat these problems, several researchers have proposed a myriad of solutions to create better engagement for their students in learning programming related course, such as mobile learning application, visualization, Web-based Java Programming, game-based learning, and 3D animation (Tsukamoto, Nitta, Takemura, & Nagumo, 2012; Chang, 2020; Dai, Zhao, & Chen, 2010; Tan, Ting, & Ling, 2009). It is suggested that the utilization of gamification could assist students to better acquire the concepts of a particular subject. Thus, the use of gamification is hoped to bring the game elements into the education context, and simultaneously exert the element of fun in learning.

A. Gamification

Gamification is defined as the process of including game elements or mechanics to a pre-existing experience to improve learners' engagement and enjoyment (Orlig, 2019). Gamification is the process by which services are enhanced utilizing motivational affordances to arouse gameful experiences and advance outcomes in behavior (Hamari, Koivisto & Sarsa, 2014). Another way to look at gamification is that it employs the same aspect of video games but in non-game applications (Su & Cheng, 2015). Thus, it can provide a more engaging and interactive method to study or revise for a rapidly changing technology as the game mechanics are added in the non-game context. It encourages and capitalizes on the technological progression of millennial and generation Z learners which can further enhance the educational benefits using gamification-based education.

The Computer Application in Management course, for example, broadens students' knowledge of the study of the emerging technology revolution. It covers among others, the IT infrastructure, the Internet, information management, digital markets and goods, IR4.0, and IT security and ethics. This will allow students to investigate the ways in which technology impacts them professionally and towards organizations. However, it is more impactful when learning about these technological advancements in fun ways rather than through typical lectures and classroom settings as it involves history and the future information of the technological revolution from the 18th century to the current, 21st century.

Gamification uses game-like features including points and various levels in a way that is not meant to entertain (De Byl, 2013). Its main goal is to foster more engagement in people by helping to create more robust experiences by utilizing game mechanics (Kim & Lee, 2015). Gamification is a great way to make mundane activities such as understanding the concepts and theories of any subjects and make them more

interesting and engaging. It transforms the passive learning environment and regular activities into a game to promote learning and deepen the understanding of the subject matter.

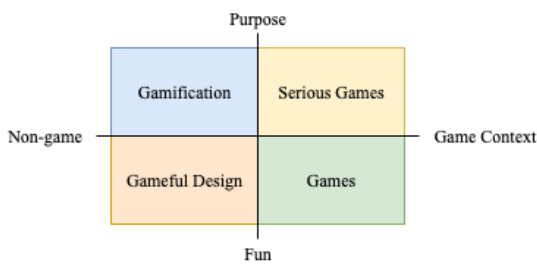


Figure 1. Gamification vs Game-based learning

A study on gamification among Postgraduate students found that gamification-based educational intervention was well accepted among millennial learners (Nevin, Westfall, Rodriguez, Dempsey, Cherrington, Roy, Patel, & Willig, 2014). It was found that they enjoyed the opportunity to compete for both individuals and teams to progress further on the leaderboard as it motivates them to be competitive.

Gamification concepts and techniques are used to engage and motivate the players to behave in a particular way in the pedagogical context through serious games (Sawyers & Smith, 2008), experiential learning theory (Kolb, Boyatzis & Mainemelis, 2001) and also Gamified Learning Theory (Landers & Landers, 2015). A basic and important distinction in any setting involves differentiating between intrinsic and extrinsic motivation. Intrinsic motivation occurs when a task is inherently interesting or enjoyable, whereas extrinsic motivation occurs when performing the task is a means to attain a desirable outcome (Ryan & Deci, 2000). In terms of gamification, as a motivational influence, players can be awarded an extrinsic prize or satisfy an intrinsic need such as the desire to succeed as a result of the game elements. The basics of any game involve working within a set of rules to achieve an objective, provide engagement, learning, and problem-solving.

B. Gamification vs Game-based Learning

Gamification and game-based learning are similar in the way that both learning approaches promote engagement and motivation in learning through game mechanics. In game-based learning, the learning activities are designed based on game characteristics and principles. It is meant to provide training and practice, for example, role-playing games. It is the process and practice of learning using games from the point of view of the learner. In game-based learning, the game itself is the lesson or is used as part of the lesson while gamification uses the game elements to reflect the learning context rather than the lesson itself. Game-based learning is the approach of participating

in learning while playing which is making the learning process more interesting by adding the fun characteristics of games. It can ascertain that the basic idea of the subject can be better understood as the theory of it is changed into practical knowledge. Through the game, it helps to increase the learning effectiveness, this improves the learning aspects. Game-based learning typically focuses on using commercial video games or creating full-fledged video games for education, such as role-playing games, strategy games, and simulation games that reflect the real environment and situations into the lessons.

C. Board Games

Numerous studies have been conducted on the effectiveness of board games in learning (Berland & Lee, 2011; Laski & Siegler, 2014; Carter et al., 2014; Cutumisu et al., 2019). Board games can help in various subjects and skills. Bayeck (2020) proposed that board games are spaces where people can learn many contexts and even mathematics. Board games are also capable in bringing possible interactions such as creativity, teamwork, and computational thinking. Moreover, board games aid to simplify complicated issues and systems.

A study done by Carter et al. (2014), analyzed a Warhammer 40,000 (W40K) board game. This game assists players to involve in critical and strategic thinking. The players are required to find descriptions for every army to draft their armies by using books provided by the designer of the game. The players can study from fiction books or conduct research before they play and use the knowledge when they play the board game. During the game, the players can use their own strategy based on the background study that they have.

Another board game is called Pandemic helps in complex computational thinking (Berland & Lee, 2011). By playing this game, players are able to comprehend the meaning of 'debugged' and form rules to create strategies and lead the game. This is done by communicating with the other players as the players need to form rules and complex logic together. Furthermore, another board game which brings benefit to learning is The RETAIN board game by RETAIN Labs Medical Inc. Edmonton, Canada. The board game is a real-life delivery room simulation. In a study by Cutumisu et al. (2019), they found that the RETAIN board game helped in enhancing participants' knowledge and performance of neonatal resuscitation scenarios. The finding of the study also supports the use of board game simulations in clinical training.

D. Monopoly Game

Many educational sectors and organizations have employed the Monopoly board game as a template reference to build their own games. For instance, The National Park Service has adapted its own version of Monopoly (Smith, 2008) with their National Parks Edition. It has also been applied to the world of business, which takes into account real estates through a board game entitled Heritage of Oshkosh (O'Halloran & Deale, 2010). In education, the monopoly games have been adapted to be applied to different fields, such as psychology (Schoen, 1996), sociopoly (Jessup, 2001), economy (Wiener, 1989), lodging development in tourism and hospitality (O'Halloran & Deale, 2010), business education (Tao, Hong, Yeh, 2010), and so on.

Collectively, the findings have shown that incorporating games such as Monopoly, or Monopoly-based games provide positive feedback from both the learners and instructors. For instance, the use of Monopoly in an introductory course in Financial Accounting are found to increase the competitiveness amongst the students which improves the classroom engagement where students are actively involved in grasping the nature and purpose of the financial accounting system compared to other pedagogical approaches that were previously used (Shanklin & Ehlen, 2017). Similarly, positive results were found by Gazdula and Farr (2019) by incorporating the monopoly game in teaching Risk and Probability, which students can reflect on decision making in risk environment using both formal and informal approaches which prompts for discussions, collaborative learning, and self-analysis among students.

E. Augmented Reality

Augmented Reality (AR) is a new element in education research, which helps educators to apply virtual objects into the classroom context. Based on the definition of AR, there are three main technological elements which are the combination, alignment, and real-time interaction of the real and virtual objects in the real environment and amongst the objects (Khan, Johnston, & Ophoff, 2019, p. 587). By implementing AR into any gamification-based intervention, it gives the player better immersion and a different experience than they are used to. It enhances traditional games with virtual elements which enables the virtual part of the game to stay hidden.

Some of the earliest studies which applied augmented reality to games include the work by Ohshima, Satoh, Yamamoto and Tamura (1998) and Govil, You and Neumann (2000). However, since the introduction of augmented reality to games, several drawbacks have

been identified, which includes the Head Mounted Devices (HMDs) for visualization being too uncomfortable for the wearer, this was then replaced by handheld devices, but this too seemed impractical as the device requires the players to hold it in an uncomfortable position. Other drawbacks include the use of markers on the board games, which was replaced by natural features.

Newer technology and improvements have allowed more updates to be made towards the use of augmented reality to board games. For instance, Molla and Lapetit (2010) use a simple webcam and Computer Vision Techniques to turn a board game into augmented reality.

III MONOPOLY-BASED GAME WITH AR

Based on the studies on this matter, it shows that gamification is an interesting matter to be explored as part of the assessment in education. A board game will be developed based on the typical gamification mechanics, specifically adopting the concepts of Monopoly. AR will be implemented as part of the board game for interactive content. The AR marker will be included on the Monopoly play cards to hide information from the players. The information is only revealed when the AR marker is scanned using any supported devices. It can reveal videos, text content, and other types of media. This enables the players to gain more knowledge from various sources through the AR code without revealing any information prior to playing the board game. By adding the AR implementation, the board can be designed with basic look-and-feel visuals, and changes to the game can be done through the AR, which means the gameplay of the board can be altered easily without having to change the physical element of the board.

A. Transfer of Learning

The objective of this Monopoly-based game with AR intervention is to assess the effectiveness of it towards the students' comprehension level in terms of their ability to make explicit references to previous learning, demonstrate and apply the knowledge in the game-based situation, in comparison to the traditional method of self-revision. It is expected that by introducing the elements of gamification using the board game, it can attract the students' interest in the course in addition to improving students' understanding. The game is used as a revision method to remind the students of the topic that has been covered during lectures. Students are expected to relearn the concepts that have been covered in the lessons through the question cards, discussions and voicing their opinion based on prior knowledge and critical thinking amongst the players and the answers (AR) provided in the board game as a benchmark of their understanding.

B. Intervention

A Monopoly-based board game with an AR element is introduced. A few factors need to be considered when designing the board game such as the game rules, theme, background story and questions that are suitable which enable students to focus on playing the game. To play the game, a dice is rolled for the players to move around the game board. The players will take turns to move. As an initial design, the board consists of fourteen spaces containing eight properties that contain questions. This is shown in Figure 2.

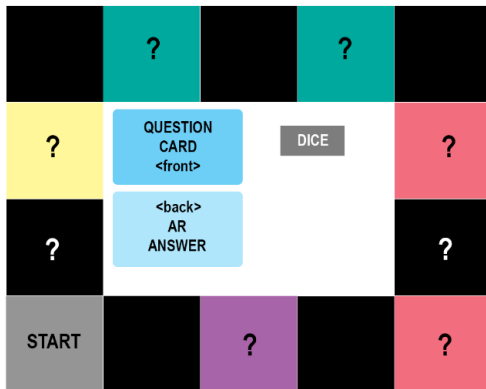


Figure 2. Initial plan of Monopoly-based game with AR

On the player's turn, the player who successfully answers the question from the question card will own the property. To make the game more interesting and to encourage discussion, other players who agree with the current player's answer can invest in the property. Each player is given four opportunities to invest in any property. The correct answer to the question is checked by scanning the AR code provided behind the question card. If the player and investors answer correctly, in the next round, they can charge other players who trespass on the property. However, if the answer is wrong, the property can be taken by another player. Players who invested in the property (wrong answer), will lose one of their investment opportunities. Therefore, this forces the players to understand and know the answers to the questions before taking the risk of investing.

This Monopoly-based game with AR intervention is currently being created and at its initial development state. The improvements expected towards it will be in terms of the game theme or background story, question cards, and the properties or spaces on the board game which are planned to be expanded so that it can cover more topics of the selected subject and course. It currently covers the topic of the Industrial Revolution which is part of the syllabus within the Computer Application in Management course in UUM.

IV CONCLUSION

In this paper, a monopoly-based game with AR intervention is proposed in attempting to utilize gamification into the education context to exert the element of fun in learning. It is expected that this gamification method can assist the students' comprehension level in acquiring important concepts and ideas in any subject in higher education, along with any program, field or discipline.

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