

Preliminary Study on Educational Game-based Learning Approach in Financial Accounting Course: Bicycle Accounting Classification Game

Maisarah Abd Rahim¹; Asyraf Afthanorhan*²; Nurul Fatimah Ilias³; Norazzie Md Zin⁴; Noor Azlina Abdullah⁵; Jasmin Ilyani Ahmad⁶

¹Senior Lecturer, Faculty of Accountancy, Universiti Teknologi Mara, Malaysia.

¹maisarahrahim@uitm.edu.my

²Faculty of Statistic, Universiti Islam Sultan Zainal Abidin, Malaysia.

²asyrafafthanorhan@unisza.edu.my

³Lecturer, Faculty of Accountancy, Universiti Teknologi Mara, Malaysia.

³tieha2303@uitm.edu.my

⁴Lecturer, Faculty of Accountancy, Universiti Teknologi Mara, Malaysia.

⁴noazzie@uitm.edu.my

⁵Senior Accounting Lecturer, Faculty of Accountancy, Universiti Teknologi Mara, Malaysia.

⁵azlina274@uitm.edu.my

⁶Senior Lecturer, Faculty of Computer and Mathematical Sciences, Universiti Teknologi Mara, Malaysia.

⁶jasmin464@uitm.edu.my

Abstract

The study has designed an educational game-based learning through the introduction of an interactive game called “bicycle accounting classification game”. The game was created to stimulate interest in learning basic financial accounting courses that are normally portrayed as a serious subject. The bicycle accounting classification game tool kit has been developed as a learning and teaching aid to enable students to collaborate and engage in the financial accounting course. The main purpose of the study is to identify the effectiveness of the tool as a mechanism to enhance students’ learning motivation investigated through individual psychological needs of autonomy, competence and relatedness in a financial accounting course. The sampling was implemented to 4 accounting lecturers and one computer science lecturer in a small group tryout and 30 non accounting students in field tryout. Questionnaires were used for data collection and analyzed using quantitative methods. From the experimental results, it is discovered that the bicycle accounting classification game has contributed to the positive learning motivation, in terms of promoting their learning participation and improving their learning excitement and understanding in the financial accounting course given that knowledge organizing, and sharing is embedded in the collaborative gaming environment.

Key-words: Educational Game-based Learning, Learning Motivation, Accounting Education, Financial Accounting Course, Malaysia.

1. Introduction

Game basically is a tool that can engage and motivate users. Usually, games are used for entertainment purposes. It is an interactive application, thus so powerful to attract users especially children and teenagers. In spite of that, games nowadays are used in many areas, especially education. Due to rapid technological advancement and emergence of gaming applications nowadays, game-based learning has been embedded into the educational process throughout the world. The main purpose of the game-based learning is it will act as a tool for students to remain engaged with the materials and assignments (Bovermann, Weidlich, & Bastiaens, 2018). Moreover, the game-based can enhance the student's interest and enthusiasm for learning, thus they are attracted and motivated to learn the subject (Sari et al., 2019). Hence, it is easy for them not only to memorize facts and formulas but also to grab the skills and techniques required for the subject.

Currently, the digital or web-based games have highly assisted in the learning process (Vlachopoulos and Makri, 2017) as the term used is gamification which can be defined as using elements of gaming in the non-gaming arena to encourage desired behaviour (Deterding, 2011). On top of that, evidence also portrayed that, vast number of new websites, services, blogs and social networking platforms have been developed and still growing to emerge with the invention of Web 2.0 technology (Kayimbaşioğlu et al., 2016). Thus, teachers, lecturers, tutors or instructors of the educational centres are highly required to integrate the usage of gamification in their classes so that the learning style applied is not obsolete. Instead of old-fashioned classroom style, adopting gamification as part of the learning process will ensure the teaching and learning process become up to date and full of excitement.

Therefore, this study has developed a bicycle accounting classification game tool kit to facilitate students in understanding and applying the accounting classification topic in the basic accounting course in secondary school and university. The study is also intended to examine the effectiveness of using the bicycle accounting game tool kit in facilitating the students to comprehend and organize the subject matter. Moreover, the aim of the study is to identify the effectiveness of the tool as a mechanism to enhance students' learning motivation investigated through individual psychological needs of autonomy, competence and relatedness.

2. Literature Review

Learning Motivation Using Game-based Learning in Financial Accounting Course

The main purpose of embedding game-based models in teaching and learning into the basic financial accounting course is to enhance the learning motivation, excitement and achievement in the learning process. Since the course is the fundamental subject, most of the students have no accounting knowledge. Therefore, it is very important to ensure the students are well-motivated to focus, learn and understand the subject matter. It is also important to promote excitement in the learning process as well as ensuring academic achievement. Research done by Gupta et al. (2006) found that the use of crossword puzzle games in an introductory accounting subject increases students' interest, motivation and participation in the subject matter. While, Seow and Wong (2016) developed the first mobile gaming app for accounting known as Accounting Challenge (ACE) and the students have given responses that ACE enabled them to learn accounting in a fun way and assisted them to better learn accounting courses.

According to Bovermann and Bastiaens (2020), gamification in education relates to motivational learning behavior or engagement in activities. The Self Determination Theory (SDT) is among the theories related to human motivation and personality as proposed by Deci and Ryan (1985). It is a formal theory that defines intrinsic and varied extrinsic sources of motivation (Ryan and Deci, 2020). Intrinsic factors focus on individuals such as attitude, goal and emotions, while extrinsic motivation rests in circumstances outside the learning process (Law et al., 2010). As summarized by Bovermann and Bastiaens (2020), the SDT posits that human motivation has three essential psychological needs known as autonomy, which refers to the need for freedom; competence refers to desire to gain proficiency; and relatedness, which is the need to be connected to others. Sánchez-Oliva et al. (2020) further explained the need for autonomy as having control over individual own behaviour; the need for competence as a feeling of being successful; the need for relatedness as a feeling of belongings. They also discovered that students with highly satisfied psychological needs of autonomy, competence and relatedness are less likely to feel demotivated and hence more likely to engage in physical education in school. Legault (2017) described that SDT also deals with critical impact of the social and cultural elements in assisting individual's physical needs, self-direction, performance and well-being. It also indicates that humans are involved in dynamic interaction with the social world for their own satisfaction and responding to circumstances (Legault, 2017). Thus,

this theory of SDT which is represented by psychological needs of autonomy, competence and relatedness has become a basis of this research.

A study by Skinner et al. (2008) using motivational development to investigate behavioural and emotional engagement of school students revealed that autonomy is the highest factor of changes in emotional engagement. It somehow shows that game-based learning allows the students to have autonomy or freedom of choosing time, place and with whom to conduct their study. When individuals are involved in an activity because they think it is exciting, they are doing it with full desire (Gagne and Deci, 2005). While students with high level of competency were likely to improve their effort in class and had moderately increased interest in the learning activities (Skinner et al., 2008). Finally, the study also indicated that relatedness has acted as a central role, where students with good relationships with their teachers show more effort and enjoyment in the learning process (Skinner et al., 2008). In addition, research by Lan and Hew (2020) also found that the components of SDT (autonomy, relatedness, competence) are significantly related to the components of engagement (behavioural, emotional, cognitive).

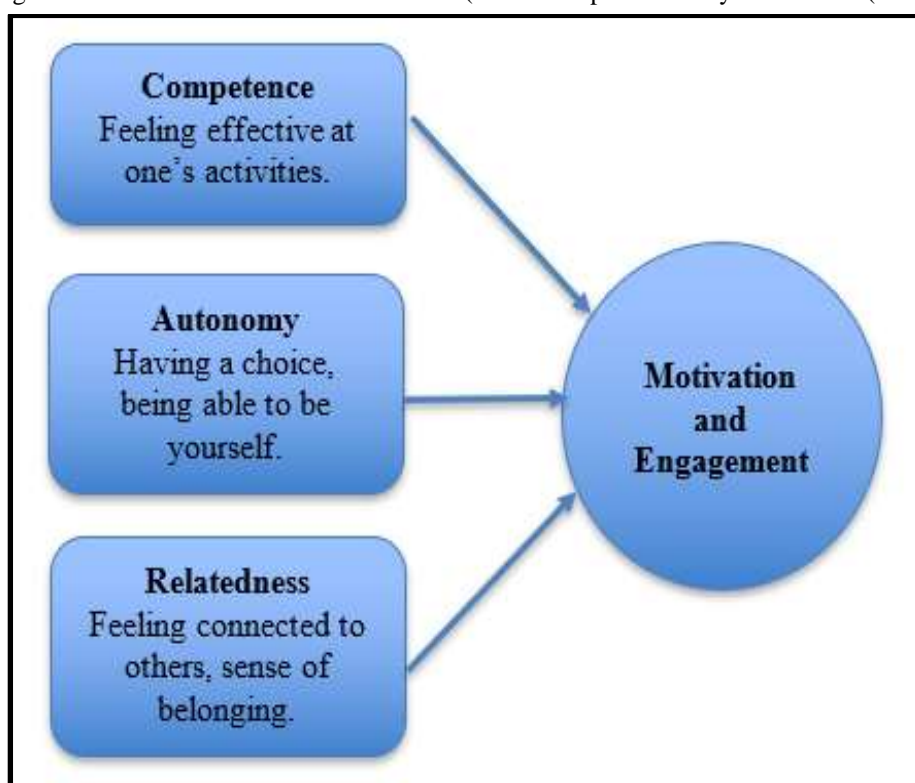
A study by Ryan et al. (2006) investigating computer game play found that game features with more perception of autonomy, competence and relatedness enhance motivation to play which related with feeling of presence when playing a game. Deterding (2011) introduced a concept of motivational affordances and connected it to SDT for researchers to study on the motivational dynamics of gamification. In another research conducted by Peng et al. (2012) discovered that the game features have impacted the players' engagement and motivation through psychological needs of autonomy (for example, player has choice of avatar) and competence (by having achievement badges). While an investigation on the interrelationship between motivation, engagement and complex problem solving in game based learning by Eseryel et al. (2014) revealed that motivation which are represented by interest, competence, autonomy, relatedness, self-determination, and self-efficacy have an impact on learners' problem solving outcomes. Furthermore, Van Roy and Zaman (2017) studied the potential of gamification as a learning technique from the perspective of SDT. They believed that psychological needs underlying the SDT help to facilitate or impede the gamification process.

In a research conducted by Law et al. (2010) to investigate the key motivating factors affecting learning among university undergraduate students found that, 'individual attitude and expectation', 'clear direction', and 'reward and recognition' have the greatest motivating effect on learning. In addition, three motivating factors, namely, 'individual attitude and expectation', 'challenging goals', and 'social pressure and competition' have a significant and positive relationship

with efficacy. In another study, it was concluded that learning with educational card games could assist the students to further understand the knowledge and even increase their interest in the subject matter (Liu and Chen, 2013). Furthermore, the application of game-based learning creates opportunities for educators to explore their teaching potential by using various modes of teaching on top of traditional classrooms (La Guardia et al., 2014), hence will enhance students' motivation and excitement in learning.

Based on the previous literature, below is the theoretical framework for this research that was adapted from Model Ryan and Deci (2017) as shown in Figure 1.

Figure 1 - Research Theoretical Framework (Source adapted from Ryan and Deci (2017))



The model which is based on Self-determination theory (SDT) which is a framework developed by Edward L. Deci and Richard M. Ryan in the mid 1980s. The theory was conceptualized motivation based on choices made by others. It consists of three human essential needs which are competence, autonomy, and relatedness. According to Ryan and Deci (2000) and Majid et al. (2019), competence is when people need to be able to master tasks and learn a variety of skills. With competence compliances, people can adapt with the environment and can accept changes in circumstances. Other than that, relatedness is defined as people need to have a sense of belonging and affection to others. This criterion is important for individuals that can motivate them to care for

others. On the other hand, autonomy is people's desire to feel free in their own lives. People with autonomy can control themselves instead of being controlled by outsiders. The combination of these three needs can contribute to motivation and engagement, thus can enhance people performance and well-being.

Based on the SDT Theory, the research has come out with three hypotheses developments. The three hypotheses developments are:

1. Perceived competency has a positive relationship with the effectiveness of using the bicycle accounting classification game tool in enhancing students' motivation in learning basic financial accounting courses.
2. Perceived autonomy has a positive relationship with the effectiveness of using the bicycle accounting classification game tool in enhancing students' motivation in learning basic financial accounting courses.
3. Perceived relatedness has a positive relationship with the effectiveness of using the bicycle accounting classification game tool in enhancing students' motivation in learning basic financial accounting courses.

These three aspects of autonomy, competence and relatedness of the motivation theory of SDT are used as the basis for gamification pedagogy approach of the gamification user types and associated game mechanics (Gil et al., 2015), which can explain students' motivational behavior (Bovermann and Bastiens, 2020).

3. Methodology

Design of the Game

Kiryakova et al. (2014) suggest that in real life, individuals do not feel that they are as good as they are in games because when confronted with obstacles, people may feel depressed, overwhelmed, frustrated or cynical; feelings that are not present in the gaming environment. individuals also prefer instant gratification to keep themselves engaged and motivated. A serious game should include learning excitement to lead to self-determination in learning. Thus, in designing the game-based learning, we have planned on a game that can deliver the learning outcome for specific accounting chapters in the accounting introductory level with excitement that can motivate students to self-learn. The said accounting chapter involved is Accounting Classification and Accounting Equation.

We applied the revised Bloom’s Taxonomy established by Anderson and Krathwohl (2001) as the design standard for the educational card game in designing this game. In the knowledge dimension of the revised Taxonomy, knowledge is divided into four levels from concrete to abstract: factual knowledge, conceptual knowledge, procedural knowledge, and meta-cognitive knowledge. Cognitive processes are divided into six levels from low complexity to high: remember, understand, apply, analyse, evaluate, and create (Eric & Po-Kuang, 2013).

Furthermore, we follow steps outlined by Huang and Soman (2013) as per below in Figure 2.

Figure 2 - Steps in Applying Gamification Element

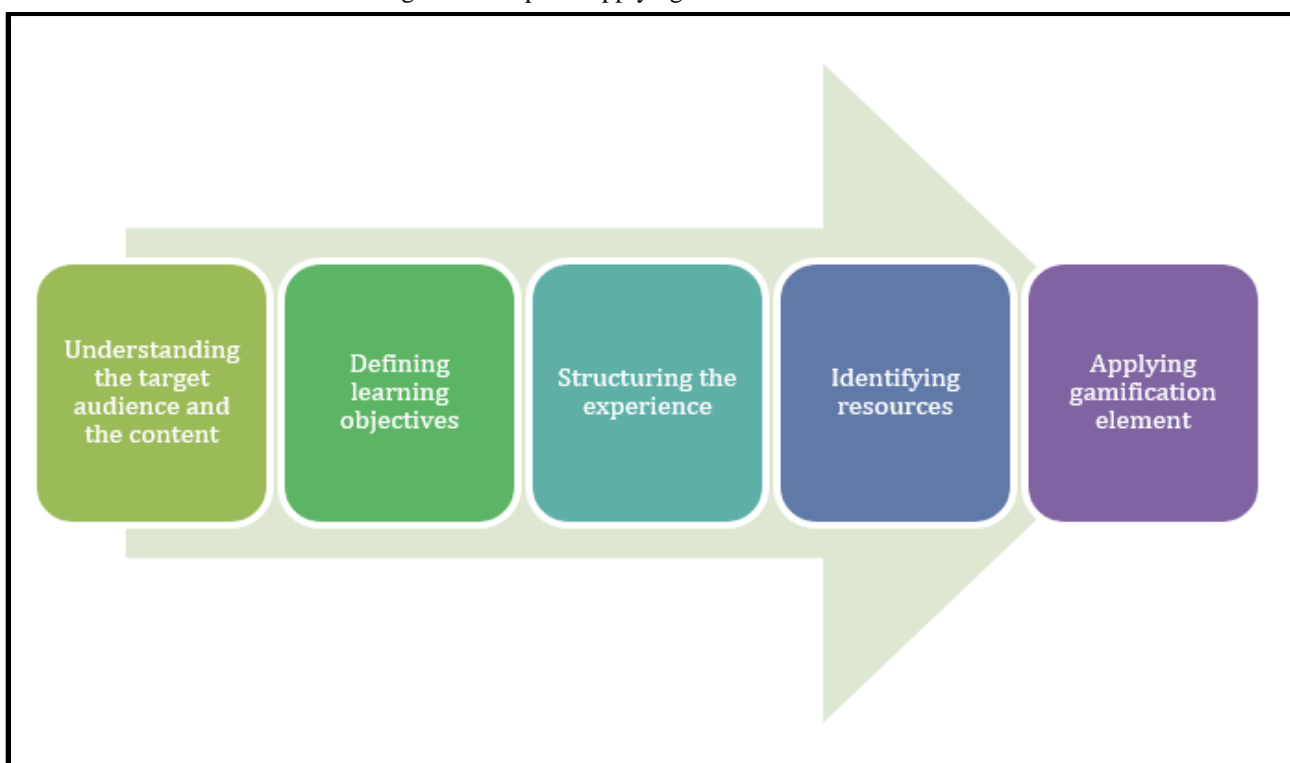


Figure 2 shows the five steps involved in applying the gamification element including understanding the target audience and content, defining learning objectives, structuring the experience, identifying all the resources and finally is to apply the gamification element.

Other than that, colour has been found to influence memory performance by increasing our attentional level and arousal (Dzulkifli and Mustafar, 2013). Wichmann et.al. (2002) proposed that colours play a significant role in enhancing memory performance in the human cognitive system. The cognitive abilities of the students refer to the way the students perceive, pay attention, remember, think, and understand the lessons. There need to be strategies to facilitate the learning process and

colours can play a role in motivating students to learn and profit from their educational experiences (Dzul kifli & Muzaffar, 2013).

Therefore by bridging the prior literature to our game, we engaged in preparing different colours of stick in representing each accounting classification. This effort aimed to enhance the student's ability in remembering and making sure the game is interactive.

Despite the important role exhibited by colors, the research also follows the steps taken by Moncada and Moncada (2014) in which the researchers suggested a list of qualities that lead to the creation of a well-designed gamification of learning activity. Table 1 below exhibits characteristics of a well-designed game.

Table 1 - Characteristics of Well-designed Game

1. Include educational objectives and clear learning outcomes.
2. Identify prerequisite skills required for the activity.
3. Offer a challenge and a sense of mastery through winning.
4. Provide a safe environment for failing.
5. Use pleasing color schemes.
6. Employ a clutter-free layout.
7. Include clear and concise instructions.
8. Have simple, easy-to-understand rules of the game play.
9. Provide relevant feedback or rewards to participants.
10. Include accurate and relevant content.
11. Foster engagement through interactivity.

The characteristics above best implemented when we included clear learning objectives, challenge between the players and there it is safe to fail and used different colors of stick as well as simple layout of the game.

In addition, the symbol of bicycle was embedded as a mnemonic approach in a way to have a better understanding of the classification of accounts by referring to the two wheels of the bicycle that are in line with the dual aspect of bookkeeping. The previous studies indicate the use of mnemonic technique in accounting education to motivate students to learn (Toney-Mc Lin, 2002), to remember and recall information related to accounting double entry (Abd Rahim, 2018), to improve students reasoning skill (Laing, 2010) and to enhance teaching technique in accounting theories (Mohd Rodzi et al., 2021) and learning technique in accounting theories (Syed Abdullah et. al., 2019).

Moreover, “bicycle accounting classification games” include clear and easy to understand instructions on how to play and the student is given the opportunity to give feedback. It is also important to notify that the game includes relevant content according to the syllabus and it fosters engagement between each one of group members.

Sampling

In order to achieve the learning objective for the game-based learning, the team has employed a small group try-out as being used by Hikmah and Mustikawati (2017), whereby she tried her game on 8 students first. Therefore, we have tried on 5 of our lecturers (4 accounting lecturers and 1 computer science lecturer) first to try and play the game. Upon playing the game, any flaws or irregularities will be jotted down for improvement before the field test. This stage is crucial in the sense that the instructor himself/herself needs to understand the game and be able to relate with the learning objectives. This step is important to make sure that the game is easy to be played and at the same time can enhance the students' understanding of the particular chapter.

After the “bicycle accounting classification game” has been tested in a small group try-out, we conducted the field try-out on 30 students. The sample size chose taking into consideration the number of students that already learned on the topic of Accounting Classification and Accounting Equation during the implementation stage. This method is chosen due to the fact that they have learned on the topic prior to the field test.

Approach of the game

Students will be given 1 set of Bicycle Accounting Classification Kits consists of:

1. 2 wheels represent Accounting Equation. The left-hand side of the bicycle represents Asset, Drawings and Expenses. Meanwhile Capital, Liability and expenses located on the

right-hand side of the bicycle.

2. 6 sets of different colored sticks consist of examples for each accounting classification (account) in Accounting Equation. There is a value of currency in Ringgit Malaysia (RM) of each account created at the end of the sticks.

The prerequisite knowledge to play this game is they must be already learned in class on that topic. The “bicycle accounting classification game” was played in a group of 4-5 students (members). They started the game with one member throwing the dice. Member that gets the greatest number of dice will start spinning the wheel on the left-hand side of the bicycle. Once the wheel stops at any of the elements in Accounting Equation, he/she will pick the match colored stick that consists of the right example for the element of Accounting Equation. Then he/she continued by spinning the right wheel in order to fulfil one of the learning objectives, that is they must be able to get a balanced accounting equation.

Next, the member also observed the figures at the end of the stick in making sure he/she obtained balanced figures within the equation. In other words, the member needs to play and get the right pair of equations with correct accounting classification. The pinnacle of this game is when the first member gets the most correct pairs of Accounting Equation.

Apart from winning the game by getting the most correct pair, the student interactively trained to remember and understand the accounting equation and classification.

4. Data Collection

The data collection on the effectiveness of the “bicycle accounting classification game” was gathered by the means of distributing the questionnaires to 30 university students at Diploma level after they have played the game. The selection of the students were identified with no accounting background to ensure the previous knowledge will not affect the result tests. The questionnaires were related to identify the effectiveness of “bicycle accounting classification game” in motivating students learning accounting concepts through playing that game which was adapted from previous related research (Jamaluddin, et al.,2020; Din, et al.,2018; Huang& Cappel, 2005; Seow & Wong, 2016). The questionnaires on effectiveness given were covered on aspects of autonomy, competence and relatedness.

The questionnaires that address students’ reactions to the accounting bicycle classification game experience were based on a five-point response scale; 5 "extremely agree," 4 "agree," 3

"satisfactory," 2 "disagree," and 1 "extremely disagree". The higher the reported mean, the more positive the outcome.

5. Results and Discussion

The results of the questionnaires on the effectiveness of using the “bicycle accounting classification game” in learning the accounting concept as shown in Table 2.

Table 2 - Students’ Learning Motivation from Three Dimensions

	Questionnaires	N	Min	Max	Mean	SD
	Overall effectiveness of the game				4.517	0.637
	Autonomy					
1	I felt motivated to learn about accounting classification using this tool.	30	3	5	4.567	0.679
2	This tool makes learning accounting classification interesting.	30	3	5	4.433	0.626
3	I found this tool worth the time and effort.	30	3	5	4.433	0.679
	Competence					
4	This tool helps me identify concepts that should be learned in more detail.	30	3	5	4.567	0.679
5	This tool enhances understanding on the accounting classification topic.	30	3	5	4.500	0.572
6	This tool should be used in the financial accounting courses.	30	3	5	4.400	0.675
7	This tool helps me to prepare for the test/exam.	30	3	5	4.200	0.664
	Relatedness					
8	I became more participative in the classroom when this tool was used.	30	3	5	4.600	0.563
9	I enjoyed using this tool in learning the accounting classification topic.	30	3	5	4.533	0.681
10	This tool allows the learning process to be interactive.	30	3	5	4.567	0.568

As from Table 2, the overall mean of students' feedback was 4.517 and overall SD were 0.637. The research findings revealed the highest mean found on the scale was (4.600 and SD=0.563) for the question asked. *I became more participative in the classroom when this tool was used* (Table 2). By using this method of bicycle accounting game based the student became more participative in the classroom with other students in learning and they enjoyed making the accounting equation to be balanced. It was supported by MacKeachie (2002) research findings that involving students as active participants results in a positive learning experience.

Participation in learning is very important in effective learning because the involvement of the students in game-based learning make them communicate with each other and also think on the solution of the game on the asset classifications and at the same time to make the accounting equation balance. *Participation* in learning was supported by Gupta et al. (2006), the use of crossword puzzle games in an introductory accounting subject increases students' interest, motivation and participation in the subject matter. Therefore, it supports the perceived relatedness that could have a positive relationship with the effectiveness of using the bicycle accounting classification game tool in enhancing students' motivation in learning basic financial accounting courses.

The second highest mean score was (4.567 and SD=0.679) for two questions asked; *I felt motivated to learn about accounting classification using this tool* and *This tool helps me identify concepts that should be learned in more details*. And as for the questionnaire item *This tool allows the learning process to be interactive* with the same mean score (4.567) but SD=0.568. The students felt motivated to apply the accounting concept and accounting classification and equation by playing a meaningful game based on new learning experience and intended to learn more on the accounting concepts. It was agreed by Andrea Bennett (2011), emphasized the power of games and played alternative learning methods were most productive and motivating learning experiences. These alternatives of learning styles can take place outside the formal education and students can learn on their own progression and freedom. Sailer et al. (2017) and Saputro et al. (2017), both researchers highlighted that the game mechanics have a positive impact on students' motivation in online learning in their research study. And these three items of questionnaires have supported all dimensions in terms of perceived autonomy, competence and relatedness that could have a positive relationship with the effectiveness of using the bicycle accounting classification game tool in enhancing students' motivation in learning basic financial accounting courses.

Last but not least, the last question that above the mean score was on the question *I enjoyed using this tool in learning the accounting classification topic*. The mean was (4.533 and SD=0.681), the students enjoyed the bicycle accounting classification game because they enjoyed learning's

through the game based. The students' feedback was in line with research conducted by (Gee, 2003 and Mcfarlane, 2002) that the teaching methodology and content needs to be changed to be more game-like rather than traditional classroom instruction to teach youth of today.

Table 3 - Correlations					
		Autonomy	Competence	Relatedness	Effectiveness
Autonomy	Pearson Correlation	1	.806**	.768**	.818**
	Sig. (2-tailed)		.000	.000	.000
	N	30	30	30	30
Competence	Pearson Correlation	.806**	1	.801**	.848**
	Sig. (2-tailed)	.000		.000	.000
	N	30	30	30	30
Relatedness	Pearson Correlation	.768**	.801**	1	.816**
	Sig. (2-tailed)	.000	.000		.000
	N	30	30	30	30
Effectiveness	Pearson Correlation	.818**	.848**	.816**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	30	30	30	30
**. Correlation is significant at the 0.01 level (2-tailed).					

To meet the research objective, the Pearson correlation is conducted to determine the strength relationships between two different variables. The Pearson correlation is chosen because the data is normal, interval and above 30 of sample size as recommended by Hair, (2009) and Afthanorhan & Aimran (2020). Given to this presented result, all variables are significant and thus we can conclude that the Autonomy, Competence, Relatedness and Effectiveness are positively related to each other. Specifically, the range of variable correlation is fall between 0.768 and 0.848.

Therefore, these variables are free from any erroneous effect of multicollinearity problem. In other words, these variables are suitable for further investigations using the same research model.

6. Conclusion

Based on the conducted research and discussion in the previous chapter, the conclusion can be drawn that the development of this educational game as overall gives a positive impact on the motivational learning basic accounting course process. The highest contributions on implementing this educational game are that it will enable positive learning experience through active learning participation in the classroom as supported by McKeachie (2002) and Gupta et.al (2006) and promoting more productive and motivating learning experience as emphasized by Andrea Bennett (2011), Sailer et al. (2017) and Saputro et al. (2017). This educational game could also drive to the more interactive and engaging classroom and ultimately would enhance learning excitement among youth students as stipulated by Gee (2003) and Mcfarlane (2002).

The finding could give an insight on the development of new tools to motivate students to learn accounting in an exciting way. This educational game is in line with the aims of the Malaysia government to integrate STEM (Science, Technology, Engineering and Mathematics) into the current education system. It provides an opportunity to see how the basic concept of accounting can be applied to develop great accounting skills among students. More importantly, the tool helps students to engage and strengthen their understanding to classify accounts with fun and interesting manner rather than just learning through lecture and tutorial in the class. Incidentally, it would improve the understanding and literacy of accounting classification.

Given a wider approach of teaching, the educators must explore the innovative and creative strategies to cater the development of education that suit the current generation and situation. Even though there is no one size fits all, the educator must ponder the way to make classrooms have active learning and participation. It is suggested that more educational tools will be employed in the future to facilitate the teaching and learning environment.

Acknowledgement

The research is supported by the Geran Dalaman Negeri (600-UiTMKDH (PJI.5/4/1) (2/2020). The authors would like to express their appreciation to the editor and anonymous referees for their constructive comments and suggestions, which have led to an improved version of the paper.

References

- Abd Rahim, M. (2018). Another way of learning double entry in Accounting: The mnemonic approach. *Accounting Bulletin*, 1, 13-18.
- Abt, C. (1970). *Serious Games*. New York. Viking Press.
- Afthanorhan, A., & Aimran, N. (2020). A prospective study of dengue infection in Malaysia: A structural equation modeling approach. *Environmental Health Engineering and Management Journal*, 7(3), 161-169.
- Andrea, B. (2011). The Role of Play and Games in Learning. *The 33rd Earl V. Pullias Lecture*. University of South California (USC) USA.
- Anderson, L.W., & Krathwohl, D.R. (Eds.). (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives. New York: Longman.
- Apostol, S., Zaharesc, L., & Aleze, I. (2013). Gamification of Learning and Educational Games. *9th International Scientific Conference eLearning and software for Education, Bucharest*, 2013.
- Bovermann, K., Weidlich, J., & Bastiaens, T. (2018). Online learning readiness and attitudes towards gaming in gamified online learning – a mixed methods case study. *International Journal of Educational Technology in Higher Education*, 15(1). <https://doi.org/10.1186/s41239-018-0107-0>.
- Bovermann, K., & Bastiaens, T.J. (2020). Towards a motivational design? Connecting gamification user types and online learning activities. *Research and Practice in Technology Enhanced Learning*, 15(1), 1-18.
- Chen, P.G., Liu, E.Z.F., Lin, C.H., Chang, W.L., Hsin, T.H., & Shih, R.C. (2012). Developing an education card game for science learning in primary education. *Fourth IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL2012)*. Japan, Takamatsu.
- Deci, E.L., & Ryan, R.M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of research in personality*, 19(2), 109-134.
- Deci, E.L., & Ryan, R.M. (2008b). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie Canadienne*, 49(3), 182–185. <https://doi.org/10.1037/a0012801>.
- Deterding, Sebastian. (2011). Situated motivational affordances of game elements: A conceptual model. *CHI Gamification Workshop 2011*. 3-6.

- Din, N.M., Tarmuji, N.H., Ahmad, M.A.N., Jamaluddin, J., Fadzillah, N.S.M., & Jabar, F.A. (2018). The Effectiveness of an Innovative Tool for Teaching Published Financial Statements. *International Journal of Academic Research in Business and Social Sciences*, 8(11), 1549–1560.
- Dzulkifli, M.A., & Mustafar, M.F. (2013). The influence of colour on memory performance: A review. *The Malaysian journal of medical sciences: MJMS*, 20(2), 3-9.
- Eric, Z.F.L., & Po-Kuang, C. (2013). The Effect of Game-Based Learning on Students' Learning Performance in Science Learning – A Case of "Conveyance Go". *International Educational Technology Conference IETC2013*.
- Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An Investigation of the Interrelationships between Motivation, Engagement, and Complex Problem Solving in Game-based Learning. *Educational Technology & Society*, 17(1), 42–53.
- Gagné, M., & Deci, E.L. (2005). Self-determination theory and work motivation. *Journal of Organizational behavior*, 26(4), 331-362.
- Gee, J.P. (2003). What Video games Have to teach Us about Learning and Literacy. *ACM Computers in Entertainment*, 1(1). <https://doi.org/10.1145/950566.950595>.
- Gil, B., Cantador, I., & Marczewski, A. (2015). Validating gamification mechanics and player types in an e-learning environment. *Springer International Publishing Switzerland*, 568–572. https://doi.org/10.1007/978-3-319-24258-3_61.
- Gupta, A.K., Smith, K.G., & Shalley, C.E. (2006). The interplay between exploration and exploitation. *Academy of management journal*, 49(4), 693-706.
- Gupta, S., Elson, R.J., & Ostapski, S.A. (2006). The puzzle game: A novel approach to teaching accounting. *The accounting instructors' report*, 1-5.
- Hair, J.F. (2009). *Multivariate Data Analysis: A Global Perspective*. 7th ed. Upper Saddle River: Prentice Hall, Print.
- Hikmah, N., & Mustikawati, Rr. Indah. (2017). The Development of Accounting Uno Card Game as an Accounting Learning Media. *International Conference on Ethics of Business, Economics, and Social Science*, 2, 134-142.
- Huang, Z., & Cappel, J.J. (2005). Assessment of a Web-based learning game in an information systems course. *Journal of Computer Information Systems*, 43-49.
- Huang, W.H.Y., & Soman, D. (2013). A Practitioner's Guide to Gamification of Education. *Research Report Series Behavioural Economics in Action*. Rotman School of Management University of Toronto.
- Jamaluddin, J., Mahali, M., Mohd Din, N., Nias Ahmad, M.A., Mohamad Fadzillah, N.S., & Abdul Jabar, F. (2020). Students Motivation Level in Gamification of Accounting Teaching and Learning – A Case of 'Accounting on the Block'. *Social and Management Research Journal*, 17(1), 17-34. <https://doi.org/10.24191/smrj.v17i1.8140>.
- Kayımbaşoğlu, D., Oktekin, B., & Hacı, H. (2016). Integration of gamification technology in education. *Procedia Computer Science*, 102, 668-676.

Kirriemuir, J., & Mcfarlane, A. (2004). Literature Review in Games and Learning. *Nesta Futurelab Series. Bristol.*

Kiryakova, G., Yordanova, L., & Angelova, N. (2014). Gamification in education. *9th International Balkan Education and Science Conference, Edirne, Turkey.*

Korkmaz, U., & Yutrtseven Avci, Z. (2016). Turkish Pre-Service Teachers' Experiences with Contemporary Technology Games and Perceptions About Teaching with Instructional Games. *Research in Social Sciences and Technology, 1(1).*

La Guardia, D., Gentile, M., Dal Grande, V., Ottaviano, S., & Allegra, M. (2014). A game based learning model for entrepreneurship education. *Procedia-Social and Behavioral Sciences, 141,* 195-199.

Laing, G. (2010). An empirical test of mnemonic devices to improve learning Elementary Accounting. *Journal of Education for Business, 85(6),* 349-358.

Lan, M., & Hew, K.F. (2020). Examining learning engagement in MOOCs: A self-determination theoretical perspective using mixed method. *International Journal of Educational Technology in Higher Education, 17(1),* 1-24.

Law, K.M., Lee, V.C., & Yu, Y.T. (2010). Learning motivation in e-learning facilitated computer programming courses. *Computers & Education, 55(1),* 218-228.

Legault, L. (2017). Self-Determination Theory. *Encyclopedia of Personality and Individual Differences, Springer International Publishing AG 2017.*

[https://doi.org/10.1007/978-3-319-28099-8_1162-1.](https://doi.org/10.1007/978-3-319-28099-8_1162-1)

Liu, E.Z.F., & Chen, P.K. (2013). The effect of game-based learning on students' learning performance in science learning—A case of “conveyance go”. *Procedia-Social and Behavioral Sciences, 103(26),* 1044-1051.

Abd Majid, N., Zainol, F.A., Daud, W.N.W., & Afthanorhan, A. (2019). Cooperative entrepreneurship in Malaysian secondary schools: A review of current practices. *The Journal of Social Sciences Research, 5(3),* 812-818.

Mcfarlane, A., Sparrowhawk, A. & Heald, Y. (2002). Report on the educational use of games. *Teachers Evaluating Educational Multimedia. Cambridge.*

Mc Keachie, W. (2002). Mc Keachie's Teaching Tips: Strategies, Research and Theory for College and University Teachers. *11th ed. Boston: Houghton Mifflin.*

Mohd Rodzi, N.K., Abdul Rahman, N., Naiimi, N., Ahmad@Muhammad, N., Ayob, S., Selamat, S. (2021). Mnemonic: An Alternative Memory Enhancement Technique in Teaching Accounting Theories. *Jurnal Intelek, 16 (1).*

Moncada, S.M., & Moncada, T.P. (2014). Gamification of learning in accounting education. *Journal of Higher Education Theory and Practice, 14(3),* 9.

Peng, W., Lin, J.H., Pfeiffer, K A., & Winn, B. (2012). Need satisfaction supportive game features as motivational determinants: An experimental study of a self-determination theory guided exergame. *Media Psychology, 15(2),* 175-196.

Ryan, R.M., & Deci, E.L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation. *Social Development, and Well-Being*, 55(1), 68–78.

Ryan, R.M. Et Deci, E.L. (2017). Self-determination theory. Basic psychological needs in motivation, development and wellness. *New York, NY: Guilford Press*.

Ryan, R.M., & Deci, E.L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860.

Ryan, R.M., Rigby, C.S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, 30(4), 344-360.

Sán chez-Oliva, D., Mouratidis, A., Leo, F.M., Chamorro, J.L., Pulido-González, J.J., & García-Calvo, T. (2020). Understanding physical activity intentions in physical education context: A multi-level analysis from the self-determination theory. *International journal of environmental research and public health*, 17(3), 799.

Sailer, M., Hense, J.U., Mayr, S.K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, 69, 371–380.

Saputro, R.E., Salam, S.B., & Zakaria, M.H. (2017). A review of intrinsic motivation elements in gamified online learning. *Journal of Theoretical and Applied Information Technology*, 95(19), 4934–4948.

Sari, A.C., Fadillaha, A.M., Jonathana, J., Prabowo, M.R.D. (2019). Interactive Gamification Learning Media Application for Blind Children Using Android Smartphone in Indonesia. *Procedia Computer Science* 157(2019), 589–595.

Skinner, E., Furrer, C., Marchand, G., & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic?. *Journal of educational psychology*, 100(4), 765.

Seow, P.S., & Wong, S.P. (2016). Using a mobile gaming app to enhance accounting education. *Journal of Education for Business*, 91(8), 434-439.

Syed Abdullah, S.L., Mohd Rodzi, N.K., Shaffee, N.S., Arus, J., Abd Rahim, M., & Abdul Rahman, N. (2019). A Qualitative Study on Memory Aid Kit (MAK) in Enhancing Students' Comprehension of Accounting Theories. *Proceedings of the Second International Conference on the Future of ASEAN (ICoFA) 2017 - Volume 1*, 419-426. Springer, Singapore.

https://doi.org/10.1007/978-981-10-8730-1_42.

Toney-McLin, P. (2002). M&M: A new paradigm for teaching beginning accounting courses. *Allied Academies International Conference Proceedings of the Academy of Accounting and Financial Studies*, 7, 95. Nashville.

Van Roy, R., & Zaman, B. (2017). Why gamification fails in education and how to make it successful: Introducing nine gamification heuristics based on self-determination theory. *Serious Games and edutainment applications*, Springer, Cham, 485-509.

Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: a systematic literature review. *International Journal of Educational Technology in Higher Education*, 14(1), 1-33.

Wichmann, F.A., Sharpe, L.T., & Gegenfurtner, K.R. (2002). The contributions of color to recognition memory for natural scenes. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28(3), 509.