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Usability of Gamification Methods in Teaching Mathematics among Special Education Teachers

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Abstract

The selection of appropriate teaching methods and strategies for Special Education teachers plays an important role in the effectiveness of Teaching and Facilitation (PdPc) sessions, especially in Mathematics subjects. This is because Special Educational Needs (SEN) have various problems to follow PdPc sessions more effectively because they easily lose focus and get bored quickly. However, Special Education teachers have constraints in implementing gamification methods due to lack of knowledge and skills. Therefore, the gamification method is seen as one of the alternatives that can be used to increase the effectiveness of PdPc Mathematics sessions. This study uses the Component Model of User Experience (CUE) (2007) to see the usability of gamification methods in PdPc Mathematics sessions from the point of view of Special Education teachers. The design of this study uses survey research and Statistical Package for Social Science (SPSS) software to analyze the data. A total of 50 Special Education teachers were involved in this study and were given a usability questionnaire to get the views of Special Education teachers in terms of usefulness, satisfaction and ease of use. The findings of the study show positive feedback from Special Education teachers regarding usability in terms of usefulness, satisfaction and ease of use with high agreement on the mean score. Therefore, the gamification method clearly shows high usability among Special Education teachers for PdPc Mathematics sessions.

Keywords: Teaching Strategies, Knowledge and Skills, Cue Model, Usability, Usefulness, Satisfaction, Ease of Use, Teaching And Facilitation.

Introduction

Strategies and teaching materials used by teachers should be in line with current technological advances. According to Henni (2016), the use of materials that have gamification elements can develop students' learning experiences by stimulating various skills such as high-level thinking skills (KBAT) and other 21st century skills. This also coincides with Fathi and Khadijah's (2021) study which proves that gamification-based materials have a positive effect on students.

Special Education teachers need strategies and teaching materials that are suitable for Special Education Needs (SEN) who often have problems in basic subjects such as Mathematics. Therefore, traditional methods are no longer suitable to be applied in the teaching and learning process (PdP) of mathematics in the 21st century (Abdul Rahman

2017). Therefore, a variety of teaching methods and strategies that apply the use of teaching aids such as gamification methods need to be applied by teachers in PdP sessions to improve student understanding in Mathematics subjects.

However, a small number of teachers are seen to be underutilizing and optimizing the use of BBM in physical or digital form using technology in their PdP. Learning in majority schools is still teacher-centered (Fathiyah, 2015). If previously PdPc sessions were only implemented traditionally without the use of TMK, Special Education teachers were not able to deliver more appropriate information according to the level of mastery and MBPK ability of learning problems. According to Norshila and Norshidah (2021), there are various applications found in mobile phones and tablets that are able to help teachers to carry out teaching and further increase the knowledge of teachers in the use of modern technology. This clearly shows that the gamification method has an impact in creating a more effective PdPc session.

Literature Research

Special Education Teacher

The level of knowledge and skills of Special Education teachers also affect the effectiveness and usability of gamification methods. In a study by Mattar et al (2020), found that teachers' pedagogical knowledge influences the use of gamification in the learning context. Teachers are also seen as less prepared in using gamification

because they lack knowledge about the concept and application of gamification (Chen & Ying, 2021). A study by Dormann et al (2021), also evaluated the knowledge and perception of teachers regarding the factors that influence the application of gamified methods in PdPc sessions. However, the positive attitude of teachers with experience using game-based gamification has an impact on PdPc sessions (Chen et al., 2019).

Gamification Methods in Special Education

Gamification is a concept that applies game mechanics and game design techniques that involve players and motivate players to achieve their goals (Mohd Faruze and Norah, 2020). Gamification uses elements that have game characteristics such as video games that are applied in indirect learning activities (Pramana, 2015). The initial strategy of the gamification method is to use rewards as a medium for players to perform the desired tasks to get rewards (Farber, 2015). Therefore, there is a significant change in the aspect of increasing student motivation successfully achieved as a result of the gamification material (Azita et. al., 2021). Thus, the applicability of the gamification method can be seen when users can use a product cheaply and easily (Kun et al., 2014).

Usability of Gamification Methods.

The study of Rohani, Suhaila and Hakim (2018), proves that the teaching and learning of Arabic requires new injections and innovations through gamification methods. This is also supported in the study of Salmah & Suhaila (2017), the gamification approach with game elements is very effective applied in teaching and learning Arabic. The findings of the study show that gamification can foster positive attitudes through educational game activities.

Students lack interest in learning resulting in less motivation to learn especially during learning session in the classroom. Azita, Lutfiah and Azrina's study (2021), found positive feedback on gamification methods carried out using Microsoft Power Point software. This was also studied by Joanna and Mistima (2021), regarding the use of the Quizziz application as an alternative formative assessment in PdPc Mathematics. As a result of this study, students' perception of the Quizziz application is high and shows an average percentage of 91.8%. Therefore, the use of technology needs to be appropriate so that its use can have a meaningful impact on students (Jamar and Noh, 2021).

Akanksha Ghai and Urvashi Tandon's study (2023) also found that the interaction of gamification and instructional design increased the usability of e-learning in higher education programs. According to Rodges et al (2018), technology has a high impact on education. Therefore, the study of Sitaresmi Wahyu et al (2020), found that the application of the concept of gamification is more meaningful in e-learning for learning animation applying 3-dimensional elements. This is also supported by Meihua and Karen (2016), who emphasize learning outcomes, learning theories used, elements in game design, and their impact on game-based target groups.

Methodology

Research Design

This study is a quantitative study using a survey research design. According to Ghazali (2018), quantitative research was chosen because it has a more structured, detailed, specific design with tables and diagrams and is more formal. However, the selection of the study design is based on the purpose of the study. According to Cohen et al (2018), the survey method can identify issues, problems and phenomena that have not been studied in addition to making generalizations from the data that has been obtained. Based on the statement made by Khairiah (2019), quantitative methods are used to obtain a comprehensive picture of an issue to be studied. This is in line with the objective of this study where teachers' views on usability need to be studied widely and comprehensively so that the data obtained can be generalized to all Special Education teachers in Kuala Lumpur and Selangor.

Sample Study

The target population for this study is 50 Special Education teachers around the Federal Territory of Kuala Lumpur and Selangor. A total of 44 Special Education teachers in the Program Pendidikan Khas Integrasi (PPKI) around the Federal Territory of Kuala Lumpur and Selangor were selected as a study sample based on Krejcie and Morgan's (1970) sample size determination. Krejcie and Morgan's table (1970) listed the sample size according to the population size of a study. The study sample was selected using a cluster random sampling technique. This is because, the sample of this study has the same characteristics, which are Special Education teachers who teach at PPKI in the Federal Territories of Kuala Lumpur and Selangor. The rationale for selecting the study sample in the two states is also based on the information and communication technology (ICT) facility that is more accessible than other states.

Study Instrument

According to Pajuri (2018), the instrument must have the ability to evaluate or differentiate individuals based on the question and the use of the correct scale on the instrument. In this study, questionnaires were distributed to the study sample involved. This is because the use of questionnaire instruments makes it easier for the researcher to get cooperation more quickly from the respondents (Sahida, 2016). The questionnaire was adapted from the study of Syar Mezee (2021), Noorashikin and Khalid (2019) and Ali et al (2014), who used Lund's (2001) usability questionnaire which is the USE (Usefulness, Satisfaction, Ease of Use) usability questionnaire. This questionnaire contains four parts, named as A, B, C and D where each part has a different number of questions according to the needs of the constructed construct.

Part A includes questions that use nominal data. Parts B, C and D use 5- point Likert scale data, namely "1=Strongly disagree", "2=Disagree", "3=Somewhat agree", "4=Agree" and "5=Strongly agree". Part A includes information on gender, school, state, teaching experience and age. Part B also contains questions about the views of Special Education teachers on the usefulness of gamification methods in PdPc Mathematics. Part C includes the question of Special Education teachers' views on the satisfaction of gamification method in PdPc Mathematics. Part D contains questions about the views of Special Education teachers on the ease of use of gamification methods in PdPc Mathematics. The USE approach was chosen because of its validity and reliability to assess dimensions of software use based on user feedback, and also because the items are stated simply and clearly (Andre, Hartson & Wiliges, 2003). This questionnaire was built based on the components found in the Component of User Experience (CUE) model (2007) which is appropriate to the needs of the study, which is to study the usability of gamification methods. Data from a pilot study using 5-point Likert scale questions were analyzed using the Statistical Package for Social Science (SPSS) version 27.0 software.

Data Collection Procedures

This study was conducted using a questionnaire instrument related to the research topic. There are several steps that the researcher needs to take in the data collection process which starts with a joint discussion between the researcher and the supervisor about the topic to be carried out. After getting the supervisor's approval, the researcher has set the main objective and purpose of the study. Next, the researcher made an application from the Planning and Research Division (EPRD), Ministry of Education Malaysia to prepare a research proposal. The researcher must also obtain permission from the head of the school, which is the principal of the schools involved. After completing the questionnaire, the researcher will analyze the data and report the results of the study. Next, the researcher discusses the results of the study in the study findings section.

Data Analysis Procedures

The data obtained in this study is quantitative. According to Mohd Yusri (2010), data collection is based on the use of instruments such as questionnaires and other tests that involve data analysis using specific tools. Therefore, the researcher will administer the questionnaire received using SPSS software (Statistical Package for The Social Sciences) 27.0 version.

Descriptive analysis was used to analyze the raw data from the questionnaire in this study. The data obtained was analyzed using descriptive and inferential analysis methods in the Statistical Package for Social Science (SPSS) software version 27.0. In addition, the data is also displayed in the form of a table to show the mean and also the standard deviation. This study uses the interpretation proposed by Asrul Azmin (2010) where the mean value of 1.00 to 1.33 is low, 1.34 to 2.66 is interpreted as medium, and 2.67 to 4.00 is interpreted as high.

The results of feedback from respondents through the distributed questionnaire will be analyzed to obtain the mean value, percentage value and standard deviation value to explain the usefulness, satisfaction and ease of use of the gamification method in PdPc Mathematics for Special Education teachers. The evaluation of the questionnaire in this study refers to the difference between respondents who agree and disagree about the aspects studied. Therefore, conclusions about the aspects studied can be made if the group that agrees is found to exceed the group that disagrees significantly at the 0.05 significance level.

Findings

Respondent Demographics

Table 1 shows personal information obtained from 50 Special Education teachers. A total of 35 (70.0%) female Special Education teachers participated in this study questionnaire compared to 15 (30.0%) male Special Education teachers. A total of 29 (58.0%) Special Education Teachers teach in Kuala Lumpur and 21 (42.0%) Special Education Teachers teach in Selangor. For the teaching experience category, it was found that a total of 24 (48.0%) Special Education Teachers have teaching experience in an environment of 1 to 5 years, a total of 5 (10.0%) Special Education Teachers have an experience of teaching in an environment of 6 to 10 years, a total of 10 (20.0%)) Special Education Teachers have teaching experience in the environment of 16 to 20 years and as many as one (2.0%) Special Education Teacher has more than 20 years of teaching experience. Next in terms of age, the Special Education Teacher respondents consisted of 40 years old and above, which amounted to 2 people (4.0%), 35 to 39 years old, 22 people (44.0%), 30 to 34 years old, 11 people (22.0%) and 25 to 29 years old is 6 people (12.0%). Meanwhile, 20 to 24 years old has a total of 9 people (18.0%).

Table 1
Demographic Information of Respondents

Items	Category	Frequency	Percentage (%)
Gender	Men	15	30.0
	Female	35	70.0
State (School)	Kuala Lumpur	29	58.0
	Selangor	21	42.0
Teaching experience	1 to 5 years	24	48.0
	6 to 10 years	10	20.0
	11 to 15 years	5	10.0
	16 to 20 years	10	20.0
	More than 20 years	1	2.0
Age	40 years and above	2	4.0
	35 to 39 years old	22	44.0
	30 to 34 years old	11	22.0
	25 to 29 years old	6	12.0
	20 to 24 years	9	18.0

Special Education Teachers' Views on the Usefulness of Gamification Methods in PDPC Mathematics

Table 2 shows the views of Special Education teachers on the usefulness of gamification methods in PdPc Mathematics. The overall findings are at a high level of agreement with a mean score value of 4.33 and a standard deviation of 0.684. It was found that all the measured items recorded a high level of agreement. The highest mean value is shown in item 3 which is mean = 4.44, SD = 0.574, n = 50. The results of the study also prove that the gamification method is useful to Special Education Teachers for them to teach Special Education Needs (SEN) with Learning Problems in PdPc Mathematics sessions more effectively.

Table 2
Special Education teachers' views on the usefulness of gamification methods in PdPc Mathematics

No	Items	N	Mean score	Standard Deviation
1.	The gamification method helps me control the class more effectively.	50	4.38	0.661
2.	Gamification methods make teaching topics easier to convey.	50	4.38	0.631
3.	Gamification method is useful for me.	50	4.44	0.574
4.	The gamification method makes it easier for me to make references for a topic that is planned and delivered.	50	4.19	0.793
5.	Gamification method saves time when conducting PdPc sessions.	50	4.31	0.643
6.	The gamification method improves my technological skills in preparing teaching aids (BBM).	59	4.29	0.723
7.	The gamification method meets my needs to become a special education teacher with learning problems, especially to teach Mathematics in a more interesting way.	50	4.33	0.760
	Overall	50	4.33	0.684

Special Education Teachers' Views on the Satisfaction of the Gamification Method in PDPC Mathematics

Table 3 is the findings of part C, which is the view of 50 Special Education Teachers on the satisfaction of the gamification method in the PdPc Mathematics session. The results of the analysis of the satisfaction (satisfaction) of the usability of the gamification method show that the overall value of the approval score of special education teachers is at a high level which is mean = 4.49, SD = 0.581, N = 50. The highest mean item result is item 2 which is mean = 4.60, SD = 0.569, N = 50 which shows that Special Education Teachers enjoy using this gamification method in PdPc Mathematics sessions for SEN learning problems.

Table 3
Special Education teachers' views on the satisfaction of the gamification method in PdPc Mathematics

No	Items	N	Min Score	Standard Deviation (SD)
1.	The gamification method helps attract MBPK's interest in the learning problem of learning Mathematics as I expected.	50	4.44	0.574
2.	I enjoy using gamification methods.	50	4.60	0.569
3.	I would recommend the gamification method to a friend.	50	4.47	0.578
4.	I see MBPK learning problems happy when I use the gamification method during PdPc sessions.	50	4.50	0.577
5.	I am satisfied with using the gamification method as a teaching strategy.	50	4.42	0.605
	Overall	50	4.49	0.581

Special Education Teachers' Views on the Ease of Use of Gamification Methods in PDPC Mathematics

Table 4 is the findings of part D which is the views of 50 Special Education Teachers on the ease of use (Ease of Use) of the gamification method in PdPc Mathematics. The overall value of the agreement score of Special Education teachers is at a high level which is mean = 4.4.2, Sd = 0.637, N = 50 which shows that the gamification method is flexible used by Special Education Teachers. The overall results of this finding clearly prove that the usability from the aspect of ease of use of this gamification method clearly shows that all Special Education Teachers agree that this gamification method is easy, simple, user-friendly, flexible and quick to use.

Table 4
Special Education teachers' views on the ease of use (Ease of Use) of the gamification method in PdPc Mathematics

No	Items	N	Min Score	Standard Deviation (SD)
1.	Gamification methods are easy to implement in PdPc sessions.	50	4.29	0.637
2.	A simple gamification method is used.	50	4.37	0.658
3.	Gamification methods are user-friendly.	50	4.25	0.653
4.	Gamification methods are flexible.	50	4.42	0.637
5.	I learned the technology to use gamification methods quickly.	50	4.37	0.627
	Overall	50	4.34	0.642

Discussion

The applicability of gamification methods in PdPc Mathematics sessions for the views of Special Education teachers is very important to ensure that teaching strategies show a more effective teaching environment. Therefore, this study aims to identify the views of Special Education teachers on the usability of gamification methods in PdPc Mathematics sessions in three main aspects, namely usefulness, satisfaction and ease of use.

The results of the study found that gamification methods are useful for Special Education teachers in helping to improve the effectiveness of PdPc Mathematics sessions. The gamification method also helps in the aspect of classroom control more effectively and meets the needs of Special Education Teachers who need to be more creative in providing teaching aids (BBM). This is also related to the component found in the CUE Model (2007), which is the aspect of controllability, effectiveness and learnability of SEN with Learning Disabilities during Mathematics PdPc session implemented by Special Education Teachers. This al is also supported in the study of Arteaga & Duarte, 2010; Szymkowiak & Jeganathan, 2022), learning methods that are easy to use will be considered something that has an impact and is useful to users. Therefore, when users feel that a technology or method is easy to use, work productivity will also increase (Lee et al., 2011).

Next, the findings for Special Education teachers' views on satisfaction are also at a high and positive level of agreement. This is also related to emotional reactions based on the CUE Model (2007). Special Education teachers show emotions, feelings, psychomotor expressiveness and positive psychological reactions after having experience using the gamification method. This is also supported in the study of Liu et al (2023), who found that

teachers obtain high satisfaction when using gamification methods when students show active involvement in class.

Accordingly, it was found that there was a high level of agreement in the findings for the views of Special Education teachers on the ease of use of the gamification method in the PdPc Mathematics session. The usability aspect also refers to the non- instrumental quality perception component found in the CUE Model (2007). In this study, Special Education Teachers showed the highest level of agreement in the item gamification method is flexible to use. This is in accordance with the characteristics of visual aesthetics, haptic and identification that can be changed or modified according to the suitability of the teaching topic. As a result, Special Education teachers can save time in preparing BBM by simply changing the teaching content in the gamification used. This is also supported in the study of Moreno et al (2017), who stated that ease of use is important for gamification methods because it also has an impact on user attitudes.

Conclusion of the study

The results of this study have found that Special Education Teachers agree on the usability of gamification methods in terms of usefulness, satisfaction and ease of use in helping the effectiveness of PdPc Mathematics sessions. This gamification method provides and increases motivation and stimulates the interest of SEN with learning problems to actively engage in PdPc sessions. However, the implementation of this gamification method also has constraints such as lack of knowledge and skills to prepare gamification materials. Therefore, teachers, especially Special Education teachers, need to strengthen themselves with the latest ICT skills and be more open in accepting current changes in the implementation of gamification methods. As a result, the usability of this gamification method has a high impact in creating more effective Mathematics PdPc sessions.

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