

STUDENTS' ENGAGEMENT AND ACADEMIC PERFORMANCE THROUGH GAMIFICATION: A QUASI-EXPERIMENTAL STUDY

Serene A. Tajora¹, Elizabeth D. Dioso, EdD²

¹Ngan Elementary School, Ngan, Compostela, Davao de Oro, Philippines

²Graduate School Faculty Member, Assumption College of Nabunturan, Nabunturan, Davao de Oro, Philippines

ABSTRACT

One learning approach to raise student engagement in the classroom is gamification. High levels of student engagement may result in better academic competence. This research study utilized quasi-experimental, two groups pretest-posttest design. The results of the study revealed that the level of students' engagement in groups A and B before the intervention were low. For academic competence both groups got below passing marks which can be interpreted as did not meet the expectation. After the intervention was utilized, the level of students' engagement in the experimental group increased and was interpreted as very high. In terms of their academic competence, the experimental group rose from below the passing marks to satisfactory. Additionally, the results also showed that there was significant difference on the students' engagement and academic competence before and after the intervention. Based on the results of the study, the researcher recommends that there should be a thorough study to be conducted by other subject teachers and contextualize the gamification process in this study to their respective subjects to achieve the same benefit achieved by the researcher.

Keyword: *student engagement, gamification, academic achievement*

1. INTRODUCTION

Gamification in education refers to teachers' integration of game design aspects into the classroom setting. Typically, the objective is to enhance the level of involvement in the learning process. When effectively implemented, a gamified lesson maintains the same learning activities while enhancing the learning experience by adding an element of enjoyment (Blankman, 2022)[1]. Games are utilized to stimulate students' curiosity, interest, and enthusiasm, so encouraging their active participation and engagement in the teaching-learning process. In the current era, when the majority of people use electronic devices, it is suitable to incorporate games into their multimedia activities. Put, games have become a commonplace aspect of students' lives. Students allocate a substantial portion of their time to engaging in gaming activities. Gamification activities will be employed to enhance student engagement in the learning process.

According to a survey conducted in Malaysia, instructors in today's classrooms continue to need help with the task of sustaining students' interest and drive to learn. The majority of teachers in Malaysia persist in employing conventional teaching methods and favor a teacher-centered approach, resulting in a detrimental effect on students' inherent motivation and involvement in the classroom environment (Saleh & Aziz, 2012)[2]. However, Erinli (2013)[3] emphasized the beneficial impact of gamification in stimulating and encouraging specific behaviors, as well as keeping

students engaged and deeply involved in their educational environment, leading to improvements in their academic performance.

Nevertheless, the study conducted by Lim (2021)[4] at Eastern Samar State University in the Philippines indicated no substantial disparity between the pretest and posttest scores. Additionally, there was only a minimal average difference observed, suggesting that utilizing gamified classrooms as a method for teaching problem-solving may only sometimes be the most effective approach in Mathematics. The integration of games or plays in the classroom performance does not guarantee effective learning. Merely observing kids enjoying themselves while engaging in games is not enough evidence to conclude that learning is taking place. The study's findings indicated that employing games as an instructional technique would yield advantages solely for particular Math disciplines.

At Ngan Elementary School, where the researcher is presently employed, kids exhibit subpar performance in Mathematics. During a specific periodic assessment, her class achieved a mean average of 57% in Mathematics. Pupils encounter challenges when it comes to problem-solving, and some individuals need help with performing specific mathematical procedures. Consequently, the researcher needs help in simplifying and interpreting the instruction. Due to the students' image of Mathematics as a challenging topic, they are hesitant to participate in teaching and learning. Here are a few experiences and observations of the researcher when teaching Mathematics. This situation prompts the researcher to carry out an experimental study on the implementation of gamification in Mathematics instruction, which influences students' level of involvement and academic achievement.

2. METHODS

2.1 Research Design

The research design employed in this study was Quasi-experimental. It is a research design that possesses some, but not all, defining features of a true experiment. It pertains to a research strategy employed to examine cause and effect linkages between variables when it is not possible or ethical to assign individuals to experimental and control groups randomly. Campbell and Stanley (1963)[5] define this as the empirical investigation of treatment effects when it is not possible to randomly assign treatments. The research guidelines prohibit the researcher from modifying the independent variable. There needs to be more randomized design, matching between the treatment and control groups, or a control group. This research consists of two groups: the experimental and control groups. Control groups are employed in experiments to eliminate confounding factors that may influence the outcome of the investigation. The experimental group is essential for elucidating the impact of the independent variable on the dependent variable. The researcher considers this design suitable because it aims to ascertain the disparity between students' involvement levels and their academic achievement in mathematics when using gamification as an intervention.

2.2 Research Locale

Researchers carried out the study at Ngan Elementary School, located in the eastern portion of Compostela Municipality, under the Compostela East District of the Davao De Oro Division.

Davao de Oro consists of a total of 11 municipalities, with one of them being named Compostela. Before the development that occurred during World War II, the Mandayas were the sole residents of the land along the Agusan River, which was then covered by a forest. This exceptional municipality comprises the wide plains of the province. To reach this town from Tagum City, one must traverse the national highways of Mawab, Nabunturan, and Montevista. Based on the 2015 PSA report, the population of that area is 87,474 individuals, with a population density of either 780 individuals per square mile or 300 individuals per square kilometer. The municipality is composed of 16 political barangays: Poblacion, Aurora, Bagongon, Gabi, Lagab, Mangayon, Mapaca, Maparat, New Alegria, Ngan, Panansalan, San Miguel, Siocon, Tamia, San Jose, and Osmea (PhilAtlas).

Ngan is a village located inside the Compostela municipality in the province of Davao de Oro. The population count as of the 2020 Census was 8,982 individuals. This population represented 9.99 percent of Compostela's total population. Ngan's population declined by 770 individuals over 30 years, dropping from 9,752 in 1990 to 8,982 in 2020. The latest census data from 2020 indicates a population growth rate of 1.55 percent, resulting in an increase of 634 individuals from the previous population of 8,348 in 2015. Ngan lies on the island of Mindanao at coordinates 7.6844 latitude and 126.1114 longitude. We calculate the elevation at these coordinates to be 79.6 meters, which equals 261.2 feet above mean sea level.

Since its founding in 1957, Ngan Elementary School has been managed by many administrators with varied management approaches. Consequently, the school has experienced numerous advancements throughout the years.

Ngan Elementary School currently has seven (7) regular permanent competitive instructors and a school head who is capable of providing vital services to the major beneficiaries, the kids. The school has 116 students, consisting of 51 males and 65 females (PhilAtlas, n.d.)(6).

2.3 Research Subject

This study comprised a sample of 31 Grade 6 students from Ngan Elementary School in Davao de Oro. The participants were selected using the universal sampling method. The experimental group, referred to as Group A, consisted of 16 kids, whereas Group B, which acted as the control group, consisted of 15 pupils.

2.4 Research Instrument

The researcher gathered the data with a pair of instruments. The initial instrument employed was the Students Engagement Questionnaire (SEQ), originally developed by Handelsman et al. (2005)(7). This questionnaire was modified and adapted to ensure its pertinence within the particular context of this inquiry.

The researcher utilized a standardized test questionnaire developed by a Davao de Oro DepEd Division office subject specialist to evaluate the student's academic achievement. The test questionnaire aimed to assess students' educational advancement in Mathematics over the fourth grading period. A Table of Specifications (TOS) was also provided to confirm the validity and reliability of the test questionnaire.

We evaluated student engagement using a four-point Likert scale from 1 to 4. The mean value was presented, along with corresponding descriptive terms and an explanation.

| Range of Mean | Descriptive Equivalent | Interpretation |
|---------------|------------------------|---|
| 3.5 - 4.0 | Very High | Indicator is always manifested; Occurrence is almost inevitable but provides a high impact. |
| 2.5 - 3.49 | High | The manifestation of the indicator is present. Very Likely to occur and has a certain impact. |
| 1.5 - 2.49 | Low | The manifestation of the indicator is present; Likely to occur but no substantial impact. |
| 1 - 1.49 | Very Low | The manifestation of the indicator is present but low and the occurrence is unlikely and provides No critical impact. |

The average percentage mean is utilized to evaluate the student's academic performance. This scale derives from the Department of Education Memorandum Number 8 series of 2015, which represents the department's current grading system.

| Grading Scale | Descriptor | Remarks |
|---------------|--------------------------|---------|
| 90-100 | Outstanding | Passed |
| 85-89 | Very Satisfactory | Passed |
| 80-84 | Satisfactory | Passed |
| 75-79 | Fairly Satisfactory | Passed |
| Below 75 | Did Not Meet Expectation | Failed |

2.5 Statistical Treatment of Data

The following are the statistical tools to be used in this study:

Mean. This method was employed to get the mean of a dataset by summing all the numbers in the set and then dividing the total by the count of numbers.

Standard Deviation. The purpose of this study is to ascertain the variability of students' academic achievement in three distinct subjects. This will provide data on the level of dispersion in the students' educational performance.

Paired T-test. After implementing the independent variable, gamification, this study aimed to assess the statistical significance of the difference in means between two dependent variables, namely students' engagement and academic competency.

3. RESULTS AND DISCUSSION

This chapter presents the data, analysis and interpretation of the data gathered. The orders of the presentations of the results were based on the statement of the problem of this study.

3.1 Student Engagement and Academic Performance Before the Intervention

Table 1 shows the results of the student engagement of group A and group B before the intervention was conducted in this study.

Table 1
Students' Engagement Before the Intervention

| Students' Group | Mean | Indicator |
|------------------------|------|-----------|
| Group A (Experimental) | 2.4 | Low |
| Group B (Control) | 2.2 | Low |

Table 1 reveals that group A, also known as the experimental group, has a mean average of 2.4, indicating that the level of student engagement in this group is low. Conversely, group B, or the control group, has a mean average of 2.2, indicating that the pupils in this group similarly exhibit limited involvement in their Mathematics lesson. Both groups exhibit equal levels of engagement in Mathematics.

The level of students' engagement before the intervention was measured in both two groups. The experimental group, Group A, obtained a mean average of 2.4, indicating a low value. The control group, Group B, obtained a mean average of 2.3, indicating a low level of achievement. Evidently, the level of student engagement was low in both the experimental group and the control group. Students exhibited minimal enthusiasm and engagement in both classes prior to the implementation of the intervention. According to Reeve (2014)[8], students' engagement can be defined as the extent to which students actively participate in the learning process. During this investigation, the researcher noted that students in both groups had a significant lack of physical activity during the session. Lack of participation in the classroom can have negative consequences on students' learning since it can directly or indirectly impact their learning outcomes (Nie et al., 2008)[9].

3.2 Students' Academic Competence Before the Intervention

Table 2 presents the data on the academic performance of the students before the intervention.

Table 2
Students' Academic Competence Before the Intervention

| Students' Group | Mean % | Indicator |
|-------------------------|--------|--------------------------|
| Group A (Experimental) | 34.7% | Did Not Meet Expectation |
| Group B (Control) | 35.3% | Did Not Meet Expectation |

Table 2 displays the results of the mathematics test before the intervention took place. The experimental group, often known as Group A, exhibits significantly low scores. The class' average percentage, which is 34.7%, indicates that this group did not pass the test. The control group, also known as Group B, has very low results, with a mean

percentage of 35.3%. Overall, both groups had a mean percentage that fell below the expected level, indicating a failure to meet expectations. Moreover, the findings suggest a significantly subpar performance of the pupils in Mathematics, which could be better from the teacher's perspective.

The academic competence of students was also measured before the intervention. The results indicated that group A obtained a mean percentage of 34.7%, which falls below the threshold for passing. These results could fall short of the expected outcome. The results in group B are closely comparable to those of the other group. Their average percentage was 35.3%, which is equivalent to group A's interpretation of "not meeting the expectation ."The results indicated a concerning trend for mathematics teachers, as both groups of students demonstrated significantly low scores on their pretest. Both groups had a lack of interest in mathematics, as evidenced by their meager results. Adams (2003)[10] suggests that pupils who possess a strong inclination towards maths are more likely to achieve good grades in mathematics examinations. The level of pupils' interest in mathematics is connected to their emotional involvement in the subject. It is tangentially connected to academic attainment (Asif et al., 2020)[11]. Therefore, it is evident that the pretest results showed a significant lack of student interest, which likely contributed to the underwhelming performance of both groups in the mathematics test.

3.3. Student Engagement After the Intervention

The table below shows the student engagement after the intervention.

Table 3
Students' Engagement After the Intervention

| Students' Group | Mean | Indicator |
|------------------------|------|-----------|
| Group A (Experimental) | 4.0 | Very High |
| Group B (Control) | 3.0 | High |

The table presented above illustrates the outcomes of students' involvement following the implementation of the intervention. The experimental group, Group A, had a mean average of 4.0, indicating high participation in the mathematics classroom. The control group, Group B, has a mean average of 3.0, indicating a high level of engagement. The findings suggest that gamification in mathematics instruction enhances students' academic achievement. The disparity is significant, and gamification is a productive approach for incorporating Mathematics instruction. Educators should thoroughly examine which method could improve students' performance in this scenario. Students perceive this topic as challenging, discouraging them from developing an interest in Mathematics. However, implementing strategies such as gamification can effectively stimulate their interest in the subject.

Following the implementation of the intervention, the degree of student involvement was once again assessed using the same measurement technique, and the findings showed a considerable increase. Group A obtained a mean average of 4.0, which is considered to be significantly high. Group B likewise exhibited significant changes, with a mean average of 3.0 or higher. The findings indicated that the experimental group, referred to as group A, demonstrated significantly elevated levels of engagement during the mathematics lesson when gamification was used as an intervention. The researcher employed a gamification method to enhance student engagement in the mathematics class due to the reported low academic performance in the subject. Moreover, this intervention was implemented due to the fact that gamification has the potential to enhance levels of engagement, resulting in learners who are more productive and actively involved in the course content (Kapp, 2012)[12].

The findings align with the research conducted by Leaning (2015)[13], which demonstrates that gamification is efficacious in stimulating and tempting individuals to engage in desired behaviors and ultimately alter their conduct. Ibanez (2014)[14] employed gamification as a means to enhance students' level of involvement in their learning. The researcher integrated points, leaderboards, and badges into the intervention of this study. The research conducted by Ibanez (2014) provided more evidence that a gamified learning environment can effectively motivate students to participate and acquire new knowledge actively.

3.4. Students' Academic Competence After The Intervention

Table 4

Students' Academic Competence After the Intervention

| Students' Group | Mean % | Indicator |
|------------------------|--------|--------------------------|
| Group A (Experimental) | 81.6 % | Satisfactory |
| Group B (Control) | 62.2 % | Did Not Meet Expectation |

The table above displays the academic proficiency outcomes following the implementation of the intervention. The experimental group, denoted as group A, achieved a mean score of 81.6% on their arithmetic test, indicating a respectable level of ability. Group B, the control group, averages 62.2%, which falls below the passing threshold and means it has yet to meet expectations.

The results additionally demonstrated that the academic proficiency of groups A and B has improved compared to their pretest scores. Group A experienced a significant rise from 34.7% to 81.6% following the intervention. Therefore, gamification in mathematics lectures has resulted in a higher degree of student involvement and ultimately improved their academic achievement in Mathematics assessments. In contrast, Group B, the control group, maintained their performance, which we characterize as unsuccessful or not meeting expectations.

The academic performance was assessed using a comparable technique, and group A showed a significant improvement, achieving a mean percentage of 81.6%, which can be construed as satisfactory. In contrast, group B, which did not receive any intervention, attained an average rate of 62.2%, which fell short of the expected outcome.

The findings of this study validate the findings of previous research undertaken by other scholars about the level of students' involvement and academic proficiency.. Prior research has established a correlation between students' level of engagement and their academic performance (Devici et al., 2016)[15]. This study, which employed gamification as a means to enhance students' involvement, may have also heightened their enthusiasm for learning mathematics. According to Wilkinson's (2003)[16] study, individuals who excel in mathematics tests possess a profound enthusiasm for the subject.

3.5. Significant Difference of Students' Engagement Before and After the Intervention

The table below illustrates the notable disparity in students' level of involvement following the implementation of the intervention.

Table 5

Significant Difference of Students' Engagement Before and After Intervention

| Paired Sample T-test | Df | p | Decision |
|------------------------|----|--------|---------------------------|
| Group A (Experimental) | 15 | <0.001 | Reject the H ₀ |
| Group B (Control) | | | |

The table above displays the outcome of student involvement, which we assessed for any notable disparity before and after the intervention. We reject the null hypothesis because the p-value is less than 0.001. It further suggests a significant gap in student engagement before and during the intervention. The substantial rise indicates that the implementation of gamification in mathematics instruction is productive and has the potential to foster more student engagement. They derive pleasure from engaging in these activities and never experience boredom because their mastery of mathematical skills always stimulates them.

The statistical analysis revealed a substantial disparity in student engagement between group A and other groups, with a p-value of less than 0.01. Consequently, the rejection of the null hypothesis indicates that there is a substantial disparity in students' involvement levels before and after the intervention. The results indicate a significant increase in student engagement following the use of gamification as an intervention. As stated by Aziz et al. (2017)[17], this intervention has the potential to enhance student motivation, ultimately resulting in higher learner engagement. Gamification can be utilized to acquire knowledge, particularly in challenging subjects, by implementing strategies such as engaging in games to enhance students' involvement. It can ultimately result in the acquisition of knowledge in subjects that are commonly perceived as difficult (Deterding et al., 2011; Khaleel et al., 2015)[18].

3.6. Significant Difference of Academic Achievement Before and After the Intervention

The table below illustrates the outcomes of the notable disparity in academic performance across students following the implementation of the intervention.

Table 6
Significant Difference of Academic Achievement Before and After Intervention

| Paired Sample T-test | Df | p | Decision |
|----------------------|----|--------|---------------------------|
| Group A | 15 | <0.001 | Reject the H ₀ |
| Group B | 14 | <0.001 | Reject the H ₀ |

Group A has a p-value of less than 0.001, indicating that the null hypothesis should be rejected. The academic performance of pupils in group A shows a notable disparity after implementing an intervention known as gamification. The academic accomplishment of pupils in group A ranges from 34.7% to 81.6% in terms of the overall mean percentage. The outcome demonstrates the efficacy of the intervention implemented in the experimental group of this study. Conversely, group B, sometimes known as the control group, has experienced a rise from 35.3% to 62.2%. The results have also demonstrated an improvement in their academic performance following instruction using traditional methods. Nevertheless, we can still construe the outcomes as "Did Not Meet Expectations" because they did not attain the minimum required scores.

The primary objective of implementing gamification as an intervention in this study is to enhance students' engagement and enthusiasm toward learning mathematics. The teachers in this school conducting the survey were concerned about the student's performance in mathematics. Integrating gamification into mathematics education has the potential to enhance the academic performance of pupils in this school. Evidently, the intervention has proven to be effective since the educational achievement of the experimental group (group A) has experienced a significant boost.

The p-value for the observed difference in academic achievement between group A is less than 0.01, indicating a significant result. The rejection of the null hypothesis indicates a substantial difference in academic performance between group A before and after the intervention. The findings for Group B indicated p values of <0.01, which can be interpreted in the same way as Group A. The findings of this study are supported by the research conducted by Poondej and Lerdpornkurlat (2016)[18], which demonstrates that incorporating gamification into courses can enhance students' engagement in the learning process. Furthermore, the results of their research suggested that incorporating gamification into learning activities is an effective method for enhancing students' involvement and, consequently, improving their academic proficiency.

4. CONCLUSIONS

Prior to the intervention, the study's findings indicated that the levels of student involvement in groups A and B were low. Prior to the intervention, the pupils' academic competence was likewise below the minimum required percentage for passing. The low scores were seen in both groups, A and B. Nevertheless, following the implementation of gamification as the intervention, significant outcomes were found, particularly in group A (the experimental group). The student's level of participation in the experimental group was initially categorized as "low" before the intervention. However, following the intervention, their level of engagement significantly increased to a "very high" level. The academic proficiency of the experimental group did not achieve the anticipated standard. Nevertheless, following the intervention, their academic proficiency improved to a satisfactory level. Finally, the experimental group exhibited a substantial disparity in their pupils' level of involvement and academic proficiency before and after the intervention.

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