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Fadhilah Mat Yamin ; Wan Hussain Wan Ishak; Norsiah Hami



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Game in Teaching and Learning: Student's Acceptance and its Impact on Their Learning

Fadhilah Mat Yamin^{1,2 a)}, Wan Hussain Wan Ishak^{3, b)} and Norsiah Hami^{1, c)}

¹*School of Technology Management and Logistics, Universiti Utara Malaysia, Sintok, Kedah, Malaysia*

²*Institute for Management & Business Research (IMBRE), Universiti Utara Malaysia, 06010, Sintok, Kedah, Malaysia*

³*School of Computing, Universiti Utara Malaysia, Sintok, Kedah, Malaysia*

^{a)} Corresponding author: fmy@uum.edu.my

^{b)} hussain@uum.edu.my

^{c)} norsiahami@uum.edu.my

Abstract. Game based learning is one of the innovative approaches to complement classroom teaching. It utilizes game related technology and features to support and facilitate students' learning. In this study, a game called Hay Day has been used as a teaching tool to help students understand Enterprise Resources Planning (ERP) topics. The Hay Day game simulates agricultural activities, where students can apply the ERP concept to manage the resources in their farm in order to obtain optimum production and profit. Students were instructed to apply what they had learned on Hay Day after the face-to-face lecture. Students' acceptance of using Hay Day in their learning is evaluated once they have completed the course. Students must also take a final test that covers the ERP topic. The marks for that topic are taken and compared to students from the previous semester. The data on student acceptance of Hay Day demonstrate that students think Hay Day is a great tool for learning and that it is simple to use. The final exam revealed that the majority of students had a strong grasp of the ERP topic. This demonstrates that students' acceptance of the game has an impact on their understanding of the topic because the game allows them to put what they've learned into practice.

INTRODUCTION

Teaching and Learning (T&L) in the Fourth Industrial Revolution (IR 4.0) is very challenging. In order to improve T&L, educators and students must be able to adapt information and communication technology (ICT) in their T&L activities. To date, ICT provides a variety of tools and services that educators can use to construct novel teaching methods. Students might use ICT to access course content and materials (Bauer, 2019), search related works from the Internet (Yamin et al., 2013), online storage (Yamin & Ishak, 2015), as well as communicate with their peers (Vareberg et al., 2020). Furthermore, the teaching method should interest students, encourage them to "enjoy" their learning, and urge them to attend lectures and participate in learning activities (López-Fernández et al., 2019).

Game is one of the innovative approaches in T&L (Squire and Jenkins, 2003). It can be used as a supplement to standard teaching techniques to increase learners' learning experiences while also teaching other skills such as rule-following, problem-solving, interaction, critical thinking, creativity, teamwork, and good sportsmanship (Zirawaga et al., 2017). A review by Sudarmilah et al (2019) also reveals that games are one of the most effective strategies for teaching students.

A game can also help students become more motivated and interested in learning (Koivisto & Hamari, 2019). It has slowly gained traction as one of the most successful strategies for enhancing user engagement or motivating teachers (Rodrigues et al., 2019), improving student achievement (Yildirim, 2017), reducing distraction, and speeding up the learning curve (Yildirim, 2017).

This paper discusses our research on the usage of games in T&L, which was conducted on a group of students. A game software was chosen for the study to help with T&L. Students were invited to complete a questionnaire about their acceptability of the game as a T&L strategy after the learning session. We also keep track of their progress depending on their exam results.

GAMES IN EDUCATION

Games are also known to be an excellent way to supplement a blended learning strategy. Blended learning is a type of education that blends traditional place-based classroom methods with online educational materials and chances for online participation. It necessitates both the teacher's and the student's physical presence, as well as some student control over time, place, path, or pace. Previous studies have shown that blended learning has a positive effect on students' participation and improves their performance (Yamin & Ishak, 2017; López-Pérez et al., 2011).

The games utilized in T&L can be divided into two groups (All et al., 2016): special purpose games that were created with an educational goal in mind, and commercial-off-the-shelf games that were created for amusement purposes but are now being used in an educational setting. Penfold (2015) provides examples of educational games with a unique purpose: 1) Duolingo, 2) McDonalds, 3) LIFESAVER, 4) City Witness, 5) Train4TradeSkills, 6) Heineken, and 7) Noble Prize. Interactive gamification components such as point systems and leaderboards, voting systems, collaboration, realistic simulation, progression, dynamic feedback, and sound effects were used on these platforms. The commercial-off-the-shelf games can be any games that are suitable and can be used for T&L.

Several studies have demonstrated the usage of games in T&L to teach mathematics (Faghihi et al, 2014 and Ke, 2013), factory management education (Müller et al., 2016), and software engineering education (Alhammad & Moreno, 2018). These studies suggest that employing a gaming strategy to aid T&L is a very effective method.

To increase its effectiveness, students who attain a particular level of achievement will be awarded. Various strategies, including as progress bars, achievements boards, in-app cash, and leaderboards (Krasko, 2018), can be used to display the reward. This method can help students become more motivated to earn points and improve their grades in class. As a result, learning will be more enjoyable.

METHODOLOGY

The respondents in this study are students enrolled in Manufacturing Information System and Operation in the first semester of 2017/2018 (A171). Respondents were asked to participate in a game relating to the ERP issue. ERP is one of the most important issues in Manufacturing Information Systems and Operations. ERP is tough to grasp since it entails planning and decision-making. ERP is typically implemented at the middle and upper levels of an organization's management structure.

The game used in this study is Hay Day (Figure 1). Hay Day is a freemium mobile farming game. This game is suitable to demonstrate planning and decision making to increase the production of a farm based on limited resources. As seen in Figure 1, in the Hay Day virtual environment, the player can purchase a variety of industrial equipment. The input produce from the farm was used to operate this equipment. Wheat, carrots, soya, chili, and other crops are shown in Figure 2 as examples of crop inputs. These crops must be harvested after a certain period of time has passed in order to acquire the input for the production. Figure 3 depicts an animal farm area with cows, chickens, sheep, and other animals. These animal products, such as eggs, cow milk, and goat milk can be utilized in a dairy mill to generate cheese, butter, and cream, which can then be used as a raw material in other manufacturing processes. The silo (Figure 4(a)) houses all of the farm's raw materials, while the barn (Figure 4(b)) houses the finished products. The storage capacity of the silo and barn must be increased. To enhance storage, the player must gather sufficient objects such as nails, screws, and bolts. As a result, this game requires the player to manage resources in order to maximize production and raise the game's level.

After attending the class lecture on the ERP topic, the students were asked to play Hay Day. Students were advised and briefed about the game and how to play it. Students were also reminded that they are supposed to apply their knowledge of ERP while playing the game. After completing several levels, students were given a questionnaire to access their acceptance of Hay Day as a learning tool. The questionnaire applies a 7-likert scale that ranges from 1 (Very poor) to 7 (Exceptional). The feedback from the questionnaire was analyzed using frequency analysis by grouping the respondents' feedback into three groups; poor (1-3), fair (4), and good (5-7). The respondents' acceptance of Hay Day as a learning tool is measured based on performance expectancy, effort

expectancy, and attitude toward using the game. Finally, students' answer to the ERP topic from the final exam question were used to assess the impact on students' academic performance. The students' grades were compared to those of the previous semester's students.



FIGURE 1. Example of View in Hay Day Virtual Environment



FIGURE 2. Example of the virtual crops area



FIGURE 3. Example of the virtual animal area



(a) Silo Storage



(b) Barn Storage

FIGURE 4. Storage – silo and barn

FINDINGS AND DISCUSSION

Figure 5 depicts the average of each measurement's score percentages. As shown in Figure 1, most of the respondents (85%) have good expectancy that the Hay Day game is beneficial and useful to increase their understanding and learning performance. Only 15% have fair judgement on Hay Day. In term of effort expectancy, 90% of the respondents give positive responses. This is due to the fact that Hay Day is simple to play, and the procedures for working on the farm are clearly presented when users first start the game. All respondents (100%) agree that Hay Day is a good choice of game to support their learning on ERP topic. In comparison to traditional classroom learning, the respondents also agree that their learning is more entertaining and interesting.

The impact of this study is measured by comparing the students' final examination results from the current semester with the previous batch. Table 1 demonstrates that all students can answer the ERP questions quite well, with the lowest mark received by the students being 6/10 out of ten, and the average score for all students being 7.2/10. When compared to the preceding batch in the A162 session, this achievement is superior. Only a few students in the A162 session were able to receive a mark for this question, with the highest marks being 5/10 and an average of 3.75/10 for all students.

In summary, the findings confirm that student acceptance of Hay Day as a learning aid corresponds to their actual achievement (Table 1). This demonstrates that Hay Day is an excellent game for students to learn about ERP. Thus, confirm that gaming is a viable T&L strategy. The game makes T&L fun, enjoyable and interesting. As a result, students have a better learning experience and are better able to visualize the learning concept than they would with a traditional approach. This finding is consistent with Yildirim (2017), Xia & Hamari (2019) and Oweis (2018), which found that games had a significant favorable impact on students' learning and performance.

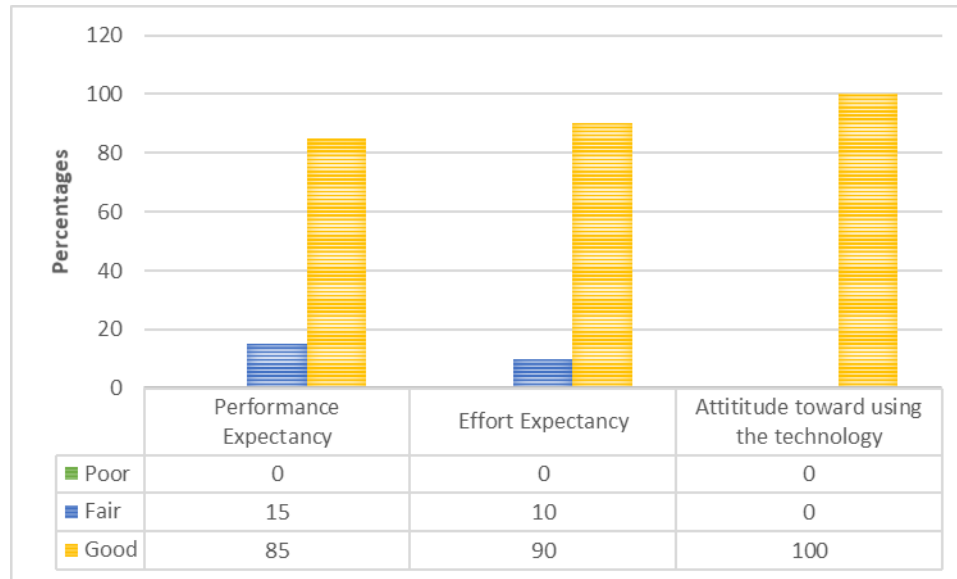


FIGURE 5. Respondents' Acceptance on Hay Day

TABLE 1. Comparison of exam results for semester A162 & A171

	A162	A171
Min	0/10	6/10
Max	5/10	8/10
Average	3.75/10	7.2/10
Median	5/10	8/10

CONCLUSION

The findings of this study show that playing games can help students learn more about the subject they are studying. Hay Day was used in this study to assist students practise and grasp the ERP topic. The data reveal that students had a positive attitude on Hay Day in terms of improving their ERP knowledge. This is due to the fact that Hay Day is very simple to comprehend and use, needing little effort on their part. As expected, the findings show that students perform better on ERP questions this semester than the previous semester. This demonstrates why using games in T&L is a good idea. Most importantly, this research demonstrates that student adoption of games as a T&L method correlates with their performance.

Other game software can be investigated in future study to see if it has potential in T&L applications. This is due to the fact that gaming software can differ in terms of functionality and requirements. As a result, instructor and student must be able to adapt and use game features to the focus topic. This study can be expanded in the future to include a larger number of respondents and to cover multiple topics rather than a single topic.

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