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Knowledge Level of Gamification, Technology and Belief of Elementary School Science Education Teachers in Selangor

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Abstract

Technology advancements have given the field of education, particularly primary Science subject, a tremendous deal of potential that can encourage students to change the way they learn, get information and use any information. In line with these developments, gamification is an interactive and engaging approach that uses the concept of games in teaching and learning process. Therefore, this article discusses the knowledge on gamification, technology and belief of primary school Science education teachers in Selangor. This study is a quantitative study that utilized a survey design. 150 teachers teaching primary school Science subjects in Hulu Langat, Selangor were selected as the study sample. Questionnaires were used as an instrument to collect research data. The data obtained was analysed using the Statistical Package for Social Sciences (SPSS) version 29 software involving descriptive analysis and Spearman's correlation. The results of the study show that the level of gamification knowledge, technology and belief of primary school Science education teachers is high. In addition, the findings of the study show that there is a significant positive relationship between the level of knowledge, technology, belief with the teacher's practice of gamification. The findings of this study are expected to give teachers an idea that the application of gamification can improve student performance and quality of education in Malaysia.

Keywords: Gamification, Online Learning, Primary School, Science Teachers, Technology

Introduction

In keeping with the modern technological era, more emphasis is being placed on the use of technology in the teaching and learning of Science. According to Faroz (2016), teaching and learning strategies that involve the concept of gamification are easy to understand and mastered by students. The concept of gamification is a learning strategy that is applied to attract students' interest and motivation towards the teacher's teaching throughout the teaching and learning process. This study discusses the level of gamification knowledge, technology and belief of primary school Science education teachers in Selangor. This study is a survey study to examine the skills of teachers in integrating technology of learning process.

The findings of this study also helped many parties gain a better grasp of the idea and use of gamification in education, which can enhance the standard of instruction in the classroom.

According to Rahman (2017), the process of learning Science in traditional ways is no longer suitable to be applied in this 21st century. This is because, Science learning needs to be carried out actively to increase student motivation and interest. The gamification concept is also a learning strategy that is applied to attract students' interest and motivation towards the teacher's teaching throughout teaching and learning process. The concept of gamification adds to students' desire to learn socially, compete and achieve goals. This strategy involves rewards for students such as badges, points, progress charging bars and also achievements to encourage students to compete (Farber, 2013). According to Ding et al (2018), there is an increase in student engagement through the gamification approach implemented by teachers.

According to Ali and Mahamod (2017), there are various challenges that arise when teachers are not proficient in conducting student-centered activities especially among new teachers. This is one of the main challenges that need to be addressed to ensure that teachers can use internet technology tools and it is equivalents to implement gamification practices. The constraints faced by new teachers are also the lack of training, guidance, resource materials and guidance to improve knowledge and skills in the process of student-centered teaching and learning through gamification practices. Therefore, this study was conducted to study the knowledge level of Science teachers in applying gamification in the teaching and learning process.

Traditional teaching and learning methods based on worksheets and books alone are not relevant today. Technological skills need to be in line with 21st century learning by applying the concept of play such as gamification practices in the teaching and learning process. Therefore, teachers need to have a high level of knowledge in technological skills to make the teaching and learning process more interesting (Ismail et al., 2018).

According to Ding et al (2018), teachers experienced challenges to maintain learner engagement in the application of gamification practices. This is due to instructional design, implementation of game elements, classroom issues as well as technical issues such as electrical supply interruptions and malfunctioning computers. These obstacles lead to teachers' doubts and confidence in the ability of gamification elements to improve students' understanding in Science subjects (Zainuddin et al., 2020). Therefore, game designs that support learning need to be well designed before implementing them in the teaching and learning process. The study carried out was expected to determine the level of teacher confidence in ensuring the effectiveness of gamification as an agent of change for conveying knowledge to students.

This study was conducted to answer six questions. i) What is the level of teachers' knowledge in applying gamification in the teaching and learning process? ii) What is the level of teachers' knowledge in technology? iii) What is the level of teachers' belief in gamification? iv) What is the relationship between the level of knowledge of gamification and the practice of gamification? v) What is the relationship between the level of knowledge of technology and the practice of gamification? vi) What is the relationship between the level of knowledge of technology and the practice of gamification?

The researcher has focused on four (4) main objectives that supported the preparation of this study within the stipulated time period. i) To study the knowledge level of Science teachers in applying gamification in the teaching and learning process. ii) To identify the knowledge level of Science teachers in technology. iii) To find out the belief level of teachers

towards gamification. iv) To see the relationship between the knowledge level of gamification, technology and belief of Science teachers in the practice of gamification.

This study utilised a quantitative study design. The researcher also used a form of research question to collect information and data about the study. This article will discuss the methodology of the study to be carried out. In addition, this article focuses on the form of the study, the background of the population, the type of sampling, the instruments used, the procedure for collecting data and the procedure for analysing the data obtained. The results of the study will be discussed in detail as well as outlining the implications and limitations for future studies.

This element is defined as the application of games for educational purposes that have design elements in a non-game context that engages students and motivates them to achieve goals. The term gamification was introduced by Nick Pelling, a British game creator, in 2002 and began to be applied in 2010 (Kamasheva et al., 2015). The concept of gamification is also a learning strategy applied to attract students' interest and motivation towards the teacher's teaching throughout the teaching and learning process. The concept of gamification adds to students' desire to learn socially, compete and achieve goals. This strategy involves rewards for students such as badges, points, progress charging bars and also achievements to encourage students to compete (Farber, 2013). According to Ding et al. (2018), there is an increase in student engagement through the gamification approach implemented by teachers.

Based on previous studies, the application of gamification elements has a positive impact in the field of education (Lee & Hammer, 2011). This fact is in line with a study by Farozi (2016) that teaching and learning strategies involving the concept of gamification easily understood and mastered by students. In addition, a study by Groening and Binnewies (2019) states that gamification can attract learner interest and participation by engaging in experiential learning. A study by Frost et al (2015) argues that the concept of gamification can fulfill their needs and increase their achievement. In addition, a study by Mishra and Koehler (2006) states that teachers need to incorporate various types of components to successfully implement gamification elements including knowledge of Science, students, pedagogy and technology.

Science Teachers' Knowledge on Gamification

According to Awi and Zulkifli (2021), teachers also need to be proficient in using technology by applying gamification elements to produce effective teaching and learning processes especially in 21st Century Learning (PAK-21). Knowledge on the use of gamification elements can be improved by attending programs and also courses to improve skills to ensure that teachers can apply them in the room of learning. Based on a study by Ding (2019), the concept of gamification can help shape more knowledgeable learners through repeated learning, patience, competition and teamwork throughout the learning process. In addition, the use of technology in the classroom also needs to fulfill the principle of problem solvings and not only be used as a substitute for existing teaching methods (Ghavifekr & Rosdy, 2015).

Science Teachers' Knowledge on Technology

The use of technology in the classroom can help the process of teaching and learning Science (Paulette et al., 2012). This is because, the use of technology for Science subjects can solve the problems of teachers as well as student learning. The growth of interactive technology has made games more interesting and relevant as an educational resource (Gee, 2014). In line

with the Industrial Revolution 4.0, teachers need to be proficient with Information and Communication Technology (ICT) and increase technological knowledge based on four main elements namely creativity, reflectivity, reciprocity and responsibility (Rahayu et al., 2020). The rapid development of technology and communication has also contributed to the development of teaching and learning materials (Iberahim & Noor, 2019). Therefore, teachers need to utilize technological elements in teaching so that students are not left behind in this technological development through the application of gamification elements.

Science Teacher Belief on Gamification

There are several factors that influence the level of teacher belief towards the application of gamification, namely external factors such as curriculum and policies while internal factors are personal interests and attitudes towards games. However, a series of academics and researchers have begun to generate deep interest in the application of gamification elements as part of the instructional retooling process to provide engaging experiences throughout the learning process (Kyewski & Krämer, 2018; Tsay et al., 2018).

TPACK Model in Teaching

According to Ismail et al (2018), parallel to the transition to Industrial Revolution 4.0 (IR 4.0), the explosion of information and communication technology (ICT) is also growing rapidly. This positive development has especially affected the education sector, which requires countries to produce students who are globalized and able to compete at the international level. This coincides with Malaysia Education Blueprint (2013-2025), the government is committed to outlining 11 recommendations for the transformation of the country's education system and among them is providing equal access to three international standard quality education (Malaysia, 2013). According to Koehler et al (2013), to achieve this desire, teachers need competence in designing lessons that apply knowledge, pedagogy and technology. A teacher needs to have knowledge about Science as well as knowledge about pedagogy to deliver Science to students. In addition, Science teachers should have knowledge of technology to help deliver teaching and learning effectively. This is in line with the desire of the Minister of Higher Education, Dato' Seri Idris Jusoh in his 2016 New Year speech who wants the approach to flexible education to be improved through innovations such as the application of gamification elements in learning.

Methodology

This study has used a quantitative study design in the form of a survey. The sample for this study was primary school teachers in Hulu Langat, Selangor which is 150 people. The researcher used a questionnaire to collect information and data about the study. The use of the questionnaire can provide the truth and accuracy of the responses as well as the answers given by the respondents are not influenced by any party. This research question contains two parts, namely Part A and Part B. Part A contains four question items related to the background information or demographics of the respondents, namely gender, age, completion of the curriculum and experience as a teacher. In part B as well, the research questions were solved to four main constructs which include gamification knowledge level, technology, belief and gamification practice.

This study has used the Statistical Package for Social Sciences (SPSS) version 29 software to analyse the data obtained from the questionnaire. The researcher has used several statistical tests to analyse the data such as the Spearman correlation test to test the study

hypothesis in terms of its relationship. Descriptive statistics were used to obtain the frequency, mean and percent values of the study data. Furthermore, the interpretation of the mean score based on the interpretation of the five-point Likert scale by (Landell, 1997).

Table 1

Mean Score Interpretation

Total Mean Score	Level
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Source: Landell (1997)

Study Findings**Respondent Demographics**

This study involved 150 primary school Science teachers in Hulu Langat as respondents. Among the aspects described in the respondents' profile are gender, age, education background and experience as a teacher.

Table 2

Descriptive analysis of respondent demographics (n=150)

Demographic items	Study respondents	Number	Frequency (%)
Gender	Men	47	31.3
	Female	103	68.7
Age	Less than 30 years	23	15.3
	31-35 years old	19	12.7
	36-40 years old	25	16.7
	41-45 years old	39	26.0
	46 years and above	44	29.3
Education background	Teaching certificate	7	4.7
	Diploma in teaching	14	9.3
	Degree	115	76.7
	Master	13	8.7
	PhD	1	0.7
Experience as a teacher	1-5 years	21	14.0
	6-10 years	19	12.7
	11-15 years	34	22.7
	16-20 years	26	17.3
	Above 21 years	50	33.3

The results of the descriptive analysis in Table 2 show that 68.7% of the respondents are from the female gender which is 103 people while 31.3% are from the male gender which is 47 people. In terms of age, the number of respondents aged less than 30 years (15.3%), 31-35 years (12.7%), 36-40 years (16.7%), 41-45 years (26.0%) and more than 46 years (29.3%). In addition, teachers who have a baccalaureate degree show the highest value of 76.7% which is 115 people while teachers who have a PhD show the lowest value of 0.7%. The author determines that teachers with less than 5 years of teaching experience are inexperienced

teachers while teachers with more than 5 years of experience are experienced teachers. The results of this analysis show that experienced teachers are more numerous than inexperienced teachers.

Teachers' Knowledge on Gamification

Teachers' level of knowledge of gamification is an important component to ensure that the teaching and learning process can be implemented properly. Overall, the results in Table 3 show that teachers' knowledge level of gamification is at a high level (M=4.042, SD=0.9818). This showed that teachers are knowledgeable in applying gamification in the teaching and learning process. The study results show item B1 which refers to "I know to use gamification practices for learning and enrichment purposes in Science subjects" shows the percentage value on the agree and strongly agree scale is the highest (83.3%). Whereas the percentage value of B6 on "I understand the ethical aspects related to gamification" shows the lowest percentage value on the agree and strongly agree scale (66.7%).

Table 3

Descriptive analysis of teachers' knowledge level of gamification (n=150)

Code	Item	Scale				
		1	2	3	4	5
B1	I know to use gamification practices for learning and enrichment purposes in Science subjects	3 (2.0%)	8 (5.3%)	14 (9.3%)	62 (41.3%)	63 (42.0%)
B2	I know to utilize the gamification method in Science subjects	2 (1.3%)	9 (6.0%)	26 (17.3%)	60 (40.0%)	53 (35.3%)
B3	I am confident in my ability and understanding of the whole gamification practice	4 (2.7%)	8 (5.3%)	35 (23.3%)	51 (34.0%)	52 (34.7%)
B4	I can identify the relationship between the use of gamification and learning objectives	2 (1.3%)	9 (6.0%)	25 (16.7%)	48 (32.0%)	66 (44.0%)
B5	I am knowledgeable and able to apply the latest developments related to gamification	3 (2.0%)	11 (7.3%)	31 (20.7%)	51 (34.0%)	54 (36.0%)
B6	I understand the ethical aspects of gamification	1 (7.0%)	13 (8.7%)	36 (24.0%)	43 (28.7%)	57 (38.0%)
B7	Gamification practices can also be done outside of the classroom	1 (7.0%)	6 (4.0%)	29 (19.3%)	53 (35.3%)	61 (40.7%)
B8	I know the assessment method of every student who participates in gamification-based learning	1 (7%)	7 (4.7%)	30 (20.0%)	53 (35.3%)	59 (39.3%)
B9	My knowledge in using gamification can enhance online learning	2 (1.3%)	6 (4.0%)	26 (17.3%)	54 (36.0%)	62 (41.3%)

B10	I know the appropriate gamification elements that can be integrated in Science subject topics	2 (1.3%)	9 (6.0%)	28 (18.7%)	41 (27.3%)	70 (46.7%)
Overall		M		4.042	SD	0.9818

Note. 1 (Strongly disagree); 2 (Disagree); 3 (Neutral); 4 (Agree); 5 (Strongly agree)

Teachers' Knowledge on Technology

Descriptive analysis was used to see the level of teachers' knowledge in technology as shown in Table 4. The study results show that the level of teachers' knowledge of technology is at a high level (M=4.0394: SD=1.015). Item B15 i.e. "I can demonstrate strategies for using technology to promote student interest in the teaching and learning process" showed the highest percentage values on the agree and strongly agree scales (80%). Finally, item B16 i.e. "I can creatively shape the game by integrating technology" showed the highest disagree and strongly disagree percentage values (64%).

Table 4

Descriptive analysis of teachers' knowledge level of technology (n=150)

Code	Item	Scale				
		1	2	3	4	5
B11	I have knowledge in the use of computer applications to apply gamification practices	1 (7.0%)	15 (10.0%)	22 (14.7%)	44 (29.3%)	68 (45.3%)
B12	I get enough exposure to improve my knowledge in technology	1 (7.0%)	16 (10.7%)	34 (22.7%)	37 (24.7%)	62 (41.3%)
B13	I keep up to date with the latest use of technology in education	1 (7.0%)	10 (6.7%)	26 (17.3%)	55 (36.7%)	58 (38.7%)
B14	My technological knowledge can be used to stabilize the teaching and learning process	2 (1.3%)	9 (6.0%)	20 (13.3%)	51 (34.0%)	68 (45.3%)
B15	I can demonstrate strategies for using technology to promote student interest in the teaching and learning process	1 (7.0%)	9 (6.0%)	20 (13.3%)	62 (41.3%)	58 (38.7%)
B16	I can creatively shape the game by integrating technology	2 (1.3%)	15 (10.0%)	37 (24.7%)	37 (24.7%)	59 (39.3%)
B17	I can use various strategies to promote the learning process by using technology	3 (2.0%)	9 (6.0%)	30 (20.0%)	45 (30.0%)	63 (42.0%)
B18	I know how to use multimedia elements such as animation, audio and graphics	5 (3.3%)	14 (9.3%)	29 (19.3%)	44 (29.3%)	58 (38.7%)
B19	My knowledge in using technology can help students holistically	3 (2.0%)	8 (5.3%)	28 (18.7%)	49 (32.7%)	62 (41.3%)
B20	I know the appropriate technology to use for implementing Science subject content	3 (2.0%)	11 (7.3%)	22 (14.7%)	45 (30.0%)	69 (46.0%)
Overall		M		4.0394	SD	1.015

Note. 1 (Strongly disagree); 2 (Disagree); 3 (Neutral); 4 (Agree); 5 (Strongly agree)

Science Teachers' Belief on Gamification

Science teachers' belief level towards the implementation of gamification is an important aspect to ensure teachers can implement this practice better and effectively. This finding has

proven that the Science teachers' confidence level in the implementation of gamification is high ($M=4.3081$; $SD=0.8413$). The results of the descriptive analysis are presented in Table 5. Based on Table 5, it is found that item B27 "I believe that gamification practice is one of the methods of teaching Science subject that can attract students' interest" has the highest percentage value on the agree and strongly agree scale (85.3%). While the lowest value of percentage on the agree and strongly agree scale (80.6%) refers to item B25 which is "Gamification-based learning contributes to the development of students' creative thinking skills".

Table 5

Descriptive analysis of Science teachers' belief level towards gamification (n=150)

Code	Item	Scale				
		1	2	3	4	5
B21	I believe that the implementation of gamification can make Science teaching and learning more engaging	1 (7.0%)	3 (2.0%)	19 (12.7%)	42 (28.0%)	85 (56.7%)
B22	I believe that gamification practices can improve student understanding and achievement in Science subjects	1 (7.0%)	2 (1.3%)	23 (15.3%)	52 (34.7%)	72 (48.0%)
B23	Gamification-based learning can contribute to the development of students' critical thinking skills	1 (7.0%)	3 (2.0%)	22 (14.7%)	53 (35.3%)	71 (47.3%)
B24	I believe that gamification practices contribute to the development of problem-solving skills	1 (7.0%)	3 (2.0%)	23 (15.3%)	49 (32.7%)	74 (49.3%)
B25	Gamification-based learning contributes to the development of students' creative thinking skills	1 (7.0%)	4 (2.7%)	24 (16.0%)	44 (29.3%)	77 (51.3%)
B26	I believe that gamification-based learning can provide an indirect exposure to the subject of Science	1 (7.0%)	3 (2.0%)	21 (14.0%)	49 (32.7%)	76 (50.7%)
B27	I believe that gamification practice is one of the methods of teaching Science subject that can attract students' interest	1 (7.0%)	2 (1.3%)	19 (12.7%)	47 (31.3%)	81 (54.0%)
B28	I believe that the gamification activities I provide are more effective in my Science teaching	2 (1.3%)	5 (3.3%)	18 (12.0%)	47 (31.3%)	78 (52.0%)
B29	Gamification-based learning has also improved my teaching skills and confidence in students	1 (7.0%)	3 (2.0%)	22 (14.7%)	45 (30.0%)	79 (52.7%)

B30	I believe that the implementation of gamification can enhance cooperation between students	1 (7.0%)	3 (2.0%)	19 (12.7%)	53 (35.3%)	74 (49.3%)
Overall		M		4.3081	SD	0.8413

Note. 1 (Strongly disagree); 2 (Disagree); 3 (Neutral); 4 (Agree); 5 (Strongly agree)

Relationship Between Gamification Knowledge Stage, Technology and Belief with Teacher Practice

To identify whether there is a significant relationship between knowledge on gamification and the practice of gamification in Science education in Selangor, testing the first null hypothesis (Ho1), a Spearman correlation analysis was conducted and the results of the analysis are shown in Table 6.

Ho1: There is no significant relationship between the knowledge on gamification and the gamification practices of primary school Science education teachers in Selangor? Based on the table, the correlation value, $\rho=0.797$ and significant value, $p<0.001$ ($p,0.01$). Since the significant value is less than 0.01, the first null hypothesis (Ho1) is rejected. This shows that there is a significant relationship between the knowledge on gamification and the gamification practices of primary school Science education teachers in Selangor.

Ho2: There is no significant relationship between knowledge on technology and gamification practice? Based on the table, the correlation value, $\rho=0.761$ and significant value, $p<0.001$ ($p,0.01$). Since the significant value is less than 0.01, the second null hypothesis (Ho2) is rejected. This shows that there is a significant relationship between the knowledge on technology and the gamification practices of primary school Science education teachers in Selangor.

Ho3: There is no significant relationship between and gamification practice? Meanwhile testing the third null hypothesis (Ho3) shows the correlation value, $\rho=0.802$ and significant value, $p<0.001$ ($p,0.01$). The significant value is less than 0.01, hence the third null hypothesis (Ho3) is rejected. In fact, there is a relationship between the belief level and the gamification practice based on the budget value of the strength of the relationship between the two variables as listed in Table 6.

Table 6
Spearman Correlation Analysis of the relationship between gamification knowledge level, technology and teacher belief with gamification practice

		Gamification practice
Gamification knowledge	Spearman Correlation	.797**
	Sig. (2-tailed)	<.001
	n	150
Technological knowledge	Spearman Correlation	.761**
	Sig. (2-tailed)	<.001
	n	150
Teachers' believe	Spearman Correlation	.802**
	Sig. (2-tailed)	<.001
	n	150

**Correlation is significant at 0.01 level (2-tailed)

Discussion

The purpose of the study was to examine the level of knowledge in gamification, technology and Science teachers' belief in the application of gamification. In addition, the study was also carried out to see the relationship between the knowledge of gamification, technology and Science teachers' belief in gamification practices.

Teachers' Knowledge on Gamification

Based on the findings of the study, it can be concluded that the level of teachers' knowledge of gamification is at a high level. To ensure the integration of gamification can be implemented, teachers' gamification knowledge level should be at a high level. The goal is to ensure that teachers can achieve effective teaching while at the same time can provide understanding to students.

The results of this study are in line with the results of a study conducted by Ibrahimi and Noor (2019) which stated that teachers' understanding of gamification affects their tendency and enthusiasm to implement this practice in the teaching and learning process. The understanding factor plays an important role in ensuring the implementation of gamification can be implemented in schools. The study result of Rahman et al (2013) has similarities in the result of this study which states that the knowledge aspect in integrating gamification is the main factor that will determine the effectiveness and success of its use in teaching. However, the findings of this study contradict the findings of the study conducted by Lubis et al (2017) where teachers prefer to use traditional teaching methods versus gamification due to technical issues such as frozen screens, slow computers and lack of application of interesting content. According to Destya (2019), teachers' understanding and ability of gamification strategies are seen to affect the learning process and become one of the main skills that need to be emphasized.

Teachers' Knowledge on Technology

Based on the results, it clearly shows that the level of teachers' knowledge of technology is at a high level. This is because the application of technology in Science learning has great potential to provide a surge for changing the learning environment in a more effective way. Effective integration of technology in teaching and learning is an important competency for teachers in the 21st century. To ensure today's education is at a satisfactory level, technology applications need to be given attention and applied in teaching and learning. The study by Ab Rahman et al (2015) also states that the factor of teacher knowledge and proficiency in technology greatly affects the effective use of technology in the teaching process. However, the findings of this study contradict the findings of the study conducted by Jain et al (2018) where study participants did not integrate technology in teaching because they did not have knowledge about approaches to integrating technology in teaching. Therefore, teachers need to be more exposed to technological knowledge in teaching so that they have knowledge about integrating technology in teaching.

In a study conducted by Osman et al (2020), also stated that the level of teacher knowledge in the use of computer-based information technology in the teaching and learning process from all aspects studied was at a modest level involving special education teachers in primary schools in Batang Padang District, Perak which is contrary to the findings of this study. The level of teacher knowledge in technology can encourage a teacher to make the right choices about what to use in teaching Science subjects.

According to Suarni et al (2021), the use of technology has greatly influenced teaching and learning especially in the subject of Biology while improving student achievement. Therefore, it is clear that a teacher needs to have a high knowledge of technology from low to high level technology (Kurnianingsih et al., 2017).

Teachers' Belief on Gamification

In conclusion, the results show that teachers have a high level of belief towards the application of gamification in the process of teaching and learning Science at the low level. This clearly shows that teachers believe the application of gamification is able to make the learning process more interesting while improving student learning achievement.

The findings of this study are in line with the study conducted by Ali and Mahamod (2017) which states that the teaching and learning process based on gamification especially in the lower grades is the best way to help students to master the concepts for a subject more effectively than those that are usually abstract to a more concrete experience. The study by Yusoff et al (2018) also supports this finding by stating that the use of gamification in teaching gets good feedback from students and they show seriousness when doing activities in the classroom.

In addition, teachers are more likely to carry out gamification-based learning because they believe that this practice can help increase student confidence, interest and motivation of students especially in the lower grades. This finding coincides with the study conducted by Iberahim and Noor (2019) which states that the practice of gamification in the teaching process of primary school teachers focuses more on an interactive learning atmosphere and to complete assignments. Therefore, teaching using gamification needs to be applied in learning for all teachers in the state of Malaysia.

The findings of this study are also supported by the study of Omar et al. (2021) which states that the level of technological knowledge of Malay language teachers in secondary schools in the state of Kelantan is at a high level. This has given a positive impact on the delivery style as well as being among the main aspects in the teaching process. Using technology as a lesson tool allows concept to be conveyed more effectively and students are easy to remember the concepts conveyed.

Gamification knowledge, technology, teacher belief and practice

The analysis of the study findings shows that there is a significant relationship between gamification knowledge, technology, teachers' belief level and primary school Science Education teachers' practice in the learning process. This shows that the teacher belief depends on the practice of teachers using gamification in the teaching and learning process. This finding is in line with the study conducted by Iberahim and Noor (2019) which states that teachers tend to implement gamification strategies because they have the perception that gamification applications can help attract interest, increase confidence and motivation of students during the teaching and learning process. Teachers show a positive tendency towards existing applications supplied by the Malaysian Ministry of Education that support gamification strategies. However, the finding is contradicted by the report of the ICT Management Sector State Education Department in Johor which states that the use of gamification in teaching is still at a low level even though Johor state has nearly 907 primary schools that have 4G internet access (Jusuf, 2016).

Based on the studies that have been carried out, some suggestions for further studies such as the number of sample size needs to be enlarged for the continuation of the same

study. The scope of this study was limited to 150 Science Education teachers only. This is to get a more solid study result. The study population consists of the same primary school or extended to different types of schools.

Conclusion

In conclusion, this study has reported that there is a significant impact on the application of gamification in the teaching and learning process of primary school Science teachers in Selangor state. The results of this study found that the use of gamification is very effective in teaching Science at the primary school level. Most teachers have a good level of knowledge in applying gamification in teaching as well as having a high level of confidence in gamification for improving student achievement in Science subjects. However, this scientific study only involved a few schools in Hulu Langat, Selangor and the respondents were randomly selected. It is hoped that the results of this study can help Science teachers in implementing quality and memorable education in every teaching and learning session.

References

- Ab. Rahman, H., Zainal, N., & Ab Karim, N. A. (2015). Keberkesanan penggunaan ICT di dalam pengajaran dan pembelajaran pendidikan Islam bagi sekolah kebangsaan Desa Pandan Kuala Lumpur. In *International Conference on Information Technology & Society* (pp. 8-9).
- Ali, A., & Mahamod, Z. (2017). Analisis keperluan terhadap pengguna sasaran modul pendekatan berasaskan bermain bagi pengajaran dan pembelajaran kemahiran bahasa kanak-kanak prasekolah. *JuKu: Jurnal Kurikulum & Pengajaran Asia Pasifik*, 3(1), 1-8.
- Awi, N. A. L., & Zulkifli, H. (2021). Amalan Kreativiti Guru Pendidikan Islam Dalam Pembelajaran Abad Ke-21. *Asean Comparative Education Research Journal On Islam And Civilization (Acer-J)*. Eissn2600-769x, 4(1), 40-54.
- Destya, S. (2019). Optimalisasi Pembelajaran Menggunakan Gamifikasi Pada Guru Smkn 2 Sewon. *Prosiding Seminar Hasil Pengabdian Masyarakat 2019, November*, 355–360.
- Ding, L. (2019). Applying gamifications to asynchronous online discussions: A mixed methods study. *Computers in Human Behavior*, 91, 1-11.
- Ding, L., Er, E., & Orey, M. (2018). An exploratory study of student engagement in gamified online discussions. *Computers & Education*, 120, 213-226.
- Farber, M. (2013). Beyond badges: Why gamify. *Edutopia*, 1-4.
- Farozi, M. (2016). Rancang bangun website gamifikasi sebagai strategi pembelajaran dan evaluasi hasil belajar mahasiswa. *Semnasteknomedia Online*, 4(1), 4-2.
- Frost, R., Armstrong, B. C., Siegelman, N., & Christiansen, M. H. (2015). Domain generality versus modality specificity: The paradox of statistical learning. *Trends in cognitive sciences*, 19(3), 117-125.
- Gee, J. (2014). Games, passion, and “higher” education. In *Postsecondary play: The role of games and social media in higher education* (pp. 171-189). Johns Hopkins University Press.
- Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International journal of research in education and science*, 1(2), 175-191.
- Groening, C., & Binnewies, C. (2019). “Achievement unlocked!”-The impact of digital achievements as a gamification element on motivation and performance. *Computers in Human Behavior*, 97, 151-166.

- Iberahim, M. F., & Noor, N. M. (2019). Amalan Gamifikasi dalam Pengajaran dan Pemudahcaraan Guru-Guru Sekolah Rendah di Negeri Johor (Gamification Practices in Teaching and Learning among Primary School Teachers in Johor). *Innovative Teaching and Learning Journal*, 3(2).
- Ismail, A. O., Mahmood, A. K., & Abdelmaboud, A. (2018). Factors influencing academic performance of students in blended and traditional domains. *International Journal of Emerging Technologies in Learning (Online)*, 13(2), 170.
- Jain, C., Mariani, M. N., Abdul Jalil, O., & Mohd Nazri, A. R. (2018). Isu pengetahuan, pedagogi dan teknologi dalam kalangan guru Prasekolah [Issues of knowledge, pedagogy and technology among Preschool teachers]. *Jurnal Kurikulum & Pengajaran Asia Pasifik*, 6(3), 7-21.
- Jusuf, H. (2016). Penggunaan gamifikasi dalam proses pembelajaran. *Jurnal TICom*, 5(1), 1-6.
- Kamasheva, A. V., Valeev, E. R., Yagudin, R. K., & Maksimova, K. R. (2015). Usage of gamification theory for increase motivation of employees. *Mediterranean Journal of Social Sciences*, 6(1 S3), 77.
- Koehler, M. J., Mishra, P., Akcaoglu, M., & Rosenberg, J. M. (2013). The technological pedagogical content knowledge framework for teachers and teacher educators. *ICT integrated teacher education: A resource book*, 2-7.
- Kurnianingsih, I., Rosini, R., & Ismayati, N. (2017). Upaya peningkatan kemampuan literasi digital bagi tenaga perpustakaan sekolah dan guru di wilayah Jakarta pusat melalui pelatihan literasi informasi. *Jurnal Pengabdian Kepada Masyarakat*, 3(1), 61-76.
- Kyewski, E., & Krämer, N. C. (2018). To gamify or not to gamify? An experimental field study of the influence of badges on motivation, activity, and performance in an online learning course. *Computers & Education*, 118, 25-37.
- Lee, J. J., & Hammer, J. (2011). Gamification in education: What, how, why bother?. *Academic exchange quarterly*, 15(2), 146.
- Lubis, M. A., Hassan, W. N. S. W., & Hamzah, M. I. (2017). Tahap pengetahuan dan kesediaan guru-guru pendidikan Islam sekolah menengah di Selangor terhadap penggunaan multimedia dalam pengajaran pendidikan Islam. *ASEAN Comparative Education Research Journal on Islam and Civilization (ACER-J)*, 1(1), 1-13.
- Malaysia, P. P. P. (2013). Pendidikan Prasekolah Hingga Lepas Menengah. *Pelan Pembangunan Pendidikan Malaysia 2013, 2025*, 4-24.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record*, 108(6), 1017-1054.
- Omar, I. M., Mamat, S., Sulaiman, S., & Ismail, N. A. (2021). Tahap Pengetahuan Teknologi, Kemahiran Dan Penggunaan Tmk Dalam Pengajaran Dan Pemudahcaraan Komsas Guru Bahasa Melayu Di Kelantan. *Jupidi: Jurnal Kepimpinan Pendidikan*, 8(1), 47-60.
- Osman, N., Yusof, M. F., Azhari, A. & Yusof, H. (2020). Kesediaan Guru Pemulihan Khas Dalam Menggunakan Teknologi Multimedia Dalam Pengajaran Dan Pembelajaran Di Sekolah Rendah Dalam Daerah Patang Padang dlm. Mat Zain, A. E., & Awang, J. (2020). Metode fenomenologi dalam kajian antara agama: sorotan literatur. In *Pembangunan penyelidikan dan inovasi dalam teknologi, pendidikan dan sains sosial*.
- Paulette, D., Donaldson, A., George, M., Knezek, D., Searson, M., Starkweather, K., Strutchens, M., Tillotson, J., & Robinson, S.P. (2012). Preparing Teachers for Tomorrow's Technologies. *Contemporary Issues in Technology and Teacher Education*, 12(1), 1-5.
- Rahayu, G. D. S., Altaftazani, D. H., Kelana, J. B., Firdaus, A. R., & Fauzi, M. R. (2020, October). Analysis of Elementary School Students' Mathematical Resilience During Learning

- During the Covid 19 Pandemic. In *Journal of Physics: Conference Series* (Vol. 1657, No. 1, P. 012001). Iop Publishing.
- Rahman, S. N. A. (2017). *Pendekatan Gamifikasi Dalam Pengajaran Dan Pembelajaran Terhadap Murid Tingkatan Dua Bagi Topik Ungkapan Algebra* (Doctoral Dissertation, Universiti Tun Hussein Onn Malaysia).
- Rahman, S., Nordin, A. B., & Alias, N. (2017). Penggunaan Ict Merentas Kurikulum Standard Prasekolah Kebangsaan (Kspk): Tinjauan Di Prasekolah Kementerian Pelajaran Malaysia. *Juku: Jurnal Kurikulum & Pengajaran Asia Pasifik*, 1(4), 12-20.
- Suarni, G. L., Rizka, M. A., & Zinnurain, Z. (2021). Analisis Pengaruh Penerapan Model Pembelajaran Sains Teknologi Masyarakat Terhadap Hasil Belajar Siswa. *Jurnal Paedagogy*, 8(1), 31-38.
- Tsay, C. H. H., Kofinas, A., & Luo, J. (2018). Enhancing Student Learning Experience with Technology-Mediated Gamification: An Empirical Study. *Computers & Education*, 121, 1-17.
- Yusoff, M. S. A., Mahpol, S., & Saad, M. L. M. (2019). Kesiediaan Pelajar Terhadap Penggunaan Aplikasi Kahoot! Dalam Pembelajaran Bahasa Arab. *International Online Journal of Language, Communication, And Humanities*, 2(2), 35-50.
- Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The Impact of Gamification on Learning and Instruction: A Systematic Review of Empirical Evidence. *Educational Research Review*, 30, 100326.
- Nur Suhaila. (2011). Hubungan antara Penilaian Prestasi dan Pengaruhnya Terhadap Komitmen Kerja Guru Di Sekolah-Sekolah Sekitar Daerah Seberang Perai Utara, Pulau Pinang (Tesis Sarjana). Fakulti Pendidikan, Universiti Utara Malaysia.
- Nur Suhaila. (2011). Hubungan antara Penilaian Prestasi dan Pengaruhnya Terhadap Komitmen Kerja Guru Di Sekolah-Sekolah Sekitar Daerah Seberang Perai Utara, Pulau Pinang (Tesis Sarjana). Fakulti Pendidikan, Universiti Utara Malaysia.
- Nur Suhaila. (2011). Hubungan antara Penilaian Prestasi dan Pengaruhnya Terhadap Komitmen Kerja Guru Di Sekolah-Sekolah Sekitar Daerah Seberang Perai Utara, Pulau Pinang (Tesis Sarjana). Fakulti Pendidikan, Universiti Utara Malaysia.