

GAME-BASED APPLICATIONS TO ENHANCE STUDENTS' ENGAGEMENT AND PERFORMANCE

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Abstract

The study aimed to determine the effect of game-based applications on engagement and performance of selected Grade 9 students of Looc Integrated School, Calamba City, School Year 2021-2022. It determined the students' perception on the attributes of game-based applications, level of students' engagement and the significant effect of game-based applications on students' engagement and performance.

Experimental design of research was used in this study in gathering the necessary data. The researcher used a self-made pre-test and post-test and a survey questionnaire as the main instrument of the study. The data gathered were treated using appropriate treatments which are Mean, Standard Deviation, Percentage and Paired t-test.

Based on the data gathered, the students perceived that the use of game-based applications was very effective, and the attributes are very appropriate. The level of engagement of the students was rated very high.

The test of difference between the pre-test and post-test of the respondents resulted to rejecting the null hypothesis which implies that there is a significant difference on the performance of students. Moreover, it showed how the game-based applications significantly affect the students' engagement. The game-based applications significantly affect the engagement of students in terms of their participation and self-regulation but does not significantly affect the students' engagement in terms of their attitude towards games, focus and attention and task orientation. It can also be concluded that game-based applications have significant effect on students' performance.

The researcher highly suggests the continuous use of game-based applications in online classes since teachers in the new normal education must be innovative and creative in their classes. The use of game-based applications can motivate students and can be used as an engaging way to start a class. The researcher also recommends the use of game-based applications to other learning areas and lessons.

Keywords: Student Engagement, Performance, Game-based, Applications, Enhancement

1. Main Text

Introduction

The COVID-19 pandemic created a large disruption in the teaching-learning process. It incapacitated the traditional face-to-face classes and shifted to the new normal education utilizing different learning modalities such as online distance learning modality and modular distance learning modality. The current situation of the education system faced teachers with the challenge of continuously providing quality education despite the pandemic.

The DepEd Order No. 12 s. 2020 was issued to capture changes and priorities in the implementation of learning continuity amidst the pandemic and came up with the Enhanced Basic Education Learning Continuity Plan for School Year 2021-2022. As stated in the BE-LCP, the commitment to continuously provide education to the learners during this time of pandemic should catalyze technological upgrades and innovations in learning resources and platforms in different subjects or disciplines.

Among the subjects, most of the students find math as one the hardest subjects especially now that they are physically away from the guidance of their teachers. This has been such a big trouble for students especially for those who are not mathematically inclined. Mathematics is very essential in daily life because it involves analytical thinking skills, reasoning skills,

and problem-solving skills which the students can apply in their everyday tasks, particularly with decision making. Many mathematical applications are essential in daily lives; thus, teachers should help students to have a better understanding of every concept of the subject despite the absence of the traditional face-to-face classes.

Hamari et. al. (2016) stated in their study “Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning” that engagement in a game has a positive effect on learning. Students tend to learn more if they are engaged in what they are studying. The challenge of the game had a positive effect on learning both directly and via increased engagement. Being skilled in the game did not affect learning directly but by increasing engagement in the game. The more the students become inclined to something they strive harder to learn, they put more effort just to be able to master it.

According to Perrota et. al. (2013) games can be a vehicle for engaging students in a “flow”. Flow was defined as a state of consciousness during which individuals are in control of their actions and completely absorbed in the task at hand. Using games can be a vehicle for getting the attention and interest of the students. With this, students can have more focus on mathematics. One of the challenges now is to make the students focused on a class even especially on online learning. Even before the pandemic, the motivation part of the lesson is very essential as teachers must get the attention of their students. Learning is an active process that needs motivation and guidance to achieve desirable ends. Motivation is important in getting students to engage in academic activities and determining how much students will learn from the activities they perform or the information to which they will be exposed.

Students tend to learn more when they are enjoying what they are doing. Teachers need to find more ways where students’ interests are in the subject and know more about it, despite the circumstances brought by the pandemic such as limited resources. Teaching in the new normal, especially online modality must allow students to be engaged. The challenge to teachers is to make the classes interactive despite the difficulties they encounter.

Background of the Study

The main purpose of education is to prepare the next generation of learners. The education system aims to produce learners that are productive and good members of the community. As 21st-century teachers, it is important to find ways on improving their own teaching and learning process that is suitable for their students. It is necessary for teachers to innovate or think of new ways to catch the attention of their learners and keep them motivated in class.

The education system is continuously changing, from the traditional face-face instruction to the new normal education where different learning modalities are being applied depending on the capabilities and resources the students and schools have.

In line with it, K-12 curriculum uses the Spiral Curriculum, according to Howard (2007) in this curriculum, key concepts are introduced to students at a young age, and cover these concepts repeatedly, with increasing degrees of complexity. The Spiral Curriculum aims to enable the learners to strengthen the retention of learning and development of skills since the design is organized through repeated learning opportunities and from simple to more complex ideas. For instance, Special Products and Factoring has been discussed in Grade 7 and 8, and it is a pre-requisite skill for Grade 9 students, and they should master their skills in Factoring since it is essential among the topics in Grade 9 up to Grade 10. But due to the pandemic, last school year has been a huge challenge for the students since all were under modular distance learning. And as of today, as the schools have already adjusted to this new normal, online classes were already provided to those students who have access to the internet and have gadgets that they can use.

Moreover, another change in this new normal is the implementation of Most Essential Learning Competencies or MELC, according to DepEd, “MELCs are defined as what the students need, considered indispensable, in the teaching-learning process to building skills to equip learners for subsequent grade levels and for lifelong learning. These MELCs are the compressed learning competencies and will enable teachers to focus instruction on the most essential and indispensable competencies that the learners must acquire, as they anticipate challenges in learning delivery.

Clark & Qian (2016) in their research “Game-based Learning and 21st-century skills: A review of recent research” mentioned that game-based learning and 21st-century skills have been gaining an enormous amount of attention from researchers and practitioners. Given numerous studies that support the positive effects of games on learning, a growing number of researchers are committed to developing educational games to promote students’ 21st-century skills development in schools. This shows that game-based learning is necessary for 21st century learners. Many researchers are already developing game-based instructions for the students.

The intent of this study was to know the effectiveness of using game-based applications in enhancing the engagement and performance of students in Factoring and Special Products. The 21st Century learners are more engaged in activities, especially in this New Normal in basic education where some teachers only see their students virtually; they are more active in lessons if they are given different tasks under time restrictions. This aimed for students to be able to solve and think fast. With this concept, students should be able to master the topic better. The 21st-century learners need the ability to think critically and solve any problem which may occur in their lives. Likewise, the 21st – century society is constantly evolving, as a result, students need to have the ability to become lifelong learners to adapt to changes and succeed in this modern society.

Theoretical Framework

This study is anchored with Gagne's Conditioning Theory. As mentioned by Surya and Erlinda (2012), Gagne's theory of learning, it is believed that every child has different cognitive abilities and that learning is a process of changing the behavior of an organism because of experience. This theory stipulates that there are several different types or levels of learning. The significance of these classifications is that each different type requires different types of instruction. Different internal and external conditions are necessary for each type of learning. Every student in a classroom is different. They learn in different ways therefore teachers should also find different ways to help their students learn.

Robert Gagné also proposed a series of events that follow a systematic instructional design process that shares the behaviorist approach to learn, with a focus on the outcomes or behaviors of instruction or training. One of the nine events of instruction of Gagne is to gain the attention of the students. Teachers should ensure that the learners are ready to learn and participate in activities by presenting a stimulus to gain their attention. It is essential for teachers to always make sure that students are interested and attentive to the subject.

In addition, Constructivism theory is also anchored in this study, wherein learning is an active process of creating meaningful learning experience. Bada (2015) stated that Constructivism is a learning theory which explains how people might acquire knowledge and learn. It has a direct application to education. The theory suggests that humans construct knowledge and meaning from their experiences. Game-based learning is built upon a constructivist type of learning. Constructivism suggests the need of providing students with the necessary tools so they can build their own procedures to solve a problem. This implies a participatory process by students, who interact with their environment to solve the situation that is being set out to them. This theory supports the aim of this study to enhance the performance and engagement of students using a game-based applications.

This study was also anchored with Jerome Bruner's spiral curriculum approach where it highlights the importance of re-engaging with ideas over time to keep them fresh in minds and consistently build on ideas. It was based on the three principles of which are Cyclical Learning, Increasing Depth on each Iteration, and learning by building on prior knowledge. According to Howard (2007), Bruner's spiral theory can be seen as to where in the curriculum, fundamental ideas, once identified, should be constantly revisited, and reexamined so that understanding deepens over time. Bruner's spiral curriculum involves regularly revisiting the same educational topics over the course of a student's education. Each time the content is re-visited, the student gains deeper knowledge of the topic. It has the benefits of reinforcing information over time and using prior knowledge to inform future learning. This theory also supports the aim of this study to enhance the skills of the students, through the repeated use of game-based applications in the online class. The topics factoring and special product will be practiced continuously so that the students can master the said topics.

Statement of the Problem

This study aimed to determine the effects of Game-based applications on enhancing engagement and performance of students in Special Products and Factoring.

Specifically, it sought to answer the following:

1. What is the level of students' perception on the attributes of the game-based applications in terms of:
 - 1.1. accessibility;
 - 1.2. enhancement factor;
 - 1.3. motivational factor; and
 - 1.4. objectives?
2. What is the level of students' engagement in terms of:
 - 2.1 participation;
 - 2.2. attitude towards games;
 - 2.3. focus and attention;
 - 2.4. task orientation; and
 - 2.5. self-regulation?
3. What is the level of the students' performance in terms of:
 - 3.1 pre-test; and
 - 3.2. post-test?
4. Is there a significant difference on the students' performance in terms of pre-test and post-test scores of the students?
5. Does the game-based applications significantly affect the engagement of Grade 9 students of Looc Integrated School?
6. Does the game-based applications significantly affect the performance of Grade 9 students of Looc Integrated School?

2. Research Methodology

This research presents the method of research used in this study. The discussion includes research design, respondents of the study, research procedure, research instrument and statistical treatment of the data.

Research Design

The researcher used the experimental design of research in this study to gather the necessary data for the variables of this study which are the Game-based applications, students' engagement and students' performance. Specifically, to know the effectiveness of Game-based applications on enhancing the engagement and performance of the students.

According to Chiang et.al. (2012) Experimental research is concerned primarily with cause-and-effect relationships in studies that involve manipulation or control of the independent variables and measurement of the dependent variables. This design utilized the principle of research known as the method of difference. This means that the effect of a single variable applied to the situation can be assessed and the difference can be determined.

The researcher utilized this kind of research to determine if there is a significant difference between the pre-test and post-test scores of the students and to know if the implemented Game-based applications significantly affect the engagement and performance of the students in Special Products and Factoring.

Population and Sampling Technique

The respondents of this study were the Grade 9 students under the Online Distance Learning from Looc Integrated School, Division of Calamba City, to test the effectiveness of Game-based applications on enhancing the engagement and performance of the students in Special products and Factoring with the use of Pre-test and Post-test Design. The respondents of the study were specifically the students who are enrolled under the Online distance learning modality that were provided with tablet by the school to use for their online classes.

Research Procedure

First, the researcher asked for the approval of the Schools Division Superintendent of Laguna, then to the Principal of Looc Integrated School for the conduct the study. The pre-test and post-test were validated by Subject Expert from other school while the questionnaire of the study was validated by the Research Adviser.

A forty (40) item pre-test about special products and factoring were given to the students using google forms. The Game-based applications was used in their online class before the start of the discussion. Game-based applications were also utilized asynchronously, a code for the game for that day was sent to them so that they can answer when they have internet connection. After the intervention, the students were given the post-test, which is parallel to the pre-test, to test the effectiveness of implementing a practice using Game-based applications. A questionnaire was also given to the students to know their perception about the Game-based applications in terms of its accessibility, enhancement factor, motivational factor, and objectives.

Research Instrument

The researcher made two sets of 40- item test covering the topics of Special Products and Factoring which were parallel with each other. The constructed test served as the pre-test and post-test of the study. The test was validated by a subject expert from Calamba Bayside Integrated School and was checked by the Research Adviser. The test was also administered to a different set of students to test the reliability of the self-made test and the result was statistically analyzed using Cronbach Alpha.

The researcher made a questionnaire with five (5) statements for each indicator, that was checked and validated by the research adviser, subject expert, and technical editor. The questionnaire was used to know the perception of the students on the attributes of the game-based applications in terms of their accessibility, enhancement factor, motivational factor, and objectives. The Likert Scale is used for the interpretation of the corresponding values of data gathered from the survey checklist.

Rating	Scale	Perception of the Attributes of the game-based Applications	Level of Engagement	Verbal Interpretation	Scale	Performance
						Remarks
5	4.20-5.00	Strongly Agree	Always	Very High	33-40	Very Good
4	3.40-4.19	Agree	Frequently	High	25-32	Good
3	2.60-3.39	Neutral	Sometimes	Moderately High	17-24	Average
2	1.80-2.59	Disagree	Seldom	Low	9-16	Below Average
1	1.00-1.79	Strongly Disagree	Never	Very Low	0-8	Poor

Statistical Treatment of Data

The following statistical tools were used to treat and interpret the data gathered in this study.

The data obtained was statistically treated with the use of Mean, standard deviation, and paired t-test effect of game-1058 based applications on students' engagement and performance.

This study used appropriate statistical treatment to determine the effect of the Math apps on the academic performance of the grade 9 learners.

The mean and standard deviation was used to determine the mean level of the student's perception on the attributes of game-based applications and on their level of engagement. While the mean and standard deviation was used to determine the mean level of the pre-test and post-test scores of the students.

The Paired t-test was used, to determine statistically the difference in the mathematics performance between the pre-test scores and post-test scores of the students to test if there is a significant difference in their performance. This was also used to test the significant effect of game-based applications to enhance the students' engagement and performance.

3. Results and Discussion

Students' Perception on The Attributes of The Game-Based Applications

The students' perception on the attributes of the game-based application in terms of accessibility, enhancement factor, motivational factor, and objectives was measured.

Table 1 presents the perception of the students on the attributes of game-based applications in terms of accessibility.

Table 1. Students' Perception on The Attributes of The Game-Based Applications in terms of Accessibility

<i>The application...</i>	Mean	SD	Remarks
<i>...has an interface that is easy to understand.</i>	4.81	0.54	Strongly Agree
<i>...provides navigations and instructions that are easy to follow.</i>	4.78	0.42	Strongly Agree
<i>...consists of appropriate guidelines that is easy for me to understand</i>	4.84	0.45	Strongly Agree
<i>...is easy to access and is user-friendly.</i>	4.81	0.40	Strongly Agree
<i>...can be accessed in mobile phones and computers</i>	4.94	0.24	Strongly Agree

Overall Mean= 4.84

Standard Deviation= 0.22

Verbal Interpretation=VH

The attributes of the game-based applications used in the study was evaluated in terms of its accessibility. It was found that applications used have interface that is easy to understand (M=4.81, SD=0.54) with an interpretation of *Strongly Agree*. The applications provided navigations and instructions that are easy to follow (M=4.78, SD=0.42) with an interpretation of *Strongly Agree*. The applications consist of appropriate guidelines that is easy to understand (M=4.64, SD=0.45) with an interpretation of *Strongly Agree*. The applications is easy to access and is user-friendly as interpreted as *Strongly Agree* (M=4.81, SD=0.40). Finally, a *Strongly Agree* interpretation was given by the students (M=4.94, SD=0.25) on the applications used can be accessed in mobile phones and computers.

The (OM=4.84, Sd= 0.22) with an interpretation of *Very High* indicates further that the game-based applications used in the study is easy to access and can be used anytime and anywhere. Easy to access is one good attribute of an application enabling the user to feel at ease on using it and giving them the opportunity to enjoy using the application.

This result was also supported by Acosta et. al. (2018) that mentioned, accessible web page does not present barriers that hinder access, regardless of the user's physical condition or situation. Web pages that comply with accessibility guidelines are more likely to display correctly on any device and any browser. Web accessibility depends not only on accessible content but also on accessible web browsers and other user agents.

Table 2 presents the perception of students on the attributes of game-based applications in terms of enhancement factor.

Table 2. Students' Perception on The Attributes of The Game-Based Applications in terms of Enhancement Factor

<i>The applications...</i>	Mean	SD	Remarks
<i>...guides me to improve my memory capacity.</i>	4.72	0.46	Strongly Agree
<i>...helps me to think fast and systematically.</i>	4.78	0.42	Strongly Agree
<i>...creates a learning environment making me enthusiastic of learning.</i>	4.81	0.40	Strongly Agree
<i>...helps me to improve my computational skills</i>	4.66	0.48	Strongly Agree
<i>...aids me to have a learning strategy.</i>	4.59	0.50	Strongly Agree

Overall Mean= 4.71
 Standard Deviation= 0.27
 Verbal Interpretation=VH

The attributes of the game-based applications used in the study was evaluated in terms of its enhancement factor. It was found that the applications guided them to improve their memory capacity (M=4.72, SD=0.46) with an interpretation of *Strongly Agree*. The applications help them to think fast and systematically (M=4.78, SD=0.42) with an interpretation of *Strongly Agree*. The applications create a learning environment making them enthusiastic of learning (M=4.81, SD=0.40) with an interpretation of *Strongly Agree*. The applications help them to improve their computational skills (M=4.66, SD=0.48) as interpreted as *Strongly Agree*. Lastly, a *Strongly Agree* interpretation was given by the students (M=4.59, SD=0.27) that the applications aided them to have a learning strategy.

The (OM=4.71, Sd= 0.27) which is verbally interpreted as *Very High* indicates that the game-based applications used in the study enhanced the skills of the students giving them the opportunity to think fast and systematically as well as to improve their memory capacity. Using games that are immersive and require strategy to win can help improve students' memory and help the brain process information quicker.

The result was supported by the study of Chen and Hwang (2014) as they mentioned that digital game-based learning can provide a more interesting and challenging learning environment for acquiring knowledge. To provide an effective digital game-based learning environment, it is important to design good learning strategies or tools in a game-based learning environment.

Table 3 presents the perception of students on the attributes of game-based applications in terms of motivational factor.

Table 3. Students' Perception on The Attributes of The Game-Based Applications in terms of Motivational Factor

The application...	Mean	SD	Remarks
...makes me eager to engage in our class.	4.66	0.55	Strongly Agree
...urges me to believe in my abilities to do well in class.	4.59	0.61	Strongly Agree
...gives me enjoyment in learning the subject.	4.81	0.40	Strongly Agree
...teaches me positive attitudes towards math.	4.53	0.51	Strongly Agree
...provides me an opportunity to show the best of my abilities.	4.66	0.48	Strongly Agree

Overall Mean= 4.65
 Standard Deviation= 0.35
 Verbal Interpretation=VH

The attributes of the game-based applications used in the study was evaluated in terms of its motivational factor. It was found that the applications make the students eager to engage in the class (M=4.66, SD=0.55) with an interpretation of *Strongly Agree*. The applications urge them to believe in their abilities to do well in class (M=4.59, SD=0.61) with an interpretation of *Strongly Agree*. The applications give them enjoyment in learning the subject (M=4.81, SD=0.40) with an interpretation of *Strongly Agree*. The applications teach them positive attitudes towards math (M=4.53, SD=0.51) with an interpretation of *Strongly Agree*. Lastly, an interpretation of *Strongly Agree* was given by the students that the applications provided them an opportunity to show the best of their abilities (M=4.66, SD=0.48).

The (OM=4.65, Sd= 0.35) which is verbally interpreted as *Very High* indicates that the game-based applications used in the study helped the students to learn better in the subject since they see fun in learning with the help of the games. The incorporation of games or gaming methods thrive on intrinsic motivational factors which give the students some sense of achievement on reaching the next level or completing a specific task.

This result was also supported by the study of Jones et.al. (2019). They mentioned that this can help engage the students to better learn difficult topics. 'KAHOOT!', a game-based application incorporates fun into the lesson plan—transforming a lesson that once seemed daunting and mundane to enhancing the student's personal achievement through academic reinforcement. He stated that it has positive impact on the students and teacher as the students learned a topic in a fun and exciting manner.

Table 4 presents the perception of the students on the attributes of game-based applications in terms of its objectives.

Table 4. Students' Perception on The Attributes of The Game-Based Applications in terms of Objectives

The application...	Mean	SD	Remarks
...has specific learning outcomes.	4.78	0.42	Strongly Agree
...uses lessons that are aligned to the specific objectives	4.72	0.52	Strongly Agree

...provides specific objectives that entails us to improve specific skills.	4.84	0.37	Strongly Agree
...incorporate objectives that are realistic and attainable.	4.75	0.51	Strongly Agree
...convey objectives that shows mastery goals that can be measured.	4.81	0.47	Strongly Agree

Overall Mean= 4.78

Standard Deviation= 0.33

Verbal Interpretation=VH

The attributes of the game-based applications used in the study was evaluated in terms of its objectives. It was found that the implementation of game-based applications has specific learning outcomes (M=4.78, SD=0.42) with an interpretation of *Strongly Agree*. The implementation of game-based applications is aligned to the specific objectives (M=4.72, SD=0.52) with an interpretation of *Strongly Agree*. The game-based applications use lessons that provides specific objectives that entails them to improve specific skills, as interpreted as *Strongly Agree* (M=4.84, SD=0.37). The applications incorporate objectives that are realistic and attainable., with an interpretation of *Strongly Agree* (M=4.75, SD=0.51). Finally, a *Strongly Agree* interpretation was given by the students (M=4.81, SD=0.47) on the applications uses lessons that convey objectives that shows mastery goals that can be measured.

The (OM=4.78, Sd= 0.33) which is verbally interpreted as *Very High* indicates further the game-based applications used in the study have specific goals that they need to attain. The games helped them to attain the objectives of the intervention and was able to master the topic using the games.

This result was also supported by the study of Graham et.al. (2021) . They discussed that lesson objectives vividly identify what the teacher wants their pupils to know by the end of the lesson, while the success criteria specify how the pupils will demonstrate the concepts, skills, and knowledge received. In other words, success criteria are the measures used to determine whether, and how well, pupils have met the learning objectives outlined in the lesson. Once a lesson is planned or carefully designed to be taught, the teacher has measurable objectives which guide them to help pupils acquire the concepts, skills, and knowledge mentioned in the lesson plan.

Level of Students' Engagement

The level of students' engagement in terms of participation, attitude towards games, focus and attention, task-orientation and self-regulation was measured and interpreted using mean, standard deviation and verbal interpretation.

Table 5 presents the level of students' engagement in terms of participation.

Table 5. Level of Students' Engagement in Terms of Participation

Participation	Mean	SD	Remarks
I participate actively in our class.	4.53	0.67	Always
I ask question if I am not able to understand our lesson.	4.31	0.78	Always
I stay focused in our class discussion.	4.66	0.60	Always
I see to it that I am prepared as I join our class	4.22	0.94	Always
I provide useful ideas when participating in class discussion.	4.78	0.61	Always

Overall Mean= 4.50

Standard Deviation= 0.51

Verbal Interpretation=VH

The level of student's engagement was evaluated in terms of participation. It was found that the students participate actively in class (M=4.53, SD=0.67) with an interpretation of *Always*. The students ask question if not able to understand the lesson (M=4.31, SD=0.78) with an interpretation of *Always*. The students stay focused in class discussion (M=4.67, SD=0.50) with an interpretation of *Always*. The students are prepared as they joined in the class (M=4.22, Sd=0.94) with an interpretation of *Always*. Finally, an interpretation of *Always* was given by the students on statement that tells provide useful ideas when participating in class discussion (M=4.78, SD=0.61).

The (OM=4.50, Sd= 0.51) which is verbally interpreted as *Very High* indicates that the students are very active in class. The students participate in class by staying focused on the discussion and ask questions to clarify concepts in the lesson. Student's participation in the teaching-learning process is very important because it is one way for the teacher to know that the students were able to understand the topic.

This result was also supported by the study of Ghalley and Rai (2019). This study mentioned that classroom participation is a very important factor in yielding positive learning outcomes for students and further developing their abilities. Participation means students speaking in the class, which consists of asking questions, making comments, and joining in-group activities.

Participation is considered as paying attention, being on task, responding to questions. Participation in-group involves discussion, asking questions, showing respect, seeking help and making good use of class time. However, in general, classroom participation requires students to interact in the classrooms to indicate that they are learning and paying attention.

Table 6 presents the level of student's engagement in terms of their attitude towards games.

Table 6. Level of Students' Engagement in Terms of Attitude Towards Games

Attitude Towards Games	Mean	SD	Remarks
<i>I enjoy the lesson with the help of the game.</i>	4.84	0.37	Always
<i>I find the lesson very interesting</i>	4.88	0.34	Always
<i>I always try my best to achieve high score.</i>	4.75	0.57	Always
<i>I feel more excited in our class.</i>	4.66	0.55	Always
<i>I gain more confidence in answering questions</i>	4.56	0.62	Always

Overall Mean= 4.74

Standard Deviation= 0.33

Verbal Interpretation=VH

The level of students' engagement was evaluated in terms of attitude towards games. It was found that the students enjoy the lesson with the help of the game (M=4.84, SD=0.37) with an interpretation of *Always*. The students find the lesson very interesting because of the games, as interpreted as *Always* (M=4.88, SD=0.34). The students always try their best to achieve high score (M=4.75, SD=0.57) with an interpretation of *Always*. The students feel more excited in class (M=4.66, SD=0.55) with an interpretation of *Always*. Finally, an interpretation of *Always* was given by the students on gaining more confidence in answering questions (M=4.56, SD=0.62) with an interpretation of *Always*.

The (OM=4.74, SD=0.33) which is verbally interpreted as *Very High* implies that the students became more engaged to the class with the help of the games. The use of games helped the students to be more inclined in having goals of achieving high scores and gaining more confidence in joining class activities.

The result is supported by the study of Galbis-Córdoba et.al. (2017) as they explored key drivers of students' attitude toward the use of gamification as an educational methodology to develop their competencies. Results suggested that perceived attention, perceived relevance, and perceived confidence influence in a direct and positive way of students' attitude towards the use of online educational video games to develop their competencies. Both attention and confidence also affect students' perceived relevance of online educational video games as a suitable means to develop their competencies.

Table 7 presents the level of students' engagement in terms of focus and attention.

Table 7. Level of Students' Engagement in Terms of Focus and Attention

Focus and Attention	Mean	SD	Remarks
<i>I stay more attentive in class.</i>	4.66	0.65	Always
<i>I carefully monitor the tasks given to avoid missing outputs.</i>	4.72	0.58	Always
<i>I listen carefully to the instruction of the given task.</i>	4.78	0.49	Always
<i>I avoid negative thoughts while doing the task.</i>	4.41	0.61	Always
<i>I concentrate on task ahead of me to achieve my goal.</i>	4.78	0.42	Always

Overall Mean= 4.67

Standard Deviation= 0.34

Verbal Interpretation=VH

The level of student's engagement was evaluated in terms of focus and attention. It was found that the students stay more attentive in class (M=4.66, SD=0.65) with an interpretation of *Strongly Agree*. The students carefully monitor the tasks given to avoid missing outputs (M=4.72, SD=0.58) with an interpretation of *Strongly Agree*. The students listen carefully to the instruction of the given task and avoid negative thoughts while doing the task (M=4.78, SD=0.49) and (M=4.41, SD=0.61) respectively, with an interpretation of *Strongly Agree*. Finally, an interpretation of *Strongly Agree* (M=4.78, SD=0.42) on the students concentrate on task ahead of to achieve their goal.

The (OM=4.67, SD=0.34) which is verbally interpreted as *Very High* indicates that the students developed their focus and attention with the help of games. The students were able to concentrate on task ahead of them and were able to set goals to achieve.

The result above is supported by the study of Wammes et.al. (2016). They considered attention is an essential basis of learning. To focus during academic activities, students must filter through a tremendous amount of distracting information coming

from both the external environment and their own minds. One particularly pervasive source of distraction is mind-wandering, 1062 which is known to be highly prevalent in academic settings and disruptive to learning.

Table 8 presents the level of student's engagement in terms of task orientation.

Table 8. Level of Student's Engagement in Terms of Task Orientation

Task Orientation	Mean	SD	Remarks
<i>I commit to achieve high score.</i>	4.78	0.42	Always
<i>I focus on the game to gain more knowledge.</i>	4.84	0.37	Always
<i>I read first the instruction of the task given.</i>	4.91	0.30	Always
<i>I follow the task in order.</i>	4.78	0.42	Always
<i>I do task systematically to avoid confusions.</i>	4.72	0.46	Always

Overall Mean= 4.81

Standard Deviation= 0.21

Verbal Interpretation=VH

The level of students' engagement was evaluated in terms of task orientation. It was found that the students commit to achieve high score (M=4.78, SD=0.42) with an interpretation of *Always*. The students focus on the game to gain more knowledge (M=4.84, SD=0.37) as interpreted as *Always*. The students read first the instruction of the task given (M=4.91, SD=0.30) as interpreted as *Always*. The students follow task in order (M=4.78, SD=0.42) with an interpretation of *Always*. Finally, the students do task systematically to avoid confusions (M=4.72, SD=0.46) with an interpretation of *Always*.

The (OM=4.81, SD=0.21) which is verbally interpreted as *Very High* indicates that the students managed to follow and comply the task given to them. The students were able to manage the task given to them leading to high performance in class.

The result above is supported by the study of Bjorn et. al. (2017) whose study examined the dynamics between perceptions of mathematics task-orientation and mathematics performance among students. The results showed that earlier, strong mathematics performance predicted high task orientation later, confirming the existing evidence that mathematics performance and task orientation continue to form a cumulative cycle which is high level of task-orientation.

Table 9 presents the level of student's engagement in terms of self-regulation.

Table 9. Level of Students' Engagement in Terms of Self-Regulation

Self-Regulation	Mean	SD	Remarks
<i>I practice in advance so that I can perform well.</i>	4.38	0.66	Always
<i>I can have my own set of goals to achieve.</i>	4.66	0.60	Always
<i>I reflect on my performance in class.</i>	4.41	0.71	Always
<i>I can think of my own strategy to accomplish my goal.</i>	4.47	0.62	Always
<i>I monitor my performance in class and use it to improve more.</i>	4.53	0.51	Always

Overall Mean= 4.49

Standard Deviation= 0.47

Verbal Interpretation=VH

The level of students' engagement was evaluated in terms of self-orientation. It was found that the students practice in advance so that they can perform well (M=4.38, SD=0.66) with an interpretation of *Always*. The students have set of their own set of goals to achieve (M=4.66, SD=0.60) with an interpretation of *Always*. The students reflect on their performance in class (M=4.41, SD=0.71) with an interpretation of *Always*. The students think of their own strategy to accomplish their goal (M=4.47, SD=0.62) with an interpretation of *Always*. Finally, the students monitor their performance in class and use it to improve more (M=4.53, SD=0.51) with an interpretation of *Always*.

The (OM=4.49, SD=0.47) which is verbally interpreted as *Very High* indicates that the students were able to set goals and monitor their performance and emotion in class. This indicates that the students were able to be flexible and perform well to achieve the desired goals they set beforehand.

The result above is supported by the study of McClelland et.al. (2018). It pointed out that self-regulation may be defined as the ability to flexibly activate, monitor, inhibit, persevere and/or adapt one's behavior, attention, emotions and cognitive strategies in response to directions from internal cues, environmental stimuli and feedback from others, in an attempt to attain personally relevant goals.

Level of Students' Performance in Terms of Pre-Test and Post-test Scores

Table 10 presents the level of students' performance in terms of pre-test and post-test scores.

Table 10. Level of Students' Performance in Terms of Pre-Test and Post-test Scores

Pre-test			Post-Test	
Score	Frequency	Percent	Frequency	Percent
33-40	0	0.00%	18	56.25%
25-32	10	31.25%	13	40.63%
17-24	11	34.38%	1	3.13%
9-16	11	34.38%	0	0.00%
0-8	0	0.00%	0	0.00%
Mean	19.56		32.44	
SD	5.77		4.63	
V.I.	Average		Very Good	

The table above shows the level of the students' performance in terms of their pre-test and post-test scores. The results show the pre-test ($M=19.56$, $SD=5.77$) of the students gained an interpretation of *Average* while the post-test ($M=32.44$, $SD=4.66$) gained an interpretation of *Very Good*. The scores revealed that the post-test scores of the students is higher than the pre-test score with the difference of 12.88. This indicates that the scores of the students increased compare with their pre-test scores.

The result is supported by the study of Pagayanan (2019). He stated that post-test is a standardized assessment done before the experimental class to evaluate what students already know and it will be compared to what they have learned.

Significant Difference on the Students' Performance in terms of Pre-test and Post- Test Scores

Table 11 presents the significant difference on the students' performance in terms of their pre-test and post- test scores.

Table 11. Significant Difference on the Students' Performance in terms of Pre-test and Post- Test Scores

	Mean	Mean Difference	T	p-value	Analysis
Pre-test	19.56	12.88	14.734	0.001	Significant
Post-test	32.44				

This table revealed the significance difference in the students' Performance in terms of pre-test and post-test scores. The results showed that there is a significant difference between the pre-test and post-test scores of the students as supported by the Mean of 19.56 and 32.44 respectively.

The students showed a higher level of thinking skills as shown in the result of the post-test. Furthermore, this shows that retention of learning appears while students experience enjoyment while learning.

The result of the study is supported by the study of Vasbieva et. al. (2016). The study described that a pre-test and post-test were the main instruments used for the purpose of data collection. The performance-based pre-test was conducted before the training period and post-test was conducted after the training period to assess the participants. The very same set of students were made to do a post-test to assess their performance based on the blended learning approach.

Significant Effect of the Game-based Applications on Students' Engagement

Table 12 shows the significant effect of Game-based Applications on students' engagement.

Table 12. Significant Effect of Game-based Applications on Students' Engagement

Learning Engagement	Game-based Applications	t	p-value	Analysis
Participation		-3.139	0.004	Significant
Attitude Towards Games		-.213	0.833	Not Significant
Focus and Attention		-1.565	0.128	Not Significant
Task Orientation		1.497	0.144	Not Significant
Self-Regulation		-3.755	0.001	Significant

It is manifested that the variables, participation and self-regulation have *significant* effect on students' engagement. Specifically, participation ($p=0.004$) and self-regulation ($p=0.001$) were lower than (0.05) level of significance which supported the result of the analysis. The results also indicated that attitude toward games, focus and attention and task orientation have *no* significant effect on students' engagement. Specifically, attitude toward games ($p=0.833$), focus and attention ($p=0.128$) and task orientation ($p=0.144$) were higher than (0.05) level of significance which supported the result of the analysis. This explains more, that the student's perception on the game-based applications does not affect their learning engagement on their attitude towards games, focus and attention, and task orientation but does have on their participation and self-regulation. This further explains that game-based applications used in the study are interactive and it helps to encourage students to participate and think of their

strategies to achieve goals. This also means that the students have their way to appreciate the materials that the teacher used in the 1064 online class.

This was supported by the study of Ibanez et.al. (2014) When they discussed the result of the study that indicates, in general, students continued their work even after reaching the learning goal, so their participation in the activity was beyond the course requirements. Therefore, it was identified as an indicator of learning engagement. However, some students did not find the gamified learning activity appealing and they made the minimum effort necessary to get a reasonable grade for the course. The finding reinforces the idea that a learning activity combining game elements in a gamified learning environment can engage students in achieving their main goal which is to learn even though it was found that motivation does not the same for everyone.

Significant Effect of the Game-based Applications on Students' Performance

Table 13 shows the significant effect of Game-based Applications on students' performance.

Table 13. Significant Effect of Game-based Applications on Students' Performance

Performance	Game-based Applications	<i>t</i>	<i>p-value</i>	<i>Analysis</i>
Post-test		3.528	0.001	Significant

It can be manifested that game-based applications have significant effect on students' performance. Specifically, Game-based applications ($p=0.001$), which is lower than (0.05) level of significance supported the result of the analysis. This explains more, that the students improved their performance with the help of the game-based applications after using them in their online class.

The result was supported by the study of Hwang et. al. (2015) which has an experimental result that indicates the proposed approach, that is a contextual educational computer game, effectively enhanced the students' learning in terms of their learning achievement, learning motivation, satisfaction degree and flow state. Furthermore, it is also found that the proposed approach benefited the "active" learning style students more than the "reflective" style students in terms of learning achievement.

4. Summary of Findings

This chapter includes the presentation of a summary, findings, conclusion based on the hypothesis, and the corresponding recommendations.

Summary

The study explored the effect of game-based application on the engagement and performance of students in Looc Integrated School at Looc, Calamba City which is under the online delivery modality. The attributes of game-based applications refer to accessibility, enhancement factor, motivational factor, and objectives. The effect of the game-based applications on students' engagement and performance was determined. Also, the difference on students' performance in pre-test and post-test.

This descriptive correlative survey was utilized among thirty-two (32) grade nine students of Looc Integrated School under the online learning modality who were provided with tablets by the school and had an internet connection at home.

Mean and standard deviation was used to determine the perception of the students on the attributes of the game-based applications as to the accessibility, enhancement factor, motivational factor, and objectives. It was also used to determine the students' engagement in terms of participation, attitude towards games, focus, and attention, task-orientation and self-regulation, including the pre-test and post-test scores. Paired t-test was used to determine the significant difference in the performance of the students and the effect of game-based applications on students' engagement and performance.

The student's perception on the attributes of the game-based application in terms of accessibility was very high as perceived by the students. This shows that the accessibility of game-based application has an interface that is easy to understand and contain appropriate instruction to access on mobile phone and computer. The enhancement factor of the game-based applications, as perceived was very high in the students showing that the application guides them to improve their memory capacity. On the other hand, the students concluded a very high level of the motivational factor on the application as it made the students eager to engage in their online class and it had given enjoyment while learning. The students also evaluated the objectives of the game-based applications very high. This means that objective of the game-based applications was realistic and attainable. This means that for learning to happen in online learning delivery modality, it is important that teachers use different materials such as game-based applications. The availability of gadgets and internet connection is also considered.

The student's engagement in terms of participation perceived as very high by the students. This show that students focused in class discussion and freely ask question to clarify some queries. The students' engagement in terms of attitude toward games conclude a very high level. In that sense, the students enjoy the lesson with the help of games that teacher used and find the lesson interesting. In terms of focus and attention, students listen carefully to the instruction of the given task to achieve the learning goal that conclude a very high level. Task-orientation also at very high level as rated by the students shows that students read first the instruction and perform task systematically. On the other hand, students' self-regulation as perceived very high shows

that students think of strategy to accomplish task on time. This implies that for the students to engage in online discussion, teachers use interactive games so that students enjoy the lesson. They also need clear instructions to follow the procedure.

The students' performance in the pre-test was average while very good in the post-test. This means that students' performance had improved after using the game-based application. The students showed a higher level of thinking skills as shown in the result of the post-test. Furthermore, this shows that retention of learning appears while students experience enjoyment while learning. There is a significant difference on the students' performance in pre-test and post-test. The post-test result was higher than the pre-test and students' retention of the lesson was observed.

Game-based applications significantly affect the students' engagement in terms of participation and self-regulation while having no significant effect on attitude towards games, focus, and attention as well as task orientation. This means that game-based applications are interactive that encourage students to participate and think of their strategies to achieve goals. This also means that the students have their way to appreciate the materials that the teacher used in the online class. Game-based applications significantly affect the student's performance in terms of post-test. The positive change in students' scores is evident. Appreciation of students in the game-based relies on them to attain the goals of the lesson.

Conclusion

Based on the findings of the study, the following conclusions were drawn:

The students perceived very highly on the use of the game-based applications as it was very effective, and the attributes are very appropriate. The level of engagement of the students was also perceived very highly.

The test of difference between the pre-test and post-test of the students has a significant difference. Moreover, it shows how the game-based applications significantly affect the students' engagement. Also, game-based applications significantly affect the engagement of students in terms of their participation and self-regulation but do not significantly affect the students' engagement in terms of their attitude towards games, focus, and attention as well as task orientation. Based on the results, it can also be concluded that game-based applications have a significant effect on students' performance.

Recommendations

1. Teachers in the new normal education must be innovative and creative in their classes. The use of game-based applications is recommended to motivate students to enjoy while learning takes place.
2. The researcher also recommends the use of game-based applications in other learning areas and lessons.
3. Future research continuously be done with other factors not mentioned in the study that may significantly affect the student's engagement and performance.
4. Further studies may be conducted that are in line with the new normal education that may help the teachers and learners to contribute to the success of the teaching-learning process.

References

- Acosta-Vargas, P., Acosta, T. and Luján-Mora S. (2018) "Challenges to Assess Accessibility in Higher Education Websites: A Comparative Study of Latin America Universities," in IEEE Access, vol. 6, pp. 36500-36508, 2018, doi: 10.1109/ACCESS.2018.2848978.
- Bada, Steve Olusegun (2015). Constructivism Learning Theory: A Paradigm for Teaching and Learning. IOSR Journal of Research & Method in Education (IOSR-JRME) e-ISSN: 2320-7388,p-ISSN: 2320-737X Volume 5, Issue 6 Ver. I (Nov. - Dec. 2015), PP 66-70 DOI: 10.9790/7388-05616670.
- Bjorn, P. Raikkonen, E. Aunola, K. and Kytälä M. (2017), Dynamics between student vs. teacher perceptions of mathematics task-orientation and mathematics performance among adolescents, Learning and Individual Differences, Volume 55, 2017, Pages 21-28,ISSN 1041-6080, <https://doi.org/10.1016/j.lindif.2017.02.005>.
- Chen, NS., Hwang, GJ. (2014) Transforming the classrooms: innovative digital game-based learning designs and applications. Education Tech Research Dev 62, 125-128 (2014). <https://doi.org/10.1007/s11423-014-9332-y>
- Clark, K., Qian, M., (2016) Game-based Learning and 21st century skills: A review of recent research. Computers in Human Behavior, Volume 63, Pages 50-58, ISSN 0747-5632, <https://doi.org/10.1016/j.chb.2016.05.023>.
- Galbis-Córdoba, A., Martí-Parreño, J., & Currás-Pérez, R. (2017). Education students' attitude towards the use of gamification for competencies development. Journal of e-Learning and Knowledge Society, 13(1).

- Ghalley, L. R., & Rai, B. M. (2019). Factors influencing classroom participation: A case study of Bhutanese higher secondary student. *Asian Journal of Education and Social Studies*, 4(3), 1-14.
- Graham, M. A., van Staden, S., & Dzamesi, P. D. (2021). Communicating Lesson Objectives and Effective Questioning in the Mathematics Classroom: The Ghanaian Junior High School Experience. *International Journal of Instruction*, 14(4).
- Hamari, Juho, Shernoff, David, Rowec, Elizabeth, Collier, Brianno, Asbell-Clarke, Jodi, Edwards, Teon (2016) Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior*, Volume 54, Pages 170-179, ISSN 0747-5632, <https://doi.org/10.1016/j.chb.2015.07.045>.
- Howard, J. (2007). Curriculum Development. Elon University: Center for the Advancement of Teaching and Learning.
- Hwang, G. J., Chiu, L. Y., & Chen, C. H. (2015). A contextual game-based learning approach to improving students' inquiry-based learning performance in social studies courses. *Computers & Education*, 81, 13-25.
- Ibanez, M. B., Di-Serio, A., & Delgado-Kloos, C. (2014). Gamification for engaging computer science students in learning activities: A case study. *IEEE Transactions on learning technologies*, 7(3), 291-301.
- Jones, S. M., Katyal, P., Xie, X., Nicolas, M. P., Leung, E. M., Noland, D. M., & Montclare, J. K. (2019). A “KAHOOT!” approach: The effectiveness of game-based learning for an advanced placement biology class. *Stimulation & Gaming*, 50(6), 832–847. <https://doi.org/10.1177/1046878119882048>.
- McClelland, M., Geldhof, J., Morrison, F., Gestsdóttir, S., Cameron, C., Bowers, E., & Grammer, J. (2018). Self-regulation. *Handbook of life course health development*, 275-298.
- Pagayanan, Rowen Q. (2019) Game Based Approach in Learning Science.
- Perrota, Carlo, Featherstone, Gill, Aston, Helen, Houghton, Emily (2013) Game-Based Learning: Latest Evidence And Future Directions. (NFER Research Programme: Innovation in Education).
- Surya E. & Erlinda N. (2017). Mathematical Learning Strategy of Fractional form by Using Learning Model of Gagne and Human Figure Line Media. *International Journal of Sciences: Basic and Applied Research (IJSBAR)* ISSN 2307-4531 vol. 34 pp 13-22.
- Vasbieva, D. G., Klimova, I. I., Agibalova, E. L., Karzhanova, N. V., & Bírová, J. (2016). Enhancement of Students' Vocabulary Learning Through a Blended Learning Approach. *International Electronic Journal of Mathematics Education*, 11(5), 1195-1203.
- Wammes, J.D.; Seli, P.; Cheyne, J.A.; Boucher, P.O.; Smilek, D. (2016). Mind Wandering during Lectures II: Relation to Academic Performance. *Sch. Teach. Learn. Psychol.*, 2, 33–48.