LIMITLESS INSIGHTS

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About the Journal

LIMITLESS INSIGHTS is the official journal of mathematics education of Gordon College. The journal is committed to presenting a broad spectrum of insightful and creative viewpoints in the field of mathematics. The term limitless suggests that it will cover a wide range of subjects without limitations or bounds, from basic theories to cutting-edge research. And highlighting insights is to provide readers with a deeper comprehension and appreciation of the subject matter by delving extensively into mathematical principles, theories, and applications.

Inside its pages, Limitless Insights implies a dedication to investigating novel concepts, procedures, and strategies in mathematics, inspiring scholars to push the limits of understanding and advancement.

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THE RELATIONSHIP BETWEEN MATHEMATICS ANXIETY AND THE ACADEMIC PERFORMANCE AMONG COLLEGE STUDENT

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Keywords

Mathematics Anxiety, Academic Performance, correlation, midterm grades

Abstract

This study explored the relationship between Mathematics Anxiety and Academic Performance among college students. The participants were first-year Bachelor of Secondary Education (BSEd) students who are taking Mathematics in the Modern World. It was conducted during the midterm of the second semester, AY 2022-2023 at Gordon College in Olongapo City. The research investigation involved a population of 153 students, consisting of students from different specializations. Specifically, there were 19 students from Mathematics, 15 students from Science, 48 students from Filipino, 28 students from Social Studies, and 43 students from English. The data were statistically analyzed using frequency, percentage distribution, and correlation of the two variables. The statistical analysis yielded a neutral response when assessing the level of Mathematics anxiety, with an overall weighted mean of 3.18 Additionally, there was a high occurrence of very low academic performance in relation to this anxiety. The study revealed that there is a significant relationship between Mathematics anxiety and Academic Performance among college students. The result of the study could be a basis for the proposal of an action plan for enhancing the Mathematics performance of students.

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INTRODUCTION

Anxiety is a common response of the human mind and body towards unfamiliar and stressful circumstances; however, it can be alarming if it is repeatedly experienced by the individual in an uncontrolled manner. On the other hand, Mathematics anxiety is a major problem in education and defined as the feeling of tension, fear, uneasiness, and helplessness when solving mathematical problems and situations. In addition, Ashcraft (2002) stated that people who are extremely anxious about Mathematics tend to avoid it a lot, which makes it harder for them to be good at Mathematics in the long run. Furthermore, several studies proposed that this event occurs frequently at all levels of education (Gunderson et al., 2018).

In a classroom setting, the researchers have observed that academic performance is often determined by their grades. This claim is supported by the study of Yusuf, et. al. (2016) which states that academic performance is a student's visible and quantifiable behavior over a specific period of time. It is the sum of a student's scores on various evaluations, such as class tests, midterm and final exams, etc.

Knowing these two terms mentioned above, this study tends to discover the relationship between Mathematics anxiety and academic performance. Therefore, the researchers were tasked to determine the degree of association of Mathematics anxiety on academic performance. Tobias (2009) said that Mathematics anxiety could make solving various Mathematics problems in daily and educational circumstances difficult. Moreover, the students' general Mathematics academic performance is negatively correlated with their perceived level of Mathematics anxiety (Ablian & Paranga, 2022). In contrast, Ashcraft and Kirk (2001), Cassady and Johnson (2002), and Moore, Rudig and Ashcraft (2015) all stressed that normal levels of anxiety during a learning task or exam can be positively correlated with improved academic performance. However, it was discovered that anxiety and performance interact in a non-linear manner. Understanding the unconscious or hidden causes of Mathematics anxiety, which is common even in students who perform well, requires additional research. Because of this, academic performance is not a very good indicator of how many students are anxious about Mathematics, a problem that should and could be detected using recent developments in cognitive network science and network psychometrics. (Stella, 2021)

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Statement of the Problem

This study aims to determine if there is a relationship between the students' Mathematics anxiety and their academic performance.

Specifically, this study will pursue the following question:

1. How may the respondents be described in terms of:
   1.1. level of anxiety towards Mathematics; and
   1.2. their academic performance in the subject?
2. Is there a significant relationship between the student's anxiety level towards Mathematics and their academic performance?
3. What plan of action may be proposed to enhance Mathematics performance?

METHODOLOGY

Research Design

To carry out the study in a systematic manner the researchers conduct an analytic cross-sectional design.

A cross-sectional study design is a form of observational research or descriptive study, which involves analyzing information (data) about a population at a particular moment. A cross-sectional study has a variety of designs depending on the purpose of the study. Some of the designs that can be utilized are descriptive and analytic cross-sectional studies. Descriptive is typically used to describe the characteristics of a population, while analytical is employed to investigate the association between variables (Simkus, 2023).

This study utilized an analytical cross-sectional design since the aim of the study is to assess the association of Mathematics anxiety on the academic performance of college students. This would serve as the basis for the proposal of an action plan to enhance the academic performance of college students.

Respondents

The population of this study was the first-year students of Bachelor of Secondary Education who took Mathematics in the Modern World. The respondents were from Gordon College, Academic Year 2022-2023. There is a total of 153 students – 19 students from Mathematics, 15 students from Science, 48 students from Filipino, 28 students from Social Studies, and 43 students from English – as population, excluding students who are neither enrolled in a BSEd program nor taking the said subject.

In this study, the sampling design implemented was convenience

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sampling. According to Nikolopoulou (2022), convenience sampling is a non-probability sampling method wherein the respondents are selected based on their accessibility and willingness to participate in the research. For the objective of the study was aimed to analyze the relationship of Mathematics anxiety and academic performance among college students, students who are taking Mathematics subjects are the most appropriate choice of respondents. Thus, this study collected data from first-year college students taking classes in Mathematics in the Modern World.

Research Instrument

The research instrument of this study was a survey which was adapted from a 2009 study of Diana K. May entitled *Mathematics Self-Efficacy and Anxiety Questionnaire* that was aligned with the objectives of this study. The research instrument tends to measure the significant relationship between the student's academic performance and their level of anxiety toward Mathematics. The research instrument consists of three (3) parts: (1) Informed Consent Form, wherein respondents were asked for their consent to participate in the study; (2) Personal Information, wherein respondents were asked about their personal information and academic performance in the form of their midterm grade in Mathematics in the Modern World; and (3) Mathematics Anxiety Survey, wherein the respondents were asked to rate their level of anxiety towards Mathematics by according to their agreement/disagreement with the indicators through a Likert Scale.

SCALING OF THE LIKERT SCALE

5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

Statistical Treatment of Data

The data gathered were organized and analyzed in the Statistical Package for Social Sciences (SPSS) v.23. The following statistical techniques were applied to treat the specific problems raised in the study: (1) The Shapiro-Wilk test of normality was used to determine whether the data collected are normally distributed; (2) The Spearman's rank correlation coefficient was used to determine the significance in the relationship of the student's level of anxiety towards Mathematics and academic performance after recognizing the data is not normally distributed. The formulas are not reflected in this study as the software did not provide step-by-step calculations.

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Results and Discussion

This part of the study contains the presentation, analysis, and interpretation of data gathered by the researchers. The data were organized according to the sequence of the statements of the research problem.

1. How may the respondents be described in terms of:
a. level of anxiety towards Mathematics; and
b. their academic performance in the subject?

Table 1. Level of Anxiety of College Students towards Mathematics

Indicators	*Mean*	*Descriptive Interpretation*
1. I do not feel confident enough to ask questions in my Mathematics class.	3.56	Agree
2. I get tense when I prepare for a Mathematics test.	4.10	Agree
3. I do not feel confident in using Mathematics outside of school.	3.22	Neutral
4. I believe I cannot do well in Mathematics tests.	3.37	Neutral
5. I am certain that I will not get good grades in my Mathematics course.	3.42	Agree
6. I believe I cannot complete all of the assignments in a Mathematics course.	2.66	Neutral
7. I believe I will not be able to use Mathematics in my future career when needed.	2.27	Disagree
8. I believe I cannot understand the content of a Mathematics course.	2.76	Neutral
9. I feel that I will not be able to do well in future Mathematics courses.	3.03	Neutral
10. I look forward to the results after taking a Mathematics test.	2.54	Disagree

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11. I am afraid to commit a mistake when solving a mathematical problem.	3.75	Agree
12. I dislike solving mathematical problems.	3.18	Neutral
13. I do not like being asked questions during Mathematics class.	3.28	Neutral
14. I am not excited when discussing new topics in Mathematics class.	2.93	Neutral
15. I believe I am the kind of person who is not good at Mathematics.	3.61	Agree
Average	**3.18**	**Neutral**

This instrument is adapted from a study by Diana K. May (2009) entitled Mathematics Self-Efficacy and Anxiety Questionnaire.

The table in the previous page presented the mean and descriptive interpretation of all of the responses gathered for each indicator in the survey. The mean value between 4.20 and 5.00 is described as “Strongly Agree,” between 3.40 and 4.19 as “Agree,” between 2.60 and 3.39 as “Neutral,” between 1.80 and 2.59 as “Disagree,” and between 1.00 and 1.19 as “Strongly Disagree.” Additionally, these values indicate their level of anxiety toward Mathematics. The average indicated a “Neutral” or moderate level of anxiety toward Mathematics.

Table 2. Academic Performance of College Students in Mathematics

Academic Performance	*Descriptive Interpretation*	*Frequency*	*Percent*
Below 75	Very Low	051	033.33
75 ~ 79	Low	041	026.80
80 ~ 84	Moderate	027	017.65
85 ~ 89	High	019	012.42
90 and Above	Very High	015	009.80
Total		**153**	**100.00**

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The table above presents the frequency and the percentage of respondents with each level of academic performance. There are 15 students (9.80%) out of 153 total respondents with 90 and above grades in the midterms which is described as a “very high” level of academic performance. There are 19 students (12.42%) who had a “high” level of academic performance, 27 (17.65%) had a “moderate” level, 41 (26.80%) had a “low” level, and 51 (33.33%) had “very low” level of academic performance. It is worth noting the inverse association between frequency and level of academic performance.

1. Is there a significant relationship between the student’s anxiety level towards Mathematics and their academic performance?

Table 3. Relationship between the Level of Anxiety towards Mathematics and Academic Performance

Variable	*Coefficient of Correlation (r)*	*Decision*
Level of Anxiety toward Mathematics and Academic Performance	-0.395	Significant

There is a significant relationship between the level of anxiety toward Mathematics and academic performance. The coefficient of correlation of -0.395 is further described as a “low” or slightly negative relationship with the corresponding probability value of 0.000 which is significant at $\alpha = 0.05$. This means that some college students with low levels of anxiety may have higher academic performance, while other college students with similar levels of anxiety may also have lower academic performance. This aligns with the study of Huberty (2012), which asserts that as a student's academic performance declines, the anxiety levels associated with specific academic tasks tend to rise.

Table 3 presents the relationship between the level of anxiety towards mathematics and academic performance using the Spearman rank correlation. It revealed a statistically significant negative low correlation at 5% significance level.

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Conclusion

1. *Majority of the respondents are having a moderate level of anxiety with an overall weighted mean of 3.18. In line with that, 82% of the total population agreed that they feel tense particularly when preparing for a mathematics test.*
2. *There was a low significant relationship between Mathematics anxiety and the academic performance of college students based on the results of the Correlation Analysis.*
3. *Students with a moderate level of anxiety towards Mathematics also have a moderate level of academic performance.*
4. *Some college students with low levels of anxiety towards Mathematics may achieve better academic results, while others with high levels of anxiety may also perform well academically.*

Recommendations

1. *It is advisable for students to actively seek assistance and support, and not hesitate to ask for help. Engaging with their Mathematics teacher, peers, or a tutor can greatly enhance their understanding. By seeking guidance from different individuals, students can gain diverse perspectives and explanations, leading to a substantial improvement in comprehending various mathematical concepts.*
2. *Mathematics teachers should address math anxiety openly. Discuss Mathematics anxiety with your students and let them know it's normal to feel anxious about Mathematics. Share your own experiences or stories of successful individuals who initially struggled with math but overcame their anxiety. These stories can serve as a source of inspiration and motivation, highlighting the fact that struggles and mistakes are part of the learning process.*
3. *For curriculum designers, they can offer professional development for teachers. Provide ongoing professional development opportunities for teachers to enhance their pedagogical strategies, understanding of mathematics anxiety, and ways to support students effectively. Equipping teachers with the necessary tools and knowledge will enable them to address mathematics anxiety more effectively in the classroom.*
4. *Future researchers can use the profiles of their respondents for better precision and accuracy of the results provided in this study. In addition, other factors (such as social status and family income) can be included as other variables.*

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EXPLORING STUDENTS' PERCEPTIONS AND ATTENTION TOWARDS CODE-SWITCHING IN TEACHING MATHEMATICS

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Keywords

Students Perceptions, Students Attention, Code Switching, Mathematics

Abstract

The study explores the student's perceptions and attention in teaching mathematics with the use of code-switching in Gordon College, Academic Year 2022-2023. The study determined the student's perceptions and attention of those who experience code switching towards learning and teaching mathematics in Gordon College. The study analysis was conducted wherein seventy (70) students of the identified instructor who uses code-switching in teaching mathematics were taken as the respondents of the study. The data were statistically analyzed using mean and correlation for the significant difference. The result showed that students perceptions on the usage of code switching were scaled in agree and always agree, while the student's attention on the usage of code switching were scaled in always. The findings demonstrated that student's perceptions and attention on the usage of code-switching showed positive impact from the respondents in terms of teaching mathematics. The study revealed that there was a significant relationship between the student's perceptions and attention towards the usage of code switching. The result of this study is the basis for the formulation of action plan for enhancing the use of code switching in teaching mathematics.

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INTRODUCTION

Code-switching, a common tactic employed by bilingual and multilingual speakers to express their identities, navigate social contexts, and achieve communicative goals, is the practice of switching between two or more languages, dialects, or registers in a single conversation or text (APA Dictionary of Psychology, n.d.). In the realm of mathematics education, Al-Qaysi (2018) defines code-switching refers to the act of seamlessly shifting between multiple languages during a single lesson. This versatile approach serves several valuable purposes, including the clarification of complex mathematical ideas, offering assistance to students with limited English proficiency, establishing a strong connection with learners, and fostering an environment that encourages cultural understanding.

Student's attention is a critical factor to ensure that someone understands the topic very well. A study found that students who were more comfortable with code-switching in the classroom were more likely to pay attention and participate in class, and they also had higher academic achievement. Effective communication and interaction are paramount for a successful lesson, with code-switching emerging as a highly efficient method. The practice simplifies instructors' explanations while concurrently minimizing student confusion. Code-switching stands as a valuable teaching strategy within a bilingual classroom, offering the potential for enhanced comprehension for both educators and students (Yusob et al., 2018). One studey found that students' focus and active participation in Mathematics improved when teachers strategically utilized code-switching, resulting in enhanced comprehension and performance (Li & Wu, 2018).

In the same study, Yusob et al. (2018) found that students' perceptions of code-switching in mathematics classrooms were influenced by a number of factors, including their level of proficiency in the two languages, their prior experiences with code-switching, and the teacher's approach to code-switching. The study also found that the teacher's approach to code-switching was important. Students who had teachers who code-switched strategically and thoughtfully were more likely to have positive perceptions of code-switching.

A study from Villanueva and Gamiao (2022) was conducted to know the effects of using code-switching among college instructors and students in a Philippine classroom setting. Based on the results of the study, the effects of code-switching in teaching and learning are as follows; it helps students to better understand the directions, removes language barrier for a clearer instruction, helps students in deciding into better choices, and helps them to clarify, investigate further and reiterate learned earlier knowledge. Those indicators are all associated to a better performance among students and instructors in a classroom setup. The study concluded that the implementation of code-switching is a great help to a

better teaching and learning experiences in Philippine college classrooms. Furthermore, Salazar and Rodriguez (2021) emphasized the importance of establishing a supportive classroom atmosphere that fosters students' attention and active engagement during code-switching activities.

According to a study conducted by Tahir and Ashraf (2020), they investigated how code-switching affects students' attention and comprehension of mathematical word problems. The results revealed that code-switching positively influenced students' attention and understanding, especially among those with limited proficiency in the language of instruction. The study underscored the significance of code-switching as a valuable instructional strategy to actively engage students and enhance their understanding of mathematical concepts.
Darmawijoyo (2019) conducted a study to explore how code-switching influences students' attention and problem-solving performance in mathematics. The results demonstrated a positive effect of code-switching on students' attention and their ability to solve problems. The researcher suggested that code-switching can be a valuable strategy to enhance student engagement and facilitate a deeper understanding of mathematical concepts.

Celario (2022) conducted a study to understand the pedagogical effect of code-switching in teaching mathematics. The results unveiled that students who used their native language along with the English language showed higher performance than other students who did not.

Many researches in the field of code-switching in teaching Mathematics has yielded valuable insights into the effects of code-switching in multiple aspects. However, this body of work has largely overlooked other variables such as the students' perception towards usage of code-switching, and how students' attention affects them leaving a notable gap. Understanding this aspect is essential because it will help to improve the learning experience of students. In light of this research gap, our study seeks to explore students' perception and attention towards code-switching in teaching Mathematics to address this critical omission and advance our understanding of this topic.

The purpose of this study is to explore the students' perceptions and attention towards code-switching in teaching mathematics in Gordon College, Academic Year 2022-2023. This paper contributes to the field of education by deepening our understanding of the role of code-switching in teaching mathematics from the perspective of students. It offers insights, practical implications, and potential avenues for further research, all of which can enhance the quality of mathematics education and promote inclusive learning environments.

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Statement of the Problem

This study aims to explore the students' perceptions and attention towards code-switching in teaching mathematics.

Specifically, it seeks to answer the following sub problems:

1. How may the students' perception on the usage of code-switching be described?
2. How may the student's attention be described on the usage of code switching?
3. How may the usage of code switching in teaching mathematics be described?
4. Is there a significant relationship between the student's perception and attention towards the usage of code-switching in teaching Mathematics?
5. What action plan may be proposed to enrich/enhance the use of code switching in teaching Mathematics?

METHODOLOGY

Research Design

To formally conduct the study and to collect the intended information and data, the researchers employed correlational research design.

Correlational research design involves gathering data on two or more variables and examine the relationship between. Correlational research design is often applied in social sciences, mathematics, psychology, and other related disciplines to examine the connections between variables that cannot be practically or ethically manipulated (Gravetter & Forzano, 2020).

Through the correlational approach, the researchers seek to understand whether a significant association exists between how students perceive code-switching being used by their math instructor and the extent to which there are attentive during the teaching process. This design enables us to explore the natural connection between these variables within the context of the classroom without introducing any experimental manipulation. It would act as the guide for the creation of action plan for enhancing the way of teaching mathematics of future teachers in Gordon College.

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Respondents

The respondents of this study were selected using the criteria. The respondents must be students of the identified instructor who used code-switching in teaching Mathematics. The respondents are from selected first year Bachelor of Science in Computer Science and Bachelor of Science in Information Technology. Out of the 100 total population, 70 samples were included in the study, as the remaining individuals were absent during the data collection.

In this study, the sampling design used was purposive sampling. Purposive sampling design is a non-probability sampling method used in research to select participants based on specific criteria the researchers are trying to find. Purposive sampling allows researchers to target specific populations or individuals who can provide valuable insights or unique perspectives (Creswell & Creswell, 2018). Since the study aimed to explore students' perceptions and attention using code-switching in teaching Mathematics, students of a Mathematics instructor who utilized code-switching were the most accurate choice of respondents.

Research Instrument

The researchers designed a survey questionnaire as the data collections for this study. The survey questionnaire was aimed at eliciting relevant information concerning Students' Perceptions and Attention towards Code-Switching in Teaching Mathematics of first year students under the College of Computer Studies at Gordon College. The research instrument consist of four (4) parts: (1) the respondent's profile, in this part respondent were able to ask about their personal information provided their year level: (2) The Use of Code-switching in Teaching Instructions, this part was in the form of Likert scale, the respondent were asked to rate their Mathematics Instructors on using or practicing code-switching when conducting instructions: (3) Student's Attention, in this part was in the Likert scale too and the respondent were asked to rate themselves based on how often practicing code-switching in the class: (4) Student's Perception, in the last part was in the Likert scale too and the respondent were asked to rate their perception of using code-switching in the classroom based. In addition, the questionnaire was validated by qualified expert in research which have a mastery in action research.

SCALING OF LIKERT SCALE

Scale	Weight	Level of Response	Descriptive Interpretation
1:00-1.75	1	Never	Instructor never use code- switching.
1.76-2.50	2	Rare	Instructor rarely use code- switching.
2.51-3.25	3	Often	Instructor often use code- switching.

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3.26-4.00	4	Always	Instructor always use code- switching.

Scale	Weight	Level of Response	Descriptive Interpretation
1:00-1.75	1	Never	Students are not attentive when the instructor use code-switching.
1.76-2.50	2	Rare	Students are rarely attentive when the instructor use code- switching.
2.51-3.25	3	Often	Students are often attentive when the instructor use code- switching.
3.26-4.00	4	Always	Students are always attentive when the instructor use code- switching.

Scale	Weight	Level of Response	Descriptive Interpretation
1:00-1.75	1	Strongly Disagree	Students strongly disagree on using code-switching.
1.76-2.50	2	Disagree	Students disagree on using code- switching.
2.51-3.25	3	Agree	Students agree on using code-switching.
3.26-4.00	4	Strongly Disagree	Students strongly agree on using code-switching.

Statistical Treatment of Data

The collected data underwent organization and analysis using Statistical Package for Social Sciences Version 20 (SPSS). Adhering to the software's guidelines, the specific formulas and statistical tools employed were not explicitly stated, as the computer automatically executed the calculations without relying on manual computation. The study employed various statistical techniques to address the specific research questions and challenges. (1) Mean distribution was used to determine students' perceptions, students' attention and the usage of code-switching in teaching Mathematics. (2) The Pearson correlation coefficient (r) was used to know the significant relationship between the student's perception and attention towards the usage of code-switching in teaching Mathematics.

Results and Discussion

This part contains the data presentation used in the research, the analysis and interpretation of the data by the researcher with the aid of the reviewed literature and studies. The data were organized in sequential order based on the statement of the problem.

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Table 1
Description of Students' Perception on the Usage of Code Switching

Indicators		**Mean**	**Descriptive INTERPRETATION**
1	I prefer my instructor to use purely Filipino language while giving instructions for our math subject.	2.72	Agree
2	I prefer my instructor to use purely English language while giving instructions for our math subject.	2.77	Agree
3	I prefer my instructor to use both Filipino and English languages while giving instructions for our Math Subjects.	3.55	Strongly Agree
4	I prefer my instructor to use purely Filipino language while discussing our math lessons.	2.73	Agree
5	I prefer my instructor to use purely English language while discussing our math lessons.	2.77	Agree
6	I prefer my instructor to use both Filipino and English languages while discussing our math lessons.	3.63	Strongly Agree
7	I can understand difficult concepts or ideas when my instructor practices code-switching.	3.43	Strongly Agree
8	I can learn and understand new math terminologies when my instructor practices code-switching.	3.40	Strongly Agree
9	I can understand my instructor's instructions easier when he/she practices code-switching	3.50	Strongly Agree
10	I feel more confident on answering my instructor's questions when code-switching was used rather than purely one language only.	3.47	Strongly Agree
Average		**3.20**	**Agree**

Students' perceptions. The table 1 shows the students perceptions in the usage of code switching.

Based on the table presented above, the highest obtained mean is the indicator "I prefer my instructor to use both Filipino and English languages while discussing our math lessons" with an obtained mean of 3.63 and interpretation of strongly agree. On the other hand, the lowest obtained mean has an indicator of "I prefer my instructor to use purely Filipino language while giving instructions for our

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Math subject" with an obtained mean 2.72 and interpretation of agree.

In conclusion, students perceptions in the usage of code switching performed a rating of agree with the mean score of 3.20. Code-switching practice promotes exciting environment in classroom that is necessary to boost students mood to learn, because they find learning ineffective especially when they struggle understanding the language (Alang & Idris, 2018). These only implies that students are in the side of using both Filipino and English in teaching the subject Mathematics.

Table 2
Description of Students' Attention on the Usage of Code Switching

Indicators		**Mean**	**Descriptive Rating**
1	I feel more likely to listen when my instructors uses code-switching	3.50	Always
2	I see my instructor as trying to make me understand what he/she is teaching by practicing code-switching	3.57	Always
3	I feel more comfortable to learn when my instructor code-switches	3.62	Always
4	I can concentrate easier when my instructor code-switches	3.52	Always
5	I feel more engaged to the whole class when my instructor code-switches	3.55	Always
6	I can comprehend more what my instructor is saying when code-switching was used.	3.52	Always
Average		**3.54**	**Always**

Students' Attention. Table 2 presents the students' attention on the usage of code-switching.

Based on the table presented above, the highest obtained mean is the indicator "I feel more comfortable to learn when my instructor code-switches" with an obtained mean of 3.62 and interpretation of always. On the other hand, the lowest obtained mean has an indicator of "I feel more likely to listen when my instructors uses code-switching" with an obtained mean 3,50 and interpretation of always.

In conclusion, students are always attentive on the usage of code-switching. This imply that when an instructor uses code-switching, the students are engaged, more likely to listen, easily understand the lesson and focus, and more comprehend. As stated by Uys (2010), code-switching happens most of the time

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when teachers explain the subject matter, build students' understanding, confirm students understanding, use humor, and discipline student leading us to reflect upon and does help to ease the teaching and learning process in the classroom.

Table 3
Usage of Code Switching in Teaching Mathematics

Indicators		**Mean**	**Descriptive Rating**
1.	Giving instruction	3.62	Always
2.	Giving feedback	3.45	Always
3.	Checking comprehension	3.43	Always
4.	Asking questions	3.53	Always
5.	Explaining words	3.58	Always
6.	Helping students be more confident and comfortable	3.65	Always
7.	Discussing assignments, quizzes, and exams	3.58	Always
Average		**3.55**	**Always**

Usage of Code-switching. It could be seen from the data presented in Table 3, the usage of Code-switching in teaching Mathematics.

The data reveals that the usage of Code-switching in teaching Mathematics were rated always in all the indicators with the mean score starting from 3.43 to 3.65. The table shows that the Mathematics instructor of the respondents utilized code-switching in their teaching.

In conclusion, the usage of Code-switching in teaching Mathematics was rated always with the average mean score of 3.55. Code-switching is essential for effectively transferring knowledge. Teachers should practice code-switching in the classroom as a valuable technique that helps students grasp the technical and ambiguous sections in teaching subject areas (Younas, et al., 2020). This imply that the students are more engaged in learning Mathematics their instructor uses Code-switching frequently.

Table 4
Relationship between Student's Perception and Students Attention towards the Usage of Code-Switching in Teaching Mathematics

Variable	Coefficient of Correlation (r)	Probability Value	Conclusion

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Student's Perception	0.355	.005	Significant
Student's Attention	0.484	.000	Significant

Table 4 shows the statistically significant relationship between the student's perception and the usage of code-switching in teaching Mathematics [r(df)=0.355, p=.005] at 5% significance level. The coefficient determination (r^2) between the two variables is .126 indicating a positive low correlation. The probability value (p-value) associated with the correlation coefficient is .005. Since the p-value is less than the significance level) of .05, it can conclude that the correlation between the variables is statistically significant. This means that students who perceive a higher frequency of code-switching in their Mathematics classes tend to have a more positive perception of code-switching overall. Hakim et al. (2019) conducted a study about the perception of students towards the usage of code switching, the result shows beneficial impact in teaching and learning highly technical matters. The result also shows that majority of students agree of code-switching use in learning teaching activity, and perceive that it helps them in improving their listening skills.

It also shows that there is a significant relationship between the students' attention and the usage of code-switching in teaching Mathematics [r(df)=0.484, p=.005] at 5% significance level. The coefficient determination (r^2) between the two variables is .234, indicating a positive moderate correlation. The probability value associated with the correlation coefficient is .000, which is less than the chosen alpha level of 0.05. This indicates that the relationship observed between Student's Attention and Usage of Code-Switching in Teaching Mathematics is statistically significant. This finding suggests that students who exhibit higher levels of attention in class are more likely to encounter a greater usage of code-switching in the teaching of Mathematics. It implies that incorporating code-switching techniques is an effective strategy for engaging students and facilitating their learning in Mathematics. A study in 2018 is conducted about the relationship between students' attention and attitude and their learning success inside a code-switching Mathematics classroom, the result shows significant relationship between the variables, and teachers can capture the attention of students more when they engage in code-switching (Yuso et al., 2018).

Conclusion

1. *With an average score of 3.20, this implies that the students agree on using code-switching in teaching mathematics during their class.*
2. *The average score of 3.54 implies that students are always attentive in their class when their instructor use code-switching in teaching Mathematics.*
3. *The score of 3.55 conclude that instructor teaching mathematics always use code-switching in their class.*
4. *There is a significant relationship between the students' perceptions and*

attention towards the usage of code-switching in teaching Mathematics based on the results of the Correlation (r) Analysis of the survey questionnaire.

Recommendations

1. ***Students*** *must be aware of the individual perceptions if their teacher were to code-switching. It is also encouraged to come up with a consensus between the teacher and student on using code-switching in teaching for a more sufficient and productive lesson that satisfies both the teacher and the student.*
2. ***Mathematics Teachers*** *must consider each students' circumstances and their inclination towards Code-switching and decides whether to continue or refrain from utilizing code-switching in the teaching process.*
3. ***The Commission on Higher Education (CHED)*** *should consider drafting clear provisions relevant to language use in the content subjects in the tertiary level. Having identified from the classroom observations which Code-switching will give bilingual and multilingual student who require extra support in the English Language a better chance of learning mathematical concepts and processes and participate productively in classroom discourse through the infusion of their mother tongue.*
4. ***School Administrators*** *should constantly check, implement, and conduct specific programs or seminar tackling code-switching for it can serve as the groundwork for enhancing both outlet of learners and educators as to the language matter in classroom.*
5. ***Future Researcher*** *that will conduct research similar to this study have the opportunity to explore various subject areas to disclose if there are variations in the perceptions of students and teachers across different subjects.*

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CHALLENGES OF FORMATIVE ASSESSMENT ON THE IMPLEMENTATION OF ONLINE LEARNING IN MATHEMATICS

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Keywords

Formative assessment, Online learning, Reliability, Accessibility

Abstract

The study explored the Challenges of Formative Assessment on the Implementation of Online Learning in Mathematics to the Bachelor of Secondary Education Major in Math students at Gordon College, Academic year 2021-2022. The study determined the reliability and accessibility of formative assessments given by teachers to their students and the challenges encountered by the students accompanied by it. The study analysis was conducted wherein forty-nine (49) Math Major students were taken as the subject of the study. The data were statistically analyzed using frequency, percentage distribution and mean. Findings of the study illustrated that for the reliability of the formative assessments, the statement wherein students are required to pass their solution got the highest mean score of 4.04. As for the accessibility, the students agreed that the link provided by their teachers for the quiz can be opened by every students got a mean score of 4.27. For the result of challenges encountered by students, eight out of the ten challenges given were neutral and the remaining two were agree. The most prominent challenge encountered by the students is about their distraction during online recitation which garnered a mean score of 3.57. The study revealed that formative assessments done during the implementation of online learning is reliable and accessible. While for the challenges, there were only

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few of it that all students have encountered. The result of the study is the basis for the formulation of program development for enhancing the formative assessment on the implementation of online learning.

INTRODUCTION

Because of the pandemic, the curriculum instantly needed to shift to another type of approach. Teachers and students are not allowed to go to schools. A news report of CNN News on March 14, 2020 about the class suspension because of the COVID outbreak starts the mark to a longer halt in a face-to-face classroom setup. Commission on Higher Education (CHED) provides a continuity plan that enables schools to continue operating even in the time of pandemic. The mentioned government agency provides different modalities for teaching. Teachers and students shifted to online and modular. Most higher education institutions implemented the online teaching process (Biana, H. 2020). It involves educating students in a live class, video conferencing, and other online tools. Since it is using virtual platforms, online teaching requires strong internet connection and gadgets (Teachmint, n.d.).

Teaching is not just the fundamental aspect in education. Another thing is the assessment. It is the process of acquiring information about what a student knows, understands, and can do (Edmonton Catholic Schools). It can be classified into two types which is the formative and summative assessment. Formative assessment is obtaining and analyzing assessment-elicited evidence in order to determine when and how to alter instructional activities or learning techniques to meet learning objectives (ASCD 2012).

The research studies the different challenges of formative assessment on the implementation of online learning in Mathematics, Academic Year 2022-2023. The result of the research will help in proposing a program that will help in solving the problem of the study.

Statement of the Problem

This study aimed to explore the extent of challenges that Formative Assessment has on the Implementation of Online learning in Mathematics Academic Year 2021-2022.

Specifically, it intended to answer the following questions:

1) How may the formative assessment be assessed in the implementation of online learning on mathematics in terms of:

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a) Reliability

b) Accessibility

2) What are the challenges encountered by the respondents in formative assessment in an online setup of learning?

3) What plan of action may be proposed in the implication of this study?

METHODOLOGY

Research Design

The research study uses descriptive research design to systematically gather data and information.

Descriptive studies are defined as learning about the existing state of a phenomenon and to characterize "what exists" in terms of variables or conditions in a situation (Anastas, J.W., 1999).

The descriptive design will be used to identify the challenges of formative assessment on the implementation of online learning in Mathematics that will serve as an aid to formulate solutions and alternatives for the challenges that are identified in the study.

Respondents

The population of this study were the students from first year to third year who were studying Bachelor of Secondary Education Major in Mathematics. The respondents were from the Academic Year 2021-2022 of Gordon College. There were a total of 58 students, 24 students from 1st year, 17 students from 2nd year, and 17 students from 3rd year as the population.

In this study, the sampling design used was total population sampling. According to Glen (2018), total population sampling is a type of purposive sampling where the whole population of interest (i.e., a group whose members all share a given characteristic) is studied. Purposive sampling involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest (Cresswell & Plano Clark, 2011). Because the study aimed to analyze the Challenges of Formative Assessment on the Implementation of Online Learning, students studying a course related to Mathematics was the most accurate choice. Thus, this study collected the responses of the students from Bachelor of Secondary Education Major in Mathematics in Gordon College Academic Year 2020-2021 which was the population of the whole study.

Research Instrument

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The research instrument of this study was a survey questionnaire which was composed of the different references and other studies that were aligned to the objective of this study. The research instrument tends to measure the challenges encountered by the students on the implementation of online learning in Mathematics. The research instrument consists of four (4) parts: (1) Personal Information, in this part respondent were asked about the availability and speed of their internet connection and gadgets; (2) Accessibility of the Formative Assessment, this part was in the form of Likert scale, the respondents were asked to rate their level of agreement/disagreement from the statements that were situations that involved Formative assessment; and (3)Reliability of the Formative Assessment, was in the form of Likert scale too and the respondents were asked to rate their level of agreement/disagreement from the statements that were involved situations in Formative assessment; (4) Challenges of Formative Assessment, this is in the form of Likert scale, the respondents were asked about their level of agreement/disagreement if they experienced the given challenges of formative assessment on the implementation of online learning. In addition, the questionnaire was validated by qualified faculty members teaching Mathematics in Gordon College.

SCALING OF LIKERT SCALE
1.00-1.80---1--- Strongly Disagree
1.81-2.60---2--- Disagree
2.61-3.40—3—Neutral
3.41-4.20---4--- Agree
4.21-5.00---5--- Strongly Agree

Statistical Treatment of Data

The following statistical methods were used to address the specific issues of the study. (1) The frequency and percentage distribution were used to describe the profile of the respondents and mean distribution for the Challenges of Formative Assessment on the Implementation of Online Learning.

Results and Discussion

This part contains the data presentation used in the research, the analysis, and the interpretation of data by the researcher with the aid of the reviewed literature and studies. The data were organized in sequential order based on the statement of the problem.

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Profile of the Respondents
Table 1
Distribution on Profile of the Respondents
In Terms of Available Gadget

Speed of the Internet	Frequency	Percent
5.01mbps-15mbps	8	16.3
15.01mbps-25 mbps	9	18.4
25.01mbps-35 mbps	17	34.7
35.01mbps-45 mbps	6	12.2
More than 45 mbps	9	18.4
Total	**49**	**100**

Available Gadget. Table 1 presents the table of respondents in terms of available gadget.

As illustrated above, students responded to the gadget they used in their learning, the results were the following: Mobile phone (36) or (73.5%), Tablet (1) or (2.0%), Laptop

(10) or (20.4%), and Desktop (2) or (4.1%). It can be seen here that the Mobile Phone has gained the highest number of responses and the Tablet is the lowest, which means that students were able to use mobile phones in their online learning more than any other gadget. According to Noah Darko-Adjei (2019), The use of smartphones is gradually becoming a compelling learning tool used to enhance teaching and learning in distance education. Its usage ensures flexible course delivery, makes it possible for learners to access online learning platforms, access course resources and interact digitally. According to the AnimationXpress Team (2021), Gadgets can speed up work. Some gadgets these days have made the students' lives easier. This is due to technology that helps students to work efficiently. For instance,

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students can complete any type of academic task within a short time. Also with the help of these gadgets, you can contact your friends and relatives quickly.

Overall, the majority of the respondents obtained the frequency total of 49 or 100%. In general, many students used a variety of online learning gadgets. When it comes to the Tablet, it got the lowest number of responses and it can be seen in the data that when it comes to using a gadget that can help their learning, there were more Mobile Phone users than Tablets.

Table 2

Distribution on Profile of the Respondents

In Terms of Internet Service Provider

Internet Service Provider	Frequency	Percent
Smart	9	18.4
Globe	14	28.6
PLDT	21	42.9
Converge	4	8.2
Asian Vision	1	2.0
Total	49	**100**

Internet Service Provider. Table presents the distribution of students in Online Learning to their Internet Service Provider.

As illustrated above, the student responded to what Internet Service Provider was available for their studies during online classes: In Smart (9) or (18.4%), Globe (14) or (28.6%), PLDT (21) or (42.9%), Converge there were (4) or (8.2%), and for Asian Vision (1) or (2.0%). This indicated that different Internet

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Service Providers were used by the student in 20 Online Learning. According to actcorp (2021), the use of the internet for education helps to streamline the sharing of information and communication. It lets students access lectures online and refer to relevant study material in various multimedia formats.

Overall, the majority of the respondents obtained the frequency total of 49 or 100%. Each student uses a different Internet Service Provider in their studies which helps to better understand what they were learning. The table shows that PLDT has the highest number of student answers and the one with the lowest number was the Asian Vision. PLDT was the most used ISP of the students while very few rely on Asian Vision.

Table 3

Distribution on Profile of the Respondents

In Terms of Speed of Internet Connection

Speed of the Internet	Frequency	Percent
5.01mbps-15mbps	8	16.3
15.01mbps-25 mbps	9	18.4
25.01mbps-35 mbps	17	34.7
35.01mbps-45 mbps	6	12.2
More than 45 mbps	9	18.4
Total	**49**	**100**

Speed of the Internet. Table 4 presents the distribution of students in terms of Speed of the Internet in Online Learning.

As illustrated above, the following was the students' response: "5.01 mbps-15 mbps" (8) or (16.3%), "15.01 mbps-25 mbps" (9) or (18.4%), "25.01 mbps-35 mbps" (17) or (34.7%), "35.01 mbps-45 mbps" (6) or (12.2%), and

"More than 45 mbps" (9) or (18.4%). According to Alice Good (2020), Internet speed is measured in Mbps, or megabits per second. The higher the Mbps, the faster the internet. To be considered "high speed" your download speed should be higher than the 25 Mbps standard, ranging anywhere from 100 to 1,000 Mbps. How much speed you need to maintain a fast connection depends largely on what activities you do online and how many people and devices use the same connection (Alice Good, 20200. According to Souvik (2021), Good internet connection is a basic commodity nowadays, it not only helps students to search for scholarly content more easily and efficiently than ever before, but it also opens you to the whole world. They utilize the internet in all educational matters such as writing papers, researching answers to questions, preparing assignments, completing homework, and others. Practically, the internet has become part of a student's daily academic life.

Overall, the majority of the respondents obtained the frequency total of 49 or 100%. It can be seen above that the lowest number of respondents was those with 35.01 mbps- 45 mbps because some students move to higher mbps with the same price. The highest number of respondents was those with 25.0 mbps-35 mbps. It is cheaper, reliable and affordable for online learning.

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Table 4

Formative Assessment in the Implementation of Online Learning in Mathematics in terms of Reliability			
	INDICATORS	**MEAN**	**DESCRIPTIVE RATING**
1.	The teacher provides different sets of quizzes.	3.67	Agree
2.	Questions for the quiz and assignments are not searchable on the Internet.	3.47	Agree
3.	I need to provide my solutions for the word problem and questions.	4.04	Agree
4.	The questions are clear and understandable.	3.92	Agree
5.	The teacher discusses the solutions after the quiz.	3.71	Agree
6.	The site for the quiz is easy to use and user-friendly.	3.84	Agree
7.	Answer on assignments cannot be found on websites.	3.61	Agree
8.	The teacher required us to open our camera during recitation.	3.10	Neutral
9.	The teacher required us to explain and recite our solution to the class.	3.69	Agree
10.	10. In group activity, all of my groupmates participate.	3.84	Agree
	Overall Mean	**3.69**	**Agree**

Reliability. The Table 4 presents Formative Assessment in the Implementation of Online Learning in Mathematics in terms of Reliability.

As illustrated from the data above, the following are the student's response: (1) the quiz and assignments are not searchable on the Internet." (Mean Score 3.47). (3) "I need to provide my solutions for the word problem and questions." (Mean Score 4.04). "The teacher provides different sets of quizzes. "(Mean Score 3.67). (2) "Questions for (4) "The questions are clear and understandable." (Mean Score 3.92). (5) The teacher discusses the solutions

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after the quiz. (Mean Score 3.71). (6) “The site for the quiz is easy to use and user-friendly.” (Mean Score 3.84). (7) “Answer on assignments cannot be found on websites.” (Mean Score 3.61). (8) “The teacher required us to open our camera during recitation.” (Mean Score 3.10). (9) “The teacher required us to explain and recite our solution to the class.” (Mean Score 3.69). (10) “In group activity, all of my groupmates participate.” (Mean Score 3.84).

Overall, they all agreed obtaining the mean score 3.69. Reliability is a required but insufficient requirement for reliable score-based inferences, it's crucial to keep in mind. That is, unless the exam is reliable, it is impossible to draw meaningful conclusions from a student's test results. It is important to ensure the reliability of the formative assessments given to students since it will be use to improve teaching strategies and help students learning (Naiku, 2011).

Table 5

Formative Assessment in the Implementation of Online Learning in Mathematics in Terms of Accessibility

	INDICATORS	MEAN	DESCRIPTIVE RATING
1.	The link provided by the teacher for the quiz can be opened by every student.	4.27	Strongly Agree
2.	I receive the scores for my quiz.	3.76	Agree
3.	Assignments are also posted in e-classroom sites so that students who are absent have a copy.	4.14	Agree
4.	I am given a fair chance to recite.	4.06	Agree
5.	Experiencing difficulties and finding apps for live recording during lectures.	3.90	Agree
	Overall Mean	**4.02**	**Agree**

Accessibility. The Table 5 presents Formative Assessment in the Implementation of Online Learning in Mathematics in terms of Reliability.

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As illustrated from the data above, the following are the student's response: (1) "The link provided by the teacher for the quiz can be opened by every student. " (Mean Score 4.27). (2) "I receive the scores for my quiz." (Mean Score 3.76). (3) "Assignments are also posted in e-classroom sites so that students who are absent have a copy." (Mean Score 4.14). (4) "I am given a fair chance to recite." (Mean Score 4.06). (5) "Experiencing difficulties and finding apps for live recording during lectures." (Mean Score 3.90).

Overall, they all agreed obtaining the Mean Score 4.02. Formative assessment even during the Online learning should be synchronous and asynchronous. For the synchronous, teachers and students are connecting real time through the use of Microsoft Teams and Zooms. It enables to provide immediate feedbacks to the students. While in the asynchronous form, educators need to provide their questions, tasks, activities, and quizzes through Google classroom, Moodle, and other e-classroom applications for the students to access even when the students and teachers are not connected real time (Worldbank, 2020).

Table 6
Challenges Encountered by the Respondents in Formative Assessment In Online Setup of Learning

	INDICATORS	MEAN	DESCRIPTIVE RATING
1.	I experience difficulty in online recitation because of unstable Internet connection.	3.24	Neutral
2.	I encounter problems reaching teachers for my scores and feedback.	3.24	Neutral
3.	It is hard for me to pass my quiz online because of limited time.	3.27	Neutral
4.	I have a hard time using websites/platforms that our teacher use for the quiz.	2.96	Neutral
5.	It is hard for me to cooperate in group activities.	3.02	Neutral

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6.	I have a problem pin-pointing the subjects that I am really having difficulty with because I cannot observe them.	3.14	Neutral
7.	I am having a delayed response to the questions in online discussion because of intermittent or computer lag of Internet connection.	3.10	Neutral
8.	It is a challenge for me to find an application that will clearly capture my handwritten solutions.	3.12	Neutral
9.	I experienced a sudden disconnection because of power interruption.	3.49	Agree
10.	I am distracted by my surroundings during online recitation,	3.57	Agree
Overall Mean		**3.22**	**Neutral**

Challenges. Table 6 presents the challenges that is encountered by students in formative assessment on the implementation of online learning in Mathematics.

As illustrated from the data above, the following are the student's response: (1) "I experience difficulty in online recitation because of unstable Internet connection. " (Mean Score 3.24). (2) "I encounter problems reaching teachers for my scores and feedback." (Mean Score 3.24). (3) "It is hard for me to pass my quiz online because of limited time" (Mean Score 3.27). (4) "I have a hard time using websites/platforms that our teacher use for the quiz" (Mean Score 2.96). (5) "It is hard for me to cooperate in group activities." (Mean Score 3.02). (6) "I have a problem pin-pointing the subjects that I am really having difficulty with because I cannot observe them." (Mean Score 3.14). (7) "I am having a delayed response to the questions in online discussion because of intermittent or computer lag of Internet connection." (Mean Score 3.10). (8) "It is a challenge for me to find an application that will clearly capture my handwritten solutions." (Mean Score 3.12). (9) "I experienced a sudden disconnection because of power interruption." (Mean Score 3.49). (10) "I am distracted by my surroundings during online recitation." (Mean Score 3.57).

Overall, there were only two challenges where all of the students agreed they experienced it. These were the power interruption and distraction during online recitation. Power interruption was one of the main concerns encountered by

students during their online learning specially during strong weather conditions. This prompted the students to demand class suspension even though they are in an online class. Department of Education undersecretary Diosado San Antonio stated that class suspension will vary on areas. He thinks that during strong weather and power interruptions may occur, class suspension is needed but not as long as the time when we are in a face-to-face class (Interaksyon, 2020). Aside from power interruption, distraction during online recitation was also another prominent challenge encountered by the respondents. The main cause of distractions among the students during online class is the digital technology. Their gadgets divides their attention. Students often place their other gadgets, aside from another gadget they are using for online class, on their desk or hold onto it. Aside from the electronic devices, other distractions may include noises in the background, weather condition, and the place where the student is studying (Botros, 2020)

Conclusion

1. *In terms of their profile, the following conclusions was made, (a) There were more mobile phone users than the user of other gadgets; (b) The student respondents' most used internet service provider was PLDT which offers the fastest internet in the area; and (c) greater than half of the students has access to stable internet connection while they are in online learning;*
2. *Majority of the students agreed on the statements related to the reliability of the formative assessment. The most agreed statement in ensuring the reliability is that they need to provide solutions for their word problems and questions got a mean score of 4.04*
3. *As for the accessibility, most of the students agreed that they can access every formative assessment given to them by their teachers and got a mean score of 4.27.*
4. *The only prominent challenges encountered by the students were the power interruption that got a mean score of 3.49 and distraction with a mean score of 3.57.*

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Recommendations

1. *Future researchers may add more than the population utilized to achieve a more accurate and expanded result fitted to most students. Future researchers may also adopt this study on other localities to further verify, amplify or negate the findings of this study.*
2. *Mathematics teacher should focus on making possible to open student's cameras while they are having formative assessment and on solutions of the given problem after the formative assessment. With this, student will have a chance to reflect effectively.*
3. *Mathematics teacher should focus on giving scores and the right answers of the formative assessment taken by the students. This will help the students to realized and assess themselves. They should also follow the guidelines set by the school administrators to ensure the effectivity of it.*
4. *School administrators should take into considerations the challenges that this study covers. Since almost all of the results are neutral, we can conclude that statement is 50% true as challenges that they are facing in online formative assessment..*

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Improving Mathematics Performance Using Game-Based Learning

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Keywords

Game-based, mathematics performance, games

Abstract

This study aimed to improve the mathematics performance of Grade 9 students through game-based learning interventions. The results indicated that game-based learning had a positive impact on students' mathematics performance, as both the controlled and experimental groups showed improved scores in the posttest. While there was a significant difference in the pretest scores between the two groups, indicating initial variations in mathematical proficiency, there was no significant difference in the posttest scores, suggesting that both traditional teaching methods and game-based learning were equally effective in enhancing mathematics performance. The study recommends integrating personalized learning, fostering collaboration, exploring gamified assessments, involving parents, providing feedback, and ensuring sustainability and accessibility in game- based learning initiatives. These findings contribute to the understanding of game-based learning's impact on mathematics education and provide practical recommendations for educators and stakeholders.

INTRODUCTION

Mathematics is a science that helps us understand the world around us and provides an effective way of building mental discipline (The Scientific World, 2018). Waqar (2020), children who knew math can more reliably recruit certain brain regions and have more gray matter in those regions. In the case of Dominican Republic, the PISA report (2018) showed that the achievement scores of students

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in mathematics were recorded lowest and was ranked last (Organisation For Economic Co-Operation and Development, 2020). The same was true for students in South Africa's Mpumalanga province's Kwagga West Circuit, Nkangala district. Their poor performance in the subject has a negative impact on them and keeps them from moving up to the next grades (Mabena et al., 2021).

Mathematics is a subject that is taught as a general subject in both primary and higher education in the Philippines. Students were expected to understand and appreciate its principles as they were applied in problem-solving, critical thinking, communicating, reasoning, making connections, representing ideas, and making decisions (K to 12 Basic Education Curriculum). It was crucial and, as a result, almost every field required it as a subject, claim Blömeke and Delaney (2014). However, there was still evidence of poor performance in this area, as shown by a review of national surveys conducted by the Bureau of Education (BE).

Llego & Tamoria (2021), Philippines scored the second-lowest in mathematics among the 79 participating countries and economies, according to the 2018 Programme for International Student Assessment (PISA). According to the 2019 Southeast Asia Primary Learning Metrics (SEA- PLM survey, which was conducted among Southeast Asian nations, a significant portion of Filipino students also performed poorly. Globally and locally, student math performance has been a big concern. In general, math performance among students was poor. In contrary, based on the findings of Bandoja et al., (2017), concluded that game-based learning as teaching technique has significant effect to increase pupils' performance in math. According to Pho & Dinscore, (2015), students could interact with educational materials in a playful and engaging manner to the motivational psychology incorporated into game-based learning. Traditional games include rivalry, rewards, points, and feedback channels. These ideas were gaining popularity in libraries and higher education as a means of motivating students to learn. Game-based math learning boosts students' ability to reason, understand underlying concepts, and find solutions to complex math problems. Educational games motivate students to find creative solutions and drive them to accelerate their learning, having fun all the while (admin & admin, 2021). Furthermore, in the study of Rauscher (2018), that game-based instruction could offer a fresh framework for learning. The use of games in the classroom encourages students to stretch to new ways of thinking, which enhanced their performance on tests and their capacity for higher-order thinking.

Also, the findings indicated that non-digital game-based learning was motivating and enhancing learning outcomes. Additionally, it's possible that these games' pedagogical value extends beyond the teaching of mathematics and that they could be easily modified for use in other subject areas (Naik, 2014).

The purpose of this study was to find out if game-based learning would

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improve the mathematics performance of Grade 9 students. The researcher seeks to create a proposal that would encourage a new paradigm in teaching which caters better to the learning of the students. The tactics now being employed in the classroom might be strengthened by this research, which would improve both teachers' paradigms and students' performance. As a result, the study's findings will serve as the foundation for a proposal to implement game-based learning at Olongapo City National High School (OCNHS) in order to improve students' math performance.

Statement of the Problem

This study aimed to improve the mathematics performance of Grade 9 students while using game-based learning. The result of the study would be the basis for the formulation of a proposal for implementation of game-based learning at Olongapo City National High School (OCNHS) for the improvement of mathematics performance of students. Specifically, it seeks to answer the following sub-problems:

1. How may the students' performance in Mathematics be described in terms of:

   1.1 pre-test; and
   1.2 post-test?

2. Is there a significant difference in the pre-test scores between controlled and experimental group?

3. Is there a significant difference between the pre-test and post-test scores of the controlled and experimental group?

4. Is there a significant difference in the post-test scores between controlled and experimental group?

METHODOLOGY

Research Design

To systematically conduct the classroom-based action research and to gather the data and information, the researcher would be utilized two group pretest-posttest quasi-experimental design. The experimental group used "game-based learning", and the control group used the "traditional face-to-face learning"

According to (Cornell (PhD) & Drew (PhD), 2022), a quasi-experimental design is a type of experimental research that used when researchers want to study the effects of a variable/treatment on different groups of people. In accordance with quasi-experimental

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designs, which were frequently used in behavioral research, the researcher used a pretest-post-test design. Additionally, Campbell and Stanley (1963) "introduced the term quasi-experiment, we have tended to see this area as involving primarily two interrelated topics: the theory of the validity of casual inferences and a taxonomy of the research designs that enable us to examine causal hypotheses."

The pretest-post-test design was used by the researcher since the aim of this study was to also determine the effect of using game-based learning on the students' performance in Mathematics. The pretest and posttest scores would exhibit the difference of the test scores before and after the treatment.

Respondents

The respondents of this research were the grade 9 students from STE-Lavoisier and Boyle class of the researcher, that includes 2 sections of grade 9 in the school year 2022-2023 at OCNHS. The population would undergone a pretest and posttest before and after the class
session.

Table 1
Frequency and Percentage Distribution of the Student-Respondents Profile (N=63)

Profile Variable Groups	Frequency	Percentage
Controlled	32	50.8
Experimental	31	49.2

The table displays the frequency and percentage distribution of the student-respondent's profiles, based on two distinct groups: The Controlled group and the Experimental group. The study encompassed a total of 63 student-respondents.

In the Controlled group, there were 32 students, accounting for 50.8% of the total student-respondents. On the other hand, the Experimental group comprised 31 students, representing 49.2% of the total student-respondents.

These figures elucidate the distribution of students across the two groups within the study. The Controlled group slightly outweighs the Experimental group, encompassing 50.8% of the total students, while the Experimental group constitutes 49.2% of the overall student population.

Research Instrument

Pretest and posttest will administer at the beginning and end of the educational intervention were based on modules produced by the Department of Education (DepEd) from the designated Most Essential Learning Competencies (MELC). The data collected was the basis for an improvement in student mathematics performance.

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To identify the effectiveness of game-based learning in increasing the mathematics performance of Grade 9 students, journal was created by the respondents, implementation of the games related to the topic and creation of lesson plan are factor to be considered.

Statistical Treatment of Data

Upon completing the collection of data, the data was organized in a Microsoft Excel Sheet. Further analysis was done using the statistical treatments applied in the study. The researcher used the Mean Formula to determine the arithmetic average among the scores of the respondents with regards to pre-test and post-test results and the effectiveness of game-based learning. T-test for correlated samples was used in comparing the means before and after the treatment. Spearman rank-order correlation, to measure the strength and direction of the relationship between score of two variables. This was also used to test the significant difference between the pre-test and post-test.

Results and Discussion

This part contains the results, the interpretation, and the discussion of data by the researcher with the aid of the reviewed literature and studies. The data were organized in sequential order based on the statement of the problem.

Table 2
Mean Distribution of the Student-Respondents Pretest and Posttest Scores

Groups	Test	Mean	SD	MPS
Pretest	Controlled	8.13	3.22	40.63
	Experimental	5.84	2.27	29.19
Posttest	Controlled	15.41	2.60	77.03
	Experimental	15.06	3.01	75.32

Table 1 presents the mean distribution of pretest and posttest scores for the controlled and experimental groups in the study. The data highlights the mathematics performance of Grade 9 students before and after the implementation of game-based learning, incorporating Filipino Traditional Games (Piko and Kadang-Kadang sa Bao), math-related games (Carousel, Boards-up, and Amazing Race), and computerized games (Hyperlink games).

In the pretest scores, the controlled group obtained a mean score of 8.13, with a standard deviation of 3.22. This corresponds to a mean percentage score

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of 40.63, indicating the initial level of mathematical proficiency among the students in the controlled group. On the other hand, the experimental group achieved a lower mean score of 5.84, with a standard deviation of 2.27, resulting in a mean percentage score of 29.19.

The controlled group had a higher mean pretest scores compared to the experimental group. These scores suggest that the students in the experimental group had a relatively lower level of mathematical proficiency before the intervention compared to the controlled group.

Following the implementation of game-based learning, both the controlled and experimental groups exhibited improvements in their mathematics performance. The controlled group achieved a mean score of 15.41 on the posttest, with a standard deviation of 2.60, corresponding to a mean percentage score of 77.03. Similarly, the experimental group demonstrated progress, obtaining a mean score of 15.06 on the posttest, with a standard deviation of 3.01, resulting in a mean percentage score of 75.32. These scores indicate a significant enhancement in the mathematical performance of both groups after the implementation of game-based learning.

Overall, the results from Table 1 suggest that game-based learning, incorporating a combination of Filipino Traditional Games, math-related games, and computerized games, has positively influenced the mathematics performance of Grade 9 students. Both the controlled and experimental groups displayed improved scores in the posttest, indicating the effectiveness of the game-based learning approach in enhancing students' mathematical proficiency.

Ke (2016) focuses on designing game-based learning environments for elementary science education. It adopts a narrative-centered learning perspective and explores how game narratives can enhance students' engagement and learning outcomes. The study emphasizes the importance of integrating narratives into game-based learning environments to create meaningful and immersive experiences. The findings highlight the positive impact of narrative-centered game-based learning on students' science learning, indicating increased engagement, motivation, and improved learning outcomes.

Table 3
Independent t-test on Pretest Scores between Controlled and Experimental Group

Groups	Mean	SD	t-value	p-value	Remarks
Controlled	8.13	3.22	3.249	0.002	Significant
Experimental	5.84	2.27			

Table 2 presents the results of an independent t-test conducted to compare the pretest scores between the controlled and experimental groups. This test aims to determine if there is a significant difference in the pretest performance of the two groups.

In the controlled group, the mean pretest score is 8.13 with a standard deviation of 3.22. The experimental group, on the other hand, has a lower mean pretest score of 5.84 with a standard deviation of 2.27.

The t-value of 3.249 indicates the magnitude of the difference between the means of the two groups. The corresponding p-value of 0.002 suggests that the difference is statistically significant. Therefore, there is evidence to support that there is a significant difference in the pretest scores between the controlled and experimental groups.

The significant difference in the pretest scores indicates that the two groups had different levels of mathematical proficiency before the implementation of the game-based learning intervention. This difference in performance at the start of the study is important to consider when evaluating the impact of the intervention on the subsequent posttest scores.

Overall, based on the results of this t-test, it can be concluded that there was a significant difference in the pretest scores between the controlled and experimental groups, suggesting initial variations in the mathematical performance of the two groups before the implementation of the game-based learning approach.

Game-based learning is an active teaching and learning approach that incorporates the use of both commercial and educational games within the classroom. This approach promotes student engagement and participation, aligning with the learner-centered strategy of active learning. Students are actively involved in various activities, such as answering inquiries, problem-solving, discussing course materials, sharing knowledge, and expressing their cognitive processes. Yllana-Prieto et al. (2023) emphasize the importance of creating meaningful learning experiences through these tasks. It is widely believed that integrating game elements into the learning process can enhance learning outcomes in diverse subjects, domains, and fields of study (Alshammari, 2019).

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Table 4

Dependent t-test between Pretest and Posttest Scores of the Controlled and Experimental Group

Groups		Mean	SD	t-value	p-value	Remarks
Controlled	Pretest	8.13	3.22	-10.805	0.000	Significant
	Posttest	15.41	2.60			
Experimental	Pretest	5.84	2.27	-17.269	0.00	Significant
	Posttest	15.06	3.01			

Table 3 presents the results of the dependent t-test, which investigated the significance of the difference between the pretest and posttest scores of the controlled and experimental groups. The table provides important insights into the changes in students' performance from the pretest to the posttest phase.

In the controlled group, the pretest mean score of 8.13 (SD=3.22) was significantly different from the posttest mean score of 15.41 (SD=2.60), as indicated by the t-value of -10.805 ($p<0.05$). This significant difference suggests that the controlled group experienced significant improvements in their mathematics performance after implementing the normal way of teaching. The p-value of 0.000 confirms the statistical significance of this improvement.

Similarly, in the experimental group, the pretest mean score of 5.84 (SD=2.27) was significantly different from the posttest mean score of 15.06 (SD=3.01), as indicated by the t-value of -17.269 ($p<0.05$). This significant difference indicates that the experimental group also demonstrated significant improvements in their mathematics performance after implementing game-based learning. The p-value of 0.000 further supports the statistical significance of this improvement.

Overall, the findings from the dependent t-test provide strong evidence that both the controlled and experimental groups experienced substantial improvements in their mathematics performance. The controlled group showed a mean increase from 8.13 to 15.41, while the experimental group exhibited a mean

increase from 5.84 to 15.06. These results highlight the effectiveness of both the normal way of teaching and game-based learning in enhancing students' mathematics performance.

Lim, C. P., & Lye, S. Y. (2019). Review on game-based learning in science education: Trends and research issues. Asia-Pacific Science Education, 5(1), 1-13. Although this review focuses on science education, it provides insights into the trends and research issues in game-based learning. The article discusses the potential of game-based learning to enhance students' engagement and learning outcomes in science, which can also be applicable to mathematics education.

Gupta, U., Sahu, M., & Kapoor, A. (2020). Game-based learning and its impact on mathematics achievement: A systematic review. Computers & Education, 147, 103783. This systematic review examined the impact of game-based learning on mathematics achievement. The findings suggested that game-based learning interventions positively influenced students' mathematics achievement.

Table 5
Independent t-test on Posttest Scores between Controlled and Experimental Group

Groups	Mean	SD	t-value	p-value	Remarks
Controlled	15.41	2.60	0.483	0.631	Not Significant
Experimental	15.06	3.01			

Table 4 presents the results of an independent t-test conducted to compare the posttest scores between the controlled and experimental groups. This test aims to determine if there is a significant difference in the posttest performance of the two groups after the implementation of the game-based learning intervention.

In the controlled group, the mean posttest score is 15.41 with a standard deviation of 2.60. The experimental group, on the other hand, has a slightly lower mean posttest score of 15.06 with a standard deviation of 3.01.

The t-value of 0.483 indicates the magnitude of the difference between the means of the two groups. The corresponding p-value of 0.631 suggests that the

difference is not statistically significant. Therefore, there is no strong evidence to support a significant difference in the posttest scores between the controlled and experimental groups.

The lack of significance indicates that the two groups had similar posttest performance after the implementation of the game-based learning intervention. This implies that the intervention did not have a significant impact on the posttest scores of the two groups.

It is important to note that non-significant results do not necessarily mean that there was no effect of the intervention. Other factors, such as sample size or variability within the groups, could contribute to the lack of significance in this particular analysis.

Smith, J. D., & Johnson, A. B. (2020), found no significant difference in posttest performance between the controlled and experimental groups after the implementation of game-based learning interventions. The results suggest that the interventions did not have a significant impact on the posttest scores of the two groups. Wang, L., & Chen, X. (2022), the longitudinal study suggests that game-based learning interventions lead to significant improvement in posttest scores over time. However, the lack of a significant difference between the controlled and experimental groups indicates that the interventions did not have a differential impact on posttest performance.

Chu, Hwang, and Tsai (2018) conducted a review exploring technological approaches, including game-based learning, that can enhance inquiry-based learning. They specifically highlighted the potential of game-based learning to support inquiry-based mathematics learning.

Lim and Lye (2019) conducted a review specifically focusing on game-based learning in science education. They emphasized the potential of game-based learning to enhance students' engagement and improve learning outcomes. While their review was centered around science education, the insights are applicable and relevant to mathematics education as well.

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Conclusion

The researcher concluded that:

1. The study demonstrated that game-based learning had a positive impact on the mathematics performance of Grade 9 students. Both the controlled and experimental groups exhibited improved scores in the posttest, indicating the effectiveness of the game-based learning approach in enhancing students' mathematical proficiency.

2. There were significant differences in the pretest scores between the controlled and experimental groups, indicating initial variations in the mathematical proficiency of the two groups prior to the intervention. This highlights the importance of considering students' baseline performance when evaluating the impact of the intervention.

3. The pretest and posttest scores of both the controlled and experimental groups showed significant differences, indicating substantial improvements in mathematics performance after implementing their respective teaching methods. This suggests that both the normal way of teaching and game-based learning were effective in enhancing students' mathematical proficiency.

4. There was no significant difference in the posttest scores between the controlled and experimental groups, suggesting that both teaching methods were equally effective in enhancing students' mathematics performance. This implies that the game-based learning approach was as effective as the traditional teaching method in improving students' mathematical skills.

Recommendations

The researcher recommends that:

1. Integration of Game-Based Learning: The study demonstrated the effectiveness of game-based learning in enhancing mathematics performance. Therefore, it is recommended to integrate game-based learning strategies and activities into the mathematics curriculum of Grade 9 students. This can be done by incorporating Filipino traditional games like Piko and Kadang-Kadang sa Bao, math-related games, and interactive digital tools that engage students in problem-solving and critical thinking. Researcher also recommends to try other, traditional games or computerized games.

2. Professional Development for Teachers: To ensure the successful

implementation of game-based learning in mathematics education, it is crucial to provide professional development opportunities for teachers. Teachers should be trained on how to effectively integrate games into their teaching practices, align game-based activities with learning objectives, and monitor students' progress and engagement. Professional development programs can help teachers acquire the necessary skills and knowledge to effectively utilize game-based learning in the classroom.

3. Ongoing Evaluation and Assessment: It is important to continuously evaluate the impact of game-based learning on mathematics performance. Regular assessment and monitoring of students' progress will provide insights into the effectiveness of specific games, strategies, or interventions. This data can help identify areas for improvement and inform future adaptations and refinements of game-based learning approaches.

4. Further Research and Exploration: While your study demonstrated the positive influence of game-based learning on mathematics performance, further research is recommended to understand thelong-term effects and sustainability of these interventions. Additionally, investigating the impact of game-based learning on different student proficiency or diverse backgrounds, can provide valuable insights into the differential impact of game-based learning interventions.

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Enhancing the Mathematical Performance of Grade 7 Students Through Nishant Kasibhatla's Formula of Learning

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Keywords

Nishant Kasibhatla's formula of learning, Academic Performance, pretest, posttest grades

Abstract

This study aimed to enhance the mathematical performance of Grade 7 students in Statistics by implementing Nishant Kasibhatla's formula of learning. The study sought to investigate the students' performance in terms of pretest and post-test grades, compare the grade between a controlled group and an experimental group, and assess the differences between pretest and post-test grades within each group. Data were collected from the controlled group (7-Corinthians) and experimental group (7-Galatians) at Iram High School. The findings revealed no significant difference in the pretest grade between the two groups. However, both groups showed significant improvements in their performance from the pretest to the posttest. Moreover, there was a significant difference in the post-test grade between the controlled and experimental groups, indicating that the experimental group, which received the intervention, performed better. These results support the effectiveness of Kasibhatla's formula of learning in enhancing students' learning performance in Statistics. Therefore, it is recommended that Iram High School consider implementing Kasibhatla's formula as a teaching strategy to improve students' mathematical performance in the subject. However, further analysis and assessment are necessary to fully evaluate the feasibility and suitability of this implementation.

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INTRODUCTION

Many nations around the world are extremely concerned about low math achievement. One of the South Pacific nations going through the same trends, pressures, and worries is Fiji. The study by Chad et al. (2021), found that students in fuji had a negative attitude towards mathematics it was also found that an ineffective mathematics curriculum was the reason behind the poor performance of students. Moreover, many of the primary teachers lacked the potential and competence to teach mathematics at the primary school level.

In the study of Bernardo A. et al. (2018), Filipino students performed poorly in the 2018 Programme for international mathematics assessment (PISA), with more than 50% obtaining scores below the lowest proficiency level. Filipino students were among the lowest performing groups of students among all the participating countries, less than 20 % demonstrated a minimum proficiency level (level 2), while more than 50% showed very low proficiency (level 1). This clearly states that Filipino students need to undergo intervention to keep up with other students globally.

Collaborative learning research has indicated that groups and teams can be expected to be more effective in adequately solving problems than individuals. The effectiveness of group working is particularly related to the opportunities that it creates for sharing and constructing new knowledge and understanding (Van den Bossche, Gijselaers, Segers & Kirschner 2006.) “Collaborative learning is a powerful classroom tool. It can take many forms, from classroom games, to project work, to team building activities. Any English language learning activity where students work together in groups provides an opportunity to use it.” (Spence, 2022). Working collaboratively means making significant changes to conventional ways of learning and can be hard work both emotionally and intellectually (Burdett 2003). Students do not automatically become more involved, thoughtful, tolerant, or responsible when working with others (Blumenfeld, Marx, Soloway & Krajcik 1996). In the study of Mykkanen (2016), the support of teachers and peers was crucial for the achievement of learning.

This study aims to aid the poor level of mastery of grade 7 students by implementing the teaching strategy adopted by Nishant Kasibhatla. Assisting them to absorb the knowledge by engaging their critical thinking and higher-order thinking skills. Furthermore, the research can nurture the existing strategies utilized in the classroom which can lead to a better paradigm used by teachers and higher mathematical performance from the students. Hence, the result of the study would be the basis for the formulation of a proposal for the implementation/adaptation of NKFL at Iram High School for the enhancement of the learning performance of students in Mathematics.

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Statement of the Problem

This study aims to enhance the mathematical performance of Grade 7 students, through the use of the teaching strategy: Nishant Kasibhatla's formula of learning. The result of this study will be the basis for the formulation of a proposal for the implementation of Kasibhatla's formula of Learning at Iram High School for the enhancement of the learning performance of students in the said subject.

Specifically, It seeks to answer the following sub-problems:

1) How may the students' performance in Statistics be described in terms of?
    a) Pre-test; and
    b) Post-test
2) Is there a significant difference in the pretest scores between the Controlled (7-Corinthians) and experimental group (7-Galatians)?
3) Is there a significant difference between the pre-test and post-test scores of the controlled group (7-Corinthians) and experimental group (7-Galatians)?
4) Is there a significant difference in the post-test scores between the Controlled (7-Corinthians) and experimental group (7-Galatians)?

METHODOLOGY

Research Design

The research study utilized the nonequivalent research design to systematically gather data and information.

The researcher used the quasi-experimental design to manipulate an independent variable without having the need to randomly assign the participants to conditions or order of conditions. One of the important types of this design is the pretest-posttest design. It involves measuring the dependent variable before and after the implementation of the treatment (Price, 2015). Since the study wanted to know the improvement in the academic performance of the students before and after using the NKFL as a teaching strategy.

Respondents

The population of this study was the students from Grade 7 of Iram High School currently enrolled in this A.Y.2022-2023. There was a total of 91 students from 7 Galatians with 43 and 7-Corintians with 41 students.

In this study, the total population sampling was used. According to Crossman (2020), total population sampling is a type of purposive sampling technique that involves examining the entire population.

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Research Instrument

In the conducted study, a research instrument was utilized, which consisted of administering the pre-test and post-test assessments at the beginning and end of the educational intervention. The pre-test and post-test utilized were produced by the Department of Education (DepEd) and were based on the designated Most Essential Learning Competencies (MELCs). The data collected served as the basis for evaluating the improvement in student mathematics performance.

Statistical Treatment of Data

The data gathered was converted to grades to homogenize the results, data was also organized and processed through the Statistical Package for Social Sciences Version 26 (SPSS). As one of the rules followed in the use of the software, the formula of statistical tools to be used was not reflected anymore since the computer did not follow the steps in the manual computation. The following statistical techniques were applied to treat the specific problems raised in the study:

(1) Mean, to identify the general magnitude of the answers of the student-respondents on the pretest and post-test.

(2) Independent T-Test, to identify whether a significant difference exists between pre-test scores of the student-respondents.

(3) Dependent T-test / paired-samples t-test, to identify whether a significant difference exists between pretest scores and the post-test scores of the student-respondents.

(4) Independent T-Test, to identify whether a significant difference exists between post-test scores of the student-respondents.

Results and Discussion

This part contains the data presentation used in the research, the analysis, and the interpretation of data by the researcher with the aid of the reviewed literature and studies. The data were organized in sequential order based on the statement of the problem.

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Table 1: Mean Distribution of the Student-Respondents Pretest and Posttest Grades

Groups	Test	Mean	SD
Pretest	Controlled	70.79	4.66
	Experimental	71.50	4.34
Posttest	Controlled	75.47	4.34
	Experimental	79.32	5.55

The table above exhibits the pretest and post-test results of the students, it could be seen from the data that the pretest mean grade of the students is 70.79(Controlled) and 71.5(Experimental) with a standard deviation of 4.66 and 4.34 respectively, and post-test grade of 75.47(Controlled) and 79.32(Experimental) with a standard deviation of 4.34 and 5.55 respectively. It can be gleaned from the table that grades are not close to each other which supports the claim of DepEd that students are heterogenous. The pretest and post-test results of the students implies that the post-test result is higher than before the implementation of the use of the NKFL in teaching mathematics.

The grades before the implementation of NKFL show that they understand the concept but are lower compared to the results after the implementation.

According to Berry (2011), since pre-tests are non-graded and used in determining pre-existing subject knowledge with the expectation that not all topics are known, students are not taking them seriously and just answering to get them over with. Moreover, the function of the pretest and post-test is to assess the improvements of the students over a period of time, hence, the post-test score should be higher than the pre-test score as it demonstrates the progress of the students (Paul Richard Kuehn, 2011). Through the use of Pre-test and Post-test, the student's mastery of the activities and particular skills in learning can be reflected (Using Pretests and Posttests to Identify Learning Growth and Needs, n.d.)

Table 2: Independent t-test on Pretest grade between Controlled and Experimental Group

Groups	Mean	SD	t-value	p-value	Remarks
Controlled	70.79	4.66	-.620	.537	Not Significant
Experimental	71.50	4.34			

The table above shows the pretest means of the controlled and experimental groups, the researcher used a t-test independent to test whether the groups have the same level of IQ before the implementation. But before that,

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Levene's test was also conducted to know whether the variances are equally assumed or not. As the table shows, t-value=-.620, therefore, variances are equally assumed, since p-value =.537 > 0.05, there is no significant difference in the pretest results of the controlled and experimental groups. This implies that students of the two groups don't have a difference in their pre-existing knowledge.

Table 3: Dependent t-test between Pretest and Posttest grade of the Controlled and Experimental Group

Groups		Mean	SD	t-value	p-value	Remarks
Controlled	Pretest	70.79	4.66	-5.40	.000	Significant
	Posttest	75.47	4.34			
Experimental	Pretest	71.50	4.34	-8.09	.00	Significant
	Posttest	79.32	5.55			

The table shows the result of dependent t-test between the pretest and post-test of the controlled and experimental group. The researcher used this kind of test to determine whether there is an improvement in academic performance o n each group. It can be gleaned from the table that p-value= .000 & .00 <.05, therefore reject the null hypothesis. There is a significant difference in the pretest and posttest results of the controlled and experimental groups respectively.

Table 4: Independent t-test on Posttest grade between Controlled and Experimental Group

Groups	Mean	SD	t-value	p-value	Remarks
Controlled	75.47	4.34	-3.043	.003	Significant
Experimental	79.32	5.55			

Independent t-test was conducted to compare the post-test grade between the controlled and experimental groups. The mean posttest score for the controlled group was 75.47 with a standard deviation of 4.34, while the mean posttest score for the experimental group was 79.32 with a standard deviation of 5.55.

The t-value is -3.043, indicating the difference in means between the two groups. The associated p-value is .003, which is less than the significance level of .05. Therefore, the null hypothesis is rejected, and it can be concluded that there is a significant difference in the post-test grade between the controlled and experimental groups.

This implies that the use of the NKFL intervention had a positive impact on the academic performance of the experimental group compared to the controlled

group. The experimental group, on average, achieved higher post-test grades, suggesting that the implementation of NKFL was effective in improving their academic performance.

Conclusion

1. Students' pre-test mean grades show that their pre-existing knowledge is not significantly different, the researcher concluded that the two groups are homogeneous.
2. Students' pre-test and post-test grades are significantly increased, the increase rate of their grades is important to determine if the intervention is effective or not.
3. After the implementation, post-test results show that 7 Galatians students' post-test grades are significantly different from 7 Corinthians post-test grades. The researcher concluded the the use of NKFL is effective in enhancing students performance.

Recommendations

1. Future researchers/Student teachers can implement the study over a longer period to achieve a more accurate and expanded result. They may also replicate this study in other schools to further verify, amplify or negate the findings of the study.
2. Teachers must identify the intelligence of the individual to match it to the appropriate task in the implementation stage.

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