

The Use of a Game to Teach Enterprise Resource Planning

Fadhilah Mat Yamin^{1,2*}, Wan Hussain Wan Ishak³ and Norsiah Hami¹

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

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

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

ABSTRACT

Computer games have been one of the potential approaches in education. The game has been adapted to aid teaching and learning (T&L) by capturing students' attention and making learning enjoyable. Games also serve as a virtual environment where students can explore and apply knowledge, gain experience and develop skills. In this study, a game called Hay Day was utilised as a teaching aid to help students comprehend Enterprise Resource Planning (ERP) subjects. The Hay Day is an agricultural simulation game in which the player must plan, organize, and manage available resources in order to optimise productivity, profit, and rewards. Students must use what they have learned in class in order to reach the goal. Once the course is completed, students' acceptance of using Hay Day in their learning is assessed. The students' marks for ERP topic are also compared to the marks obtained by the previous semester's students. The results show that the vast majority of students have a thorough comprehension of the ERP topic. Students' acceptance of the game has an impact on their grasp of the problem since it helps them to put what they've learned into practice.

Keywords: Computer game, Teaching and Learning, Enterprise Resource Planning, Technology Acceptance, Blended Learning

1. INTRODUCTION

A game is a systematic kind of play that is usually done for the purpose of pleasure or enjoyment. It usually involves skills, knowledge, or luck, with specified rules being followed in an attempt to defeat an opponent or solve a problem. In teaching and learning (T&L), computer games have become one of the popular tools due to their interactive and entertaining features [1]. As highlighted by López-Fernández et al [2], the teaching technique should pique students' attention, motivate them to "enjoy" their learning, and encourage them to attend lectures and participate in learning activities.

The use of games in T&L is consistent with the blended learning strategy. Blended learning is a type of T&L that mixes traditional classroom learning with online learning. Blended learning has been found to be effective for improving students' learning experiences and performance [3]. Games may be useful as a supplement to blended learning to increase students' engagement by making learning fun and more interactive. For example, Kahoot! is a game-based learning platform that is widely used to engage students during T&L [4].

In general, games that are used in education can be categorised into two: educational games and entertainment games [5]. Educational purpose games are those that were designed with T&L in mind. These games are primarily intended to achieve an educational goal. An example of this type of game can be seen in [6]. Entertainment purpose games, on the other hand, are games designed solely for the goal of amusement. However, some of these games have educational benefits and

*Corresponding Author: fmy@uum.edu.my

are appropriate for use in T&L. Many of these games can be found on the Google Play Store (play.google.com).

Aside from being interactive and entertaining, games in T&L provide numerous advantages. As for instance, a review by Wang and Tahir [4] indicates that Kahoot! has a positive impact on learning performance. Earlier studies by Yildirim [7] revealed that games in T&L have a positive impact on student achievement and attitudes towards lessons. Zirawaga et al [8] also highlighted that games can increase student engagement, aid in memorization, improve visual and computer literacy abilities, improve rule following, improve problem solving and critical thinking, aid in concentration, develop sportsmanship, and peer interaction and teamwork. According to one study, game-based learning experiences can boost students' motivation and enthusiasm for learning [9].

Several studies have shown that games can be used successfully in T&L to teach math and algebra [10;11;12], manufacturing management education [13], history [8], software engineering education [14]. According to these studies, using a game strategy to help with T&L is a very effective method.

This paper discusses our findings from using the game Hay Day to teach Enterprise Resource Planning (ERP). On the market, there are ERP simulation game software that may be used to model ERP procedures [15]. However, this software required a subscription, which most students could not afford. Hay Day is a free-to-play agricultural game for mobile devices. This game can be used to demonstrate how to plan and make decisions in order to maximise a farm's output while dealing with limited resources. Thus, this game is appropriate for simulating ERP processes. Students were asked to fill out a survey at the end of the semester about their acceptance of the game as a T&L approach. The scores that students received for the ERP topic in the final examination were also analysed.

2. HAY DAY TO SIMULATE ERP PROCESSES

Enterprise Resource Planning (ERP) is an integrated management of key business processes, which is often done in real time and mediated by software and technology. ERP is a type of business management software that companies use to manage day-to-day operations, including accounting, procurement, project management, risk management, and compliance, as well as supply chain operations (Figure 1). ERP is a challenging topic to grasp because of its complexity and the fact that it necessitates planning and decision-making. ERP systems are usually installed at the middle and upper levels of a company's management hierarchy.

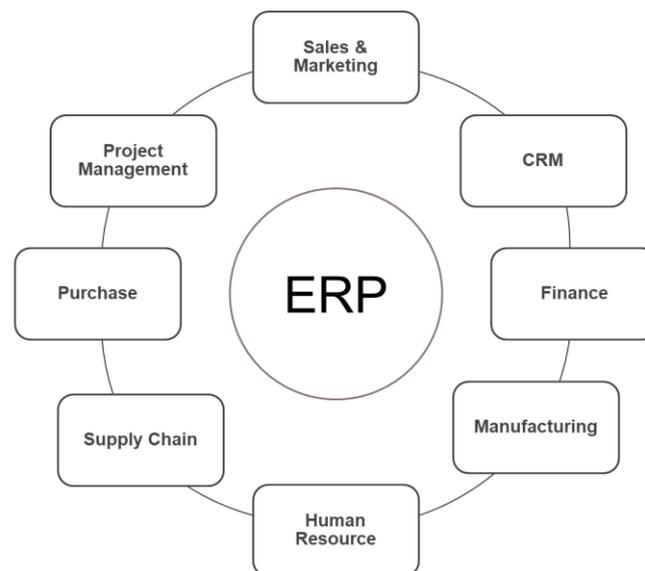


Figure 1. Components of ERP

Hay Day can be used to imitate the ERP components indicated in Figure 2. The user can purchase and operate a range of manufacturing equipment in the Hay Day virtual environment. These machines may be used to make a variety of things, including breads, cakes, clothes, jewelry, and many more. Crops grown by players and animals kept by them will be used as input for production. Players must plan their activities efficiently in order to collect enough input for the production. Production surpluses can be sold for profit (Figure 3). In addition, if necessary, players may purchase supplies from other players.

Figure 4 depicts some of the crop inputs that the player can plant, such as wheat, carrots, soya, and chili. To obtain the input for production, these crops must be harvested after a particular amount of time has passed. Figure 5 displays a cow, chicken, sheep, and other animals on an animal farm. Eggs, cow milk, and goat milk, for example, can be used in a dairy mill to make cheese, butter, and cream, which can then be used as a raw material in other production processes.

The farm's raw materials are stored in the silo (Figure 6(a)), while half-completed and finished products are kept in the barn (Figure 6(b)). The storage capacity of the silo and barn must be increased in order to keep sufficient room for the objects. To increase storage, the player must collect enough materials like nails, screws, and bolts. As a result, the player must wisely manage all resources in order to maximise production and increase the game's level.

Aside from that, the player can enlist some help in finding the necessary supplies and managing the animals' farm. For example, Tom (Figure 7(a)) can be hired to look for anything on the player's behalf. Rose and Ernest (Figure 7(b)), on the other hand, can be hired to run the animals' farm. In order to use their services, players must pay them either diamonds or coins.



Figure 2. Example of View in Hay Day Virtual Environment



(a) Roadside shop



(b) Lorry and visiting customer

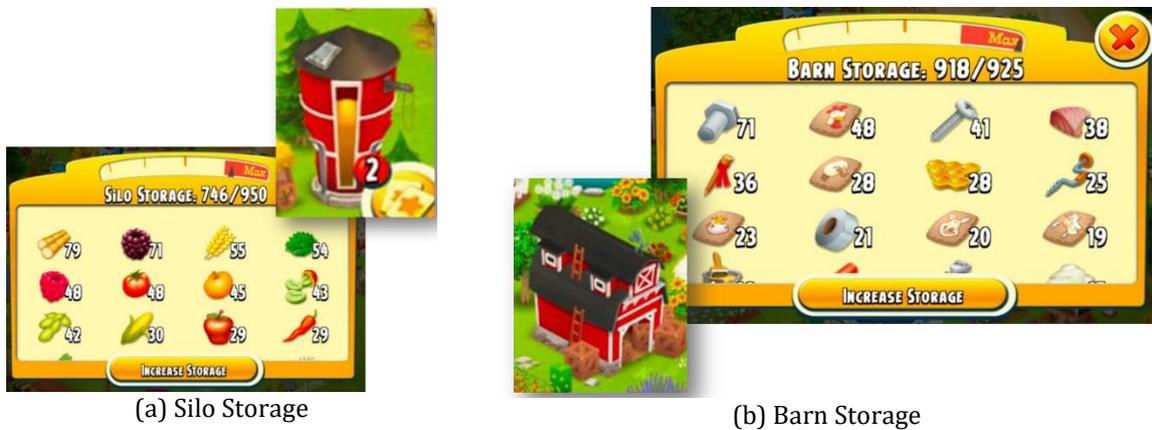
Figure 3. Selling Products



Figure 4. Example of the Virtual Crops Area



Figure 5. Example of the Virtual Animal Area



(a) Silo Storage

(b) Barn Storage

Figure 6. Storage – barn and silo



(a) Tom

(b) Rose and Ernest

Figure 7. Human Resources

3. METHODOLOGY

The respondents in this study are students in the first semester of 2017/2018 (A171) who are enrolled in Manufacturing Information System and Operation. ERP is one of the topics covered in this course. The students were asked to play Hay Day after the lecture and discussion session was over. 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.

At the end of the course, students were given a questionnaire to assess 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 analysed using frequency analysis by grouping the respondents' feedback into three groups; poor (1-3), fair (4), and good (5-7). Finally, the score percentage is calculated. 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' answers 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.

4. FINDINGS AND DISCUSSION

The average of each measurement's score percentages is shown in Figure 8. As indicated in Figure 8, the majority of respondents (85%) believe that the Hay Day game will help them improve their knowledge and learning performance. Only 15% have fair judgement on Hay Day. In terms of effort expectancy, 90% of the respondents give positive responses. Hay Day is simple to play, and the guidelines for working on the farm are clearly given 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.

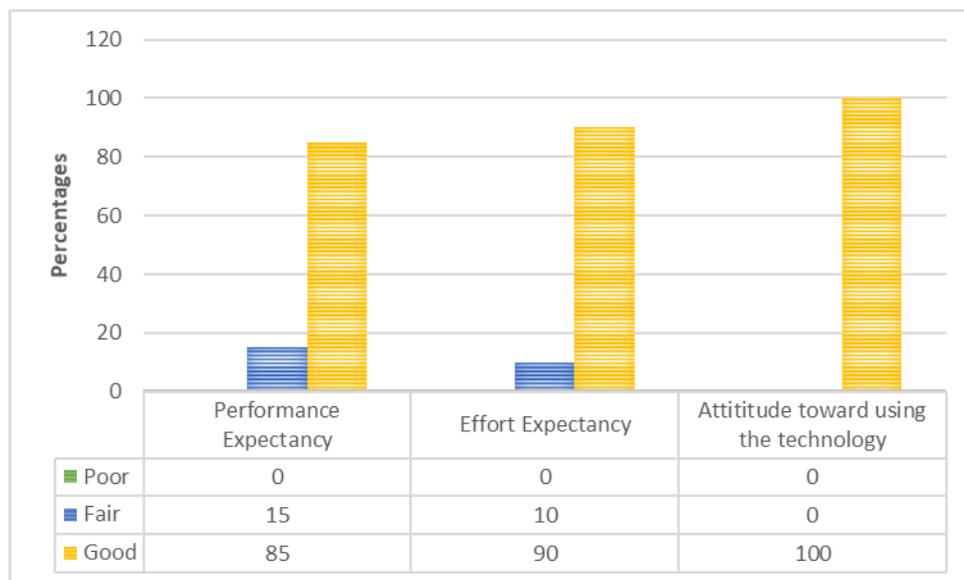


Figure 8. Respondents' Acceptance on Hay Day

The impact of this study is determined by comparing the current semester final examination scores to the previous batch. Figure 9 shows that all students can answer the ERP questions reasonably well, with the lowest score being 6/10 (out of ten) and the average score for all students being 7.2/10. This performance is superior to that of the previous batch in the A162 session. Only a few students in the A162 session were able to receive a mark for this question, with the highest score being 5/10 and the overall average being 3.75/10.



Figure 9. Comparison of exam results for semester A162 & A171

In summary, the findings confirm that student acceptance of Hay Day as a learning aid corresponds to their actual achievement (Figure 9). This demonstrates that Hay Day is an excellent game for students to learn about ERP. As a result, we can 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 visualise the learning concept than they would with a traditional approach. This finding is consistent with [4;7;8;9] which found that games had a significant favourable impact on students' learning and performance.

5. CONCLUSION

The findings of this study suggest that students can learn more about the subject they are learning by playing games. In this study, Hay Day was utilised to imitate ERP operations and help students practise effective management and problem solving. The findings show that students had a positive attitude on Hay Day in terms of strengthening their ERP knowledge. This is because Hay Day is so easy to understand and use, requiring little effort on their part. As expected, students do better on ERP questions this semester compared to the previous semester's students. This exemplifies why employing games in T&L is beneficial. Most notably, this study shows that students' use of games as a T&L approach correlates with their academic achievement.

Other game software can be investigated in future studies 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, the instructor and students 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.

In the future, other game software can be studied to see if it has potential in T&L applications. This is because gaming software might vary in terms of usefulness and requirements. As a result, both the instructor and the student must be able to adapt and utilise game features in relation to the focus topic. In the future, this survey could be expanded to include a larger number of respondents and to cover multiple topics.

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REFERENCES

- [1] E. Sudarmilah, I.H.A. Wahab, D.A.P.Putri, W.D.Pratisti, I. Yuliana, "Game Education of Disaster Mitigation: A Systematic Literature Review", *International Journal of Advanced Trends in Computer Science and Engineering*, 8(6), (2019), pp: 2940 – 2943.
- [2] D. López-Fernández, J.M. Ezquerro, J. Rodríguez, J. Porter, V. Lapuerta, "Motivational Impact of Active Learning Methods in Aerospace Engineering Students", *Acta Astronautica*, 165, (2019), pp. 344-354.
- [3] F.M. Yamin, W.H.W. Ishak, "Does the Blended Learning and Student Centered Learning Method Increase Student's Performance?", *Proceedings of the 1st Inspirational Scholar Symposium (ISS 2016)*, (2017), pp. 8-17.
- [4] A.I. Wang, R. Tahir, "The effect of using Kahoot! for learning – A literature review", *Computers & Education*, 149, (2020), 103818, <https://doi.org/10.1016/j.compedu.2020.103818>
- [5] A. All, E.P.N. Castellar, J.V. Looy, "Assessing the Effectiveness of Digital Game-Based Learning: Best Practices", *Computers & Education*, vol. 92-93, (2016), 90-103.
- [6] S. Penfold. "7 Elearning Examples that Use Gamification to Engage Learners", 2015, available at: <http://www.elearningsuperstars.com/gamification-examples/>
- [7] I. Yildirim, "The Effects of Gamification-Based Teaching Practices on Student Achievement and Students' Attitudes Toward Lessons", *Internet and Higher Education*, 33, (2017), pp. 86-92.
- [8] V.S. Zirawaga, A.I. Olusanya, T. Maduku, "Gaming in Education: Using Games as a Support Tool to Teach History", *Journal of Education and Practice*, 8(15), (2017), pp: 55-64
- [9] J. Koivisto, J. Hamari, "The Rise of Motivational Information Systems: A Review of Gamification Research", *International Journal of Information Management*, 45, (2019), pp. 191–210.
- [10] S.N.M. Mohamad, I.B.M. Khanapi, N.A. Ismail, "Mobile Game Application for Student with Learning Disabilities to Improve Understanding on Addition and Subtraction Operation", *Proceedings of the International University Carnival on e-Learning*, (2019), pp. 166-168.
- [11] U. Faghihi, A. Brautigam, K. Jorgenson, D. Martin, A. Brown, E. Measures, S. Maldonado-Bouchard, "How Gamification Applies for Educational Purpose Specially with College Algebra", *Procedia Computer Science*, 41, (2014), pp. 182–187.
- [12] F. Ke, "Computer-Game-Based Tutoring of Mathematics", *Computers & Education*, 60, (2013), pp. 448–457, <https://doi.org/10.1016/j.compedu.2012.08.012>
- [13] B.C. Müller, C. Reise, and G. Seliger, "Gamification in Factory Management Education—A Case Study With Lego Mindstorms", *Procedia CIRP*, 26, (2016), pp. 121–126.
- [14] M.M. Alhammad, A.M. Moreno, "Gamification in Software Engineering Education: A Systematic Mapping", *Journal of Systems and Software*, 141, (2018), pp. 131-150. <https://doi.org/10.1016/j.jss.2018.03.065>
- [15] P.M. Léger, J. Robert, G. Babin, D. Lyle, P. Cronan, P. Chartran, "ERP Simulation Game: A distribution game to teach the value of integrated systems", *Developments in Business Simulation and Experiential Learning*, 37, (2010), pp. 329-334