

# E-Learning Games Enjoyment to Pupils' Learning Behaviors in Mathematics Classroom

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## Abstract

One of the hardest courses for students to grasp is mathematics, yet it's a crucial ability to have. In order to figure out why students behave in a certain way when studying mathematics, researchers must look for the factors that influence their behaviors. This study helped by presenting the Grade 6 students' learning behaviors in mathematics and their enjoyment of e-learning games. With thirty (30) grade six students as respondents to the adapted-modified survey questionnaire, the study's objectives for the academic year 2021–2022 were successfully met through the descriptive-correlational research design and purposive sampling technique. The findings demonstrate a positive significant relationship between interest, confidence, motivation, and usefulness that is consistent with students' learning behavior in mathematics and the enjoyment of e-learning games in terms of concentration, goal clarity, feedback, challenge, autonomy, immersion, social interaction, and knowledge improvement. Findings showed that e-learning games were helpful at increasing students' interest in the subject. This means that using e-learning games as a good teaching tool can help to enhance and enhance students' learning behavior. Taking into account the limitations on a specific subject, the study suggests further scrutiny on the enjoyment of e-Learning games as applied in other disciplines.

**Keywords:** *Enjoyment of e-learning games, Grade 6, Learning Behavior Mathematics*

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## 1. Introduction

Mathematics is one of the most difficult courses for students to grasp (Anwar et al., 2020), but it is a crucial skill to have. It is regarded by society as the foundation of scientific and technological knowledge, and it is highly valued by people all over the world (Kanafiah & Jumadi, 2013). It always comes to people's minds that mathematics is needed to survive and go along with life. However, some students believe mathematics is boring, complicated, and uninteresting. Many students drop out of mathematics classes before completing their assignments. Despite the benefits of studying mathematics, many people believe that it is complex, obscure, and of little interest to them. Although mathematics is undeniably important in life, most students find it incredibly challenging to grasp the numerous mathematical abilities and procedures required in their daily lives. (Kanafiah & Jumadi 2013).

With the advances in technology and the consequence of the pandemic, new landscape of learning mathematics and all other subjects have emerged. For instance, e-learning enabled by technological advancements and globalization can add to the improvement and enjoyment of mathematics teaching and learning. Many games can aid in the teaching and learning process and meet the basic requirements of learning environments. Similarly, mobile technology (such as smartphones) is increasingly getting used in mathematics teaching and learning (e.g., tablets and computers), due to its specifications of portability, availability, and internet access which has piqued the interest of educational researchers and practitioners. The broad acceptability among youth and other individuals, makes mobile devices to emerged as an emergent agent capable of expanding the parameters of outside-the-classroom mathematics instruction. The mathematical, scientific, and engineering processes covered by the Common Core Math and Next Generation Standards will be easily mapped to the properties of mobile devices such as recording and gathering data, interacting with people and working together, reading and analyzing content, and developing one's own forms of expression and representation (Moyer-Packenham et al., 2019).

Given the students' negative behavior towards learning mathematics and the new paradigm of teaching and learning, this study merged the two concepts to assess their relationship. The concept of learning behaviors in mathematics is extracted from the study of Otoo et al. (2018). They use variables that have not been examined by previous researchers and these are interest, motivation, confidence, and usefulness. Hence, this study determines

primary school kids' enjoyment of playing online math games and its effects on their behavior as learners in Grade 6. The study specifically aims to ascertain the level of enjoyment of Grade 6 students by describing their participation in playing educational video games during Mathematics lessons in terms of their concentration, goal clarity, feedback, challenge, autonomy, immersion, social interaction, and knowledge improvement and to describe learning behavior in attending Mathematics lessons in terms of interest, confidence, motivation, and usefulness. Additionally, the study seeks to ascertain whether or not Grade 6 students' enjoyment of playing online math games during class time significantly influences their performance.

## **2. Literature Review**

### ***2.1. Enjoyment of E-Learning Games***

The assessment of enjoyment in e-learning games is based on the parameters proposed by Csikszentmihalyi (1998), which has eight sub variables namely: concentration, goal clarity, feedback, challenge, autonomy, immersion, social interaction and knowledge improvement. According to Lu and Yang (2018), concentration has the ability to direct one's thoughts in the desired direction and is essential for learning, and important for efficient learning to improve students' academic achievement. On the other hand, goal clarity is described in management and applied psychology literature as the extent to which the job's end goals and objectives are clearly communicated and properly defined (Anderson & Stritch, 2016). Moreover, Mag (2019) asserts that feedback can be used for a variety of purposes, including the graded achievements, students' understanding, skills, and motivation are developed. Furthermore, Oliveira et al. (2021) refers challenge as the level of difficulty in the game; a component found in many case studies stated that increasing difficulty levels for students' aid in the progressive development of knowledge.

Following the study of Lim et al. (2019), when a person is immersed in a certain object, they lose sight of their surroundings and personal difficulties. As such, real-world dissociation is a common trait of concentration and immersion. Social interaction influences person's behavior, which includes networking, interaction, inspiration, and persuasion (Msomi et al., 2018). It is the way to communicate and interact with other people. On the other hand, to obtain a complete knowledge information representation, a hierarchical knowledge improvement-based representation learning approach is employed to carry out hierarchical progressive

learning of character level information, local information, and global information (Wang et al., 2020).

Game-based learning is now one of the most popular e-learning trends, and it appears to be growing in popularity. Doney (2019) recognized the NMC Horizon Project (2012) as one of six technologies that are expected to have a significant influence on learning. As applied in mathematics, mathematical enjoyment is the degree to which students enjoy doing and learning mathematics. Students' attitudes and conduct may be influenced by how much fun they are having while studying. Hence, the association of game-based learning and mathematics.

### ***2.2 Learning Behavior in Mathematics***

Learning behavior is a mental activity that takes place when a pupil is learning while learning is a moderately long-term modification of behavior brought about by prior experiences. Learning behavior is a mental/psychological process and results of active participation in the learning environment, leads to changes in knowledge, comprehension, abilities, and attitude values (Darari & Firdaus, 2020).

In this study, the assessment of the learning behavior in mathematics is based on the parameters which has four sub-variables: interest, confidence, motivation and usefulness. Sutarto et al. (2020) argues that interest plays an important role in learning. This desire motivates students to learn and help them achieve better results. On the other hand, confidence is one of the personality traits that might influence learning because confident individuals believe in their skills and maintain a positive attitude even when confronted with issues they have never encountered before (Yaniawati et al., 2020). Moreover, Cook and Artino (2016) describe motivation as the process of initiating and maintaining goal-directed behaviors. It is a result of the anticipation of success and perceived value, according to the expectancy-value hypothesis. In addition, Mathematics has a wide range of usefulness in human activity. This usefulness does not only refer to practical convenience, but rather to its foundation in a fundamental aspect of mathematics (Nakamura, 2017).

### ***2.3. Theoretical Framework***

This study is anchored from the concept and ideas about GameFlow and the study of Otoo et al. (2018). GameFlow is a game assessment, a collection of numerous criteria and a concise model of enjoyment based on research, accessibility and student's experience in games, which inspired the notion of enjoyment in e-learning games. Feedback, immersion, autonomy, goal clarity, challenge, and concentration are all factors suggested that might

generate flow, as well as the extra factor of player involvement. In addition, criteria are being developed to transform elements that may impact enjoyment into design guidelines for games (Fu et al., 2009). Meanwhile, the concept of learning behaviors in mathematics is extracted from the study entitled of Otoo et al. (2018). The study used the variables interest, motivation, confidence, and usefulness that have not previously been studied by academics. Success in mathematics and science has been linked to a variety of factors, including self-concept, self-efficacy, confidence in one's ability to learn math and science, interest in those subjects, and motivation. These characteristics also influence kids' avoidance of mathematics and science, which has an impact on long-term success and career ambitions in the math/science sector (Otoo et al., 2018). As a result, the students felt the effectiveness of e-learning games to boost their enjoyment implying that usage of e-learning games as an effective teaching tool can contribute to successfully improved students' learning behavior in studying mathematics.

### **3. Methodology**

#### ***3.1. Research Design***

This is a quantitative research that utilized a descriptive design in describing the enjoyment on E-learning games of Grade 6 Pupils and how it is related to their learning behavior in mathematics. Descriptive study is a type of research that aims to correctly describe existent phenomena. The phenomena discovered in the descriptive study have already been documented (Atmowardoyo, 2018). This study is more interested in what happened than how or why it happened (Nassaji, 2015).

#### ***3.2. Sampling Technique***

The respondents of the study are the grade six students in a public elementary school in the Philippines conducting classes online during the academic year 2021-2022. There are 30 target students from the school who are considered using a purposive sampling technique to determine the sample. Since the goal is to choose a specific or specified sample, judgmental or purposive sampling is appropriate (Deshpande & Girme, 2019). The respondents are those who are currently conducting online learning or e-learning.

#### ***3.3. Research Instrument***

**Construction.** The first questionnaire is the enjoyment of E-Learning Questionnaire. A 56-item survey questionnaire with a 4-point Likert scale is provided. This was intended to measure and evaluate students' enjoyment of e-learning games. This adapted-modified instrument from Fu et al. (2009). The second questionnaire is the Learning Behaviors in

Mathematics Questionnaire. This is also an adopted-modified instrument from Otoo et al. (2018) and uses a Likert scale ranging from 1-4, strongly disagree to strongly agree. This is divided into four components to investigate students' mathematical learning behavior including interest, confidence, motivation, and usefulness. The survey questionnaire for students' mathematical learning behavior consists of 20 items.

**Validity and Reliability.** The study's findings are dependent on the validity and reliability of the questionnaire used to assess the independent variable enjoyment of E-learning games and the dependent variable learning behaviors in mathematics.

Internal Consistency – Cronbach's alpha. The consistency with which test objects assess the same construct is referred to as internal consistency. Theoretically, there should be an obvious association between objects that claim to quantify the same construct (Estrella 2015).

**Table 1**

*Result of Reliability Testing*

Subscales	No. of Items	Cronbach's Alpha	Internal Consistency
<b>Enjoyment of e-Learning Games</b>			
Concentration	6	.914	Excellent
Goal Clarity	3	.876	Good
Feedback	6	.912	Excellent
Challenge	9	.951	Excellent
Freedom	6	.944	Excellent
Immersion	4	.933	Excellent
Social Interaction	4	.819	Good
Knowledge Improvement	4	.912	Excellent
<b>Learning Behavior in Mathematics</b>			
Interest	5	.929	Excellent
Confidence	5	.935	Excellent
Motivation	5	.940	Excellent
Usefulness	5	.918	Excellent

The degree of association between the test question items describing each of the independent and dependent variables was calculated using Cronbach's alpha. It takes numbers between 0 and 1, with 1 signifying perfect internal precision. Cronbach alpha values of 0.7 or higher indicate good internal accuracy in addition to values less than 0.7 (Taber, 2017). The study ensures that each question provided in the instrument is internally consistent by conducting a pilot testing survey. It is depicted from the given table that the items set in the given research instrument posted a Cronbach's alpha that is said to be greater than 0.70. This

indicates that the items are internally consistent from excellent to a good level. This implies that all items are retained to ensure an acceptable level of internal consistency.

### 3.4. Data Collection and Analysis

After the validation of the research instruments and approval of the requested permission to conduct the study from the school principal and respondents by following the separate procedure, the copy of the questionnaire was sent to the teacher via Google Form. The teacher sent the link to the survey questionnaire to the students and retrieved all the answered survey questionnaires after four days.

### 3.5. Data Analysis

The study used frequency count, weighted mean and correlation analysis to analyze the data using MS Excel Data Analysis Tool Pack.

### 3.6. Ethical Consideration

The personal information of the respondents was kept private. The respondent's name was also omitted from any document.

## 4. Findings and Discussion

**Table 2**

*Extent of Enjoyment of e-learning Games in Learning Mathematics*

Indicators	Mean	SD	Verbal Interpretation
Concentration	3.37	0.80	ME
Goal Clarity	3.63	0.59	GE
Feedback	3.58	0.61	GE
Challenge	3.56	0.60	GE
Autonomy	3.48	0.63	ME
Immersion	3.15	0.89	ME
Social Interaction	3.54	0.60	GE
Knowledge Improvement	3.61	0.54	GE
<b>OVERALL</b>	<b>3.49</b>	<b>0.66</b>	<b>ME</b>

**Legend:** 3.50-4.00 Great Extent (GE), 2.50-3.49 Moderate Extent (ME), 1.50-2.49 some Extent (SE), 1.00-1.49 Not at all (NA)

Table 2 shows the overall mean of 3.49, indicating that enjoyment of e-Learning games is to a moderate extent. This means that enjoyment of e-Learning games is one of the factors that drive students to enjoy participating in learning activities, and also determines whether they will engage and learn even more. Goal clarity had the highest mean of 3.63 while,

knowledge improvement (3.61), feedback (3.58), challenge (93.56), and social interaction (3.54) are all interpreted as having a great extent of enjoyment. However, autonomy (3.48) and concentration (3.37) posted a moderate extent of enjoyment of e-Learning games which is also similar to immersion (3.15) that ranks last.

The conclusion backs up the findings of De Almeida and dos Santos Machado (2021) that educational serious games are frequently presented to students by their teachers, directing them to play rather than play willingly. As Maher et al. (2020) observe, gamification concept has recently been considered to motivate and engage learners to maximize learning outcomes. Thus, gamified adaptive educational systems can aid in engaging learners in the learning process at their own pace, allowing them to learn while having fun and developing skills based on their learning preferences. It is relevant to the results of this study showing that the overall mean demonstrates a very high level of learning behavior in terms of interest (table 3) of students in learning mathematics. This suggests that the respondents are interested in learning more about the subject and they can make use of that interest by turning their free time into something more useful. The highest mean was 3.63 with a standard deviation of 0.59 in which students strongly agreed with the indicators inferred that students are more interested in the mathematics subject and it also aids in their integration of the subject into a significant and more realistic viewpoint. The fact that students strongly agreed with the study's indicators and posted a high level suggests that interest is being observed. In addition to that, e-learning games become a useful educational tool for students learning Mathematics.

**Table 3**

*Perceived Learning Behavior in Mathematics*

Indicators	Mean	SD	Verbal Interpretation
Interest	3.51	0.73	VH
Confidence	3.39	0.75	H
Motivation	3.57	0.65	VH
Usefulness	3.50	0.70	VH
<b>OVERALL</b>	3.49	0.71	H

*Legend: 3.50- 4.00 Strongly Agree/Very High (VH), 2.50- 3.49 Agree/High (H), 1.50- 2.49 Disagree/Low (L), 1.00- 1.49 Strongly Disagree/Very Low (VL)*

The overall mean of 3.49 shown in Table 3 posted a high level of learning behavior indicating that the respondents have already figured out how to behave when learning mathematics in a way that will allow them to learn and interact with others. Motivation



exhibited the highest mean of 3.57 which also translates to a very high learning behavior when students were thought to observed it in themselves followed by interest, with a mean of 3.51 and usefulness with 3.50 interpreted as both very high. Contrarily, confidence has the lowest mean of 3.39 which only posted high, meaning that it was also observed in their behavior in the classroom when learning mathematics.

The results show that there is a clear connection between motivation and confidence that is similar to the study of Otoo et al. (2018) that confidence directly influences students' enthusiasm for learning mathematics. Students with mathematical confidence is more enthusiastic and motivated to learn more and be engaged in learning mathematics. Additionally, students desire to learn mathematics is heavily influenced by their understanding of its value.

**Table 4**

*Relationship between the Enjoyment of e-learning games and Learning behavior*

	<b>Interest</b>	<b>Confidence</b>	<b>Motivation</b>	<b>Usefulness</b>
Concentration	.535**	.598**	.672**	.654**
Goal Clarity	.700**	.621**	.720**	.619**
Feedback	.688**	.730**	.757**	.725**
Challenge	.582**	.638**	.619**	.682**
Freedom	.547**	.505**	.525**	.592**
Immersion	.597**	.653**	.634**	.545**
Social Interaction	.698**	.590**	.772**	.903**
Knowledge Improvement	.739**	.607**	.683**	.817**

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

Table 4 shows that there is a positive significant relationship between enjoyment of e-learning games and the learning behavior of grade 6 pupils in mathematics. It is reflected that there is a positive significant relationship between concentration as an enjoyment description of e-learning games and the learning behavior of grade 6 pupils in mathematics. It only means that a moderate extent of concentration in the lessons that students need to understand, would lead and help them characterized the essentials of learning behavior by having a very high level of interest, confidence, motivation, and usefulness. It only shows that playing e-learning games wherein student is truly focused on the mechanics of the game and how they would be able to

capture the learning content in mathematics while enjoying it would help them to understand the certain problems that they need to explore (Mendoza et al. 2018).

Moreover, goal clarity as an enjoyment description of e-learning games has a positive significant relationship to the learning behavior. It only means that a great extent of goal clarity in learning mathematics subjects helps student to consider the fundamentals of learning behavior by having a high level of interest, confidence, motivation, and usefulness. It shows that playing e-learning games wherein students understand clearly the goals of the game are likely to participate, learn and engage in the learning process while still having a great time playing. There is also a positive significant relationship between feedback as an enjoyment description of e-learning games and the learning behavior. It only means that a great extent of feedback helps the students to be able to characterize the learning behaviors by showing a high level of interest, confidence, motivation, and usefulness. It shows that students are being notified regarding the progress they are having while using or playing e-learning games during mathematics class and how they can enhance their knowledge would help them to grasp the learning in mathematics subject. Challenge as an enjoyment description of e-learning games also posted a positive significant relationship to the learning behavior. It means that a great extent of challenge will help them characterize the importance of learning behavior by showing a high level of interest, confidence, motivation, and usefulness. It only shows that playing e-learning games with obstacles and challenges while having fun would develop their logical and critical thinking in completing and accomplishing mathematical tasks. Challenge plays an important role in experiencing enjoyment.

It is evident in the table that autonomy as an enjoyment description of e-learning games has a positive significant relationship to the learning behavior of grade 6 pupils in mathematics. It only means that a moderate extent of autonomy in lessons enables learner to determine the essentials of learning behavior posted a high level of interest, confidence, motivation, and usefulness. It shows that having the freedom on playing e-learning games, being able to express themselves and explore would help to improve their understanding and learning mathematics. Students claimed that they reconceptualized the skills they learned in the class in other DVGs to guess the meaning of unknown vocabulary (Ebrahimzadeh & Alavi, 2016). Similarly, there is a positive significant relationship between immersion as an enjoyment description of e-learning games and the learning behavior. It only means that a moderate extent of immersion in the lessons helped students to be exposed and aware and lead them to characterized the

essentials of learning behavior by having a very high level of interest, confidence, motivation, and usefulness. It only shows that playing e-learning games wherein a student truly feels a sense of belongingness, involvement in the game itself, and make real-time decision over long periods helps to capture the learning content in mathematics that would help and train students to solve hard problems while experiencing the simulation of real life (Kassymova et al., 2020).

There is a positive significant relationship between social interaction as an enjoyment description of e-learning games and the learning behavior. It only means that a great extent of social interaction in the lessons where students need to cooperate with peers to achieve the learning goals helped them characterized the essentials of learning behavior by having a very high level of interest, confidence, motivation, and usefulness. It only shows that playing e-learning games wherein a student feels that he or she is participating in a learning assignment through a game that requires teamwork with peers to achieve the learning goals helps to capture the learning content in mathematics while enjoying would help students to engage in mathematical activities which is similar to the findings of Retnowati et al. (2017).

It is also shown in the table that there is a positive significant relationship between knowledge improvement as an enjoyment description of e-learning games and the learning behavior. It only means that a great extent of knowledge improvement in the lessons would lead and help them to characterized the essentials of learning behavior by having a very high level of interest, confidence, motivation, and usefulness. It means that playing e-learning games wherein a student truly improved their knowledge of the game and how they would be able to capture the learning content in mathematics while enjoying it, helps them use games to broaden their knowledge and inspired to use what they have learned in games demonstrated significant knowledge improvement.

## **5. Conclusion**

The findings reflect that all components of enjoyment of e-learning games is to a moderate extent which is considered as one of the factors that drive students to enjoy and participate in learning activities, also determines whether they will engage and learn even more. In terms of the perception as to how student describe their behavior in mathematics, their interest, confidence, motivation, and usefulness posted a high level indicates respondents have noticed that they have already figured out how to behave when learning mathematics in a way that will allow them to learn and interact with others. It was manifested in the findings that there is a significant relationship between the Enjoyment of e-learning games and the learning

behavior of Grade 6 in Mathematics. The more that students enjoy playing e-learning games, the more they learn and gain knowledge in the subject of mathematics. The variables under the enjoyment of e-learning games of the students have a positive significant relationship to the student's learning behavior in mathematics. It is shown that students felt the effectiveness of e-learning games to boost their enjoyment when it comes to the said subject which also implies that the usage of e-learning games as an effective teaching tool can contribute to successfully improved students' learning behavior in studying mathematics.

The outcome of the study recommends that the teacher may consider providing more activities wherein the discussion is in detail as well as activities wherein students will be more engaged and have the freedom to express their knowledge in the mathematics subject. It is also recommended that a certain learning task will be provided to the learners wherein they are the ones who will present their work to their classmates so that it can boost their confidence that they know something in line with mathematics. This study suggested among the teachers may consider the e-Learning games that are provided to the learners have an element of enjoyment since it would help learners to appreciate further mathematical concepts. Furthermore, a parallel study can be conducted to further the knowledge of teachers on whether the enjoyment of e-Learning games can be used and utilized in other subjects aside from mathematics or whether the learning behavior presented here can be modified.

## Appendices

### Appendix A

#### *Extent of Enjoyment of e-learning Games in Learning Mathematics*

Indicators	Mean	SD	Verbal Interpretation
<b>Concentration</b>			
1. Game grabs my attention	3.37	0.72	ME
2. Game provides content that stimulates my attention.	3.43	0.86	ME
3. Gaming activities are related to the learning task.	3.6	0.67	GE
4. I can stay focused on the game if I concentrate on the tasks that I should be concentrating on.	3.43	0.82	ME
5. It is easier for me to do tasks that seem unrelated.	3.03	0.93	ME
6. Workload in the game is appropriate.	3.33	0.8	ME
<b>OVERALL</b>	<b>3.37</b>	<b>0.8</b>	<b>ME</b>
<b>Goal Clarity</b>			
1. Overall game goals were clearly presented in the beginning of the game.	3.6	0.67	GE
2. Intermediate goals were clearly presented in the beginning of each scene.	3.63	0.56	GE
3. Learning goals were clearly understood through the game.	3.67	0.57	GE

	<b>OVERALL</b>	<b>3.63</b>	<b>0.59</b>	<b>GE</b>
<b>Feedback</b>				
I receive...				
1. feedback on my progress in the game.		3.57	0.68	GE
2. immediate feedback on my actions during the game.		3.47	0.68	ME
3. new tasks immediately.		3.63	0.61	GE
4. new events immediately.		3.47	0.68	ME
5. information on my success (or failure) of intermediate goals immediately.		3.7	0.47	GE
6. information on my status, such as score or level.		3.63	0.61	GE
	<b>OVERALL</b>	<b>3.58</b>	<b>0.61</b>	<b>GE</b>
<b>Challenge</b>				
1. I enjoy the game without feeling bored or anxious.		3.67	0.48	GE
2. Challenge is enough and appropriate.		3.53	0.63	GE
3. Game provides “hints” that help me overcome the challenges.		3.53	0.68	GE
4. Game provides “online support” that helps me overcome the challenges.		3.6	0.5	GE
5. My skill gradually improves through the course of overcoming the challenges.		3.57	0.57	GE
6. I am encouraged by the improvement of my skills.		3.67	0.48	GE
7. As my skills improved, the difficulty of challenges increases.		3.47	0.63	ME
8. Game provides new challenges with appropriate pacing.		3.53	0.68	GE
9. Game provides different levels of challenges suited to different players.		3.43	0.73	ME
	<b>OVERALL</b>	<b>3.56</b>	<b>0.6</b>	<b>GE</b>
<b>Autonomy</b>				
1. I have the control over the menu such as start, stop, save, etc.		3.57	0.57	GE
2. I have control over interactions between roles or objects.		3.53	0.51	GE
3. The game supports my recovery from errors.		3.5	0.63	GE
4. I can use strategies freely.		3.4	0.77	ME
5. I have a control and mastery over the game.		3.5	0.63	GE
6. I know the next step in the game.		3.4	0.67	ME
	<b>OVERALL</b>	<b>3.48</b>	<b>0.63</b>	<b>ME</b>
<b>Immersion</b>				
		3.23	0.9	ME
2. I temporarily forget worries about everyday life while playing the game.		3.23	0.94	ME
3. I am too exposed in the game.		3.03	0.93	ME
4. I feel unconsciously involved in the game.		3.1	0.8	ME
	<b>OVERALL</b>	<b>3.15</b>	<b>0.89</b>	<b>ME</b>
<b>Cooperation</b>				
1. I feel cooperative toward other classmates.		3.43	0.68	ME
2. I strongly collaborate with other classmates.		3.47	0.63	ME
3. Teamwork in the game is effective for learning.		3.63	0.56	GE
4. Game supports social interaction between players (chat, etc.)		3.63	0.56	GE
	<b>OVERALL</b>	<b>3.54</b>	<b>0.6</b>	<b>GE</b>
<b>Knowledge Improvement</b>				
1. Game increases my knowledge.		3.57	0.5	GE
2. I applied the basic ideas of the knowledge taught in the game.		3.63	0.56	GE
3. Game motivates me to integrate the knowledge taught.		3.63	0.56	GE
4. I want to know more about the knowledge taught.		3.6	0.56	GE
	<b>OVERALL</b>	<b>3.61</b>	<b>0.54</b>	<b>GE</b>

**Appendix B***Perceived Learning Behavior in Mathematics*

Indicators	Mean	SD	Verbal Interpretation
<b>Interest</b>			
Playing e-learning games in Mathematics...			
1. makes the subject interesting to me.	3.53	0.73	SA
2. allows me to integrate the lesson to other subjects	3.47	0.78	A
3. helps me develop my critical thinking.	3.5	0.78	SA
4. makes my leisure time worth productive for the subject	3.53	0.63	SA
5. helps me apply lessons to real perspective.	3.53	0.73	SA
<b>OVERALL</b>	<b>3.51</b>	<b>0.73</b>	<b>SA</b>
<b>Confidence</b>			
Playing e-learning games in Mathematics makes me...			
1. think logically.	3.27	0.94	A
2. confident in learning the lesson.	3.47	0.73	A
3. follow the lesson.	3.37	0.61	A
4. good in problem-solving.	3.43	0.73	A
5. feel good in the subject	3.43	0.73	A
<b>OVERALL</b>	<b>3.39</b>	<b>0.75</b>	<b>A</b>
<b>Motivation</b>			
Playing e-learning games in Mathematics helps me...			
1. to learn the subject on my own.	3.7	0.65	SA
2. feel encouraged to learn the subject.	3.63	0.56	SA
3. to gain knowledge in Mathematics.	3.67	0.48	SA
4. develop myself more in learning the subject.	3.5	0.73	SA
5. to develop my reasoning ability.	3.37	0.85	A
<b>OVERALL</b>	<b>3.57</b>	<b>0.65</b>	<b>SA</b>
<b>Usefulness</b>			
Playing e-learning games in Mathematics makes me...			
1. realize the importance of the subject.	3.5	0.82	SA
2. apply the lesson in everyday life.	3.5	0.68	SA
3. learn other subjects.	3.67	0.55	SA
4. apply learning to solve real-life situations.	3.5	0.68	SA
5. engaged throughout the lesson.	3.33	0.76	A
<b>OVERALL</b>	<b>3.5</b>	<b>0.7</b>	<b>SA</b>

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