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Math Clips as Learning Aid in Solving Equations, Inequalities, and Functions

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Abstract – *During the COVID-19 pandemic, the Philippine school system faced an exacerbated challenge, notably the struggle of Filipino students to comprehend mathematical concepts. Proficiency levels in General Mathematics, a pivotal subject in the senior high school curriculum, fell below the established mastery standard. This deficiency indicated that senior high school students had yet to attain the essential skills required for the subject. To address this pressing issue, this study was conducted to assess the effectiveness of math clips as a learning aid for solving equations, inequalities, and functions. Employing a controlled experimental design, the study compared a control group, which underwent traditional classroom instruction, with an experimental group that experienced both traditional teaching and the integration of math clips. Pre-test and post-test were administered before and after the implementation of math clips, and various statistical analyses were applied to assess quantitative data from respondents' scores. The results revealed that both the two groups of students improved their performance in mathematics after the implementation of traditional classroom discussion and integration of math clips. Furthermore, learners utilizing math clips outperformed their counterparts who only received traditional classroom instruction. Consequently, it is recommended that mathematics teachers incorporate math clips as a valuable learning tool for addressing equations, inequalities, and functions in general mathematics classes.*

Keywords – *Mathematics, Math Clips, Mastery Level*

INTRODUCTION

The learning of mathematics has posed a significant challenge for students for years. Gafoor and Kurukkan (2015) suggest that a prevalent belief exists, indicating that a majority of students harbor a dislike for mathematics, influenced by various factors encompassing instructional methods, cognitive and affective attributes of learners, psychomotor skills, subject matter, and the learning environment.

Within the Philippine education system, Filipino learners' struggles with understanding mathematical concepts have become a persistent issue. According to the Trends in International Mathematics and Science Study 2019, the Philippines scored notably lower than other participating countries. The assessment revealed that only 19% of Filipino students reached the Low benchmark, signifying "some basic mathematical knowledge," while a staggering 81% did not attain this level (Magsabol, 2020).

The challenges extend to General Mathematics, a core subject in the senior high school curriculum. Mojica (2019) discovered that the learning outcomes for General Mathematics indicated an overall mean percentage score (MPS) of 31.99% and 39.27% for the first and second quarters, falling far below the standard of above 80%. Nine least mastered competencies were identified, focusing on rational, exponential, and logarithmic functions.

Similar findings were corroborated by Mamolo (2019), who rated senior high school students as "fair" in general mathematics competencies. This suggests that these learners have not yet fully mastered the required competencies outlined by the Department of Education. Furthermore, the data revealed that seven out of fifteen least learned Most Essential Learning Competencies were concentrated in the concept of

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functions. These pieces of evidence underscore the alarming difficulty senior high school students face in achieving the most essential learning competencies in General Mathematics, particularly in the domain of functions.

The closure of educational institutions during the COVID-19 pandemic posed significant challenges to the education system and students' learning for approximately two years. Modular distance learning, the preferred modality for parents, was adopted in public schools (Bernardo, 2020). Self-learning using printed modules was encouraged, but Dangle & Sumaoang (2020) noted that many students struggled to study independently, finding it difficult to comprehend instructions without teacher assistance. The shift to remote learning presented a considerable challenge for developing countries (Rotas and Cahapay, 2020).

Throughout the lockdowns, young people in the Philippines exhibited a notable increase in social media usage, leading to issues such as pathological internet use, gaming addiction, psychological distress, escapism, and low self-esteem (Fernandes et al., 2021). Given that social media usage significantly impacts academic performance (Tus et al., 2021) and excessive engagement negatively affects learners (Cordovilla et al., 2019), these problems compounded the difficulties faced by senior high school students.

Contrary to the negative aspects of social media exposure, its use could be an asset in adapting to and continuing education during lockdowns. Several studies have explored the incorporation of TikTok, a prominent video-sharing platform (Shutsko, A., 2020), in education, revealing positive effects such as increased student motivation, an engaging learning environment, and the development of skills like creativity and curiosity (Middleton, S., 2022; Syah, R., Nurjanah, S., Mayu, V., 2019). TikTok is recommended as a teaching-learning tool (Escamilla-Fajardo, P., Alguacil, M., Lopez-Carril, S., 2021).

Additionally, video lessons have proven beneficial in helping students understand mathematical concepts and complement module-based lessons (Insorio & Macandog, 2020). Students enjoyed teacher-made videos, leading to improved motivation, enhanced knowledge, and better academic performance in mathematics (Lalian, 2019).

As face-to-face classroom setups are reintroduced in various regions, teachers must exert more effort and employ a variety of teaching strategies to support students who face challenges during the pandemic. Consequently, this study focuses on the effectiveness of pre-recorded mathematics video clips or math clips to reinforce learning in a face-to-face school setup.

OBJECTIVES OF THE STUDY

The study was conducted to determine the effectiveness of math clips as a learning aid in solving equations, inequalities, and functions. Specifically, it aims to (1) determine the academic performance of the learners before the utilization of math clips, (2) assess the difference in academic performance between the control and experimental groups prior to the use of math clips, (3) to determine the academic performance of the control and experimental groups following the utilization of math clips, (4) to analyze the significant difference in the academic performance of the control and experimental groups before and after the utilization of math clips, and (5) to examine if the academic performance of the experimental group was significantly higher than control group after the utilization of math clips.

MATERIALS AND METHODS

This research employed a controlled experiment design, defined as an experiment where all factors are kept constant except for one—the independent variable (Helmenstine, 2019). In this study, the independent variable pertained to the teaching strategies implemented during discussions on specific concepts in the concept of functions. The controlled experiment design involves the comparison of a control group and an experimental group, both being identical in all aspects except for the experimental manipulation. The control group remains unexposed to the independent variable, serving as a baseline for evaluating any changes observed in the experimental group (Simkus, 2022).

The participants of the study were the grade 11 students enrolled at one secondary public high school during the school year 2022 – 2023. The study is limited to students who took General Mathematics subject during the said timeline. To determine the sample size, the researcher employed Slovin's formula with a 0.05 margin of error, resulting in a required sample of 55 learners from a total population of 63 learners.

The research also utilized the stratified random sampling technique, specifically employing the proportionate stratification approach. This method ensures that the sample size for each stratum (corresponding to the colleges or departments to which

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the respondents belong) is proportionate to the population size of that stratum. Consequently, each stratum has an equal sampling fraction. The distribution of samples per group is presented in Table 1.

Table 1. Distribution of respondents per strata.

Groups	Population	Proportionate Probability	Sample
Controlled	35	0.55	30
Experimental	28	0.45	25
Total	63	1.00	55

Respondents were randomly selected from two groups and designated as the experimental group and the control group. The traditional classroom teaching was applied to the control group while both traditional classroom teaching and utilization of math clips were applied to the experimental group.

The proposed approach outlined in this research involved incorporating pre-recorded video clips focused on mathematics, referred to as "math clips," to enhance the learning experience of students enrolled in face-to-face General Mathematics classes. The researcher created math clips for specific lessons, including 1) function evaluation, 2) operation on functions, 3) rational equations and inequalities, 4) inverse functions, 5) exponential equations and inequalities, and 6) logarithms. Notably, the content of these video clips comprised a distinct set of examples compared to those covered in traditional classroom discussions. Experimental groups accessed these math clips through various social media platforms such as Facebook group chats and TikTok. The Department of Education provided personal tablets to both the control and experimental groups for use during classroom sessions. Math clips were stored on these tablets, facilitating easy access for the experimental group during their studies. Personal tablets from the Department of Education were distributed to both the control and experimental groups which were used during classroom discussions. Math clips were stored in the said personal tablets and distributed to the experimental group for easier access.

The academic performance of the two groups of students was assessed through a pretest and post-test administered by the researcher. The results of the administered pretest and post-test for the control and experimental groups were collated and examined. The success of the instructional pedagogies in both groups of learners was measured by comparing the scores from the pretest and post-test. The difference in post-test scores between the control and experimental groups, on the other hand, determined the effectiveness of the math clips as a learning aid.

RESULTS AND DISCUSSION

Academic Performance of the Learners Based on the Pre-test Scores

Table 2 displays the academic performance of the students assessed through a pre-test. The analysis revealed that both the control group, engaged in traditional classroom discussions and the experimental group, exposed to both traditional classroom discussions and the use of math clips, demonstrated a low mastery of competencies related to the concept of function.

Table 2. Performance of respondents in the pretest.

Group		**Control**	**Experimental**
Mean		7.80	7.76
SD		3.41	6.02
MPS		22.29	22.17
Mastery Achievement Level	Mastered (96 -100%)	0	0
	Closely Approximating Mastery (86-95%)	0	0
	Moving Towards Mastery (66-85%)	0	0
	Average (35-65%)	0	1
	Low (15-34%)	30	24
	Very Low (5-14%)	0	0
	Absolutely No Mastery (0-4%)	0	0

Table 3 shows the comparison in academic performance between the control and experimental groups based on the administered pre-test. With a p-value exceeding 0.05, the rejection of the null hypothesis suggests that there is no significant

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difference in the academic performance of the control and experimental groups concerning the concepts under function. These variables were examined to ensure compliance with the conditions of the controlled experimental design, where the groups were expected to be equivalent in all aspects before the application of treatment.

Table 3. The difference in the performance of respondents in the pre-test.

Group	t-value	P-value	Interpretation	Implication
Control	0.067	0.947	Not significant	Failed to Reject the Null Hypothesis
Experimental				

Academic Performance of the Learners Based on the Post-test Scores

Table 4 depicts the academic performance of students in the conducted post-test. Within the control group, comprised solely of participants engaged in traditional classroom discussions, 73% achieved an average mastery level, while eight (8) learners attained a low mastery level. Conversely, in the experimental group, which involved both traditional classroom discussions and the utilization of math clips, 64% achieved an average mastery level, eight (8) learners fell into the low mastery level category, and only one (1) learner reached the moving towards mastery level.

Table 4. Performance of respondents in post-test.

Group		Control	Experimental
Mean		13.07	14.68
SD		3.53	3.53
MPS		37.33	41.94
Mastery Achievement Level	Mastered (96 -100%)	0	0
	Closely Approximating Mastery (86-95%)	0	0
	Moving Towards Mastery (66-85%)	0	1
	Average (35-65%)	22	16
	Low (15-34%)	8	8
	Very Low (5-14%)	0	0
	Absolutely No Mastery (0-4%)	0	0

Difference in Academic Performance of the Learners based on the Pre-test and Post-test Scores

Table 5 highlights the variation in academic performance among learners in the competencies under the concept of function. The pre-test and post-test scores of the control group, exposed solely to traditional classroom teaching, exhibited a noteworthy difference. This outcome suggests that the control group demonstrated enhanced performance as a result of traditional classroom discussions, even without the inclusion of math clips. Several researchers also argue that for authentic learning experiences or examinations, physical presence in a specific location, such as a classroom, with a teacher or trainer providing continuous guidance, is considered essential (Fann & Lewis, 2001; Berg, Muilenburg & Haneghan, 2002; Virginio, Massimo, & Marco, 2004; Al-Alawneh, 2013).

Similarly, the pre-test and post-test scores of the experimental group, which experienced both traditional classroom teaching and the use of math clips, demonstrated a significant difference. Elfaki, Abdulraheem, and Andulrahim (2019) also arrived at a related outcome and stated that the incorporation of multimedia technologies and the internet into education within various universities is recognized as a strategy to enhance accessibility, improve the quality of delivery, and promote effective learning experiences for both students and teachers.

Table 5. Difference in the performance of respondents in the pretest and post-test.

Group	t-value	P-value	Interpretation	Implication
Control	-9.527	0.000	Significant	Reject Null Hypothesis
Experimental	-14.438	0.000	Significant	Reject Null Hypothesis

Difference in Academic Performance of the Learners after the Utilization of Math Clips

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Table 6 illustrates the difference between the academic performance of the control group who were subjected to traditional classroom teaching and the experimental group who were subjected to both traditional classroom teaching and utilization of math clips. The effectiveness of the utilization of math clips was analyzed by calculating the significant difference between the post-test scores of the experimental group as compared to the control group. The p-value indicates that the academic performance of the control and experimental groups was not the same. It was also found that the experimental group performed better than the control group. This result is supported by numerous studies that advocated for the adoption of technology-integrated education due to its favorable impact on learning. Lin, Chen, and Liu (2017) found that technology-integrated education, or digital learning, not only enhances learning motivation more effectively than traditional teaching but also yields superior positive effects on learning outcomes.

Numerous researchers have recognized that integrating digital learning can optimize teaching effectiveness by reinforcing traditional teaching methods and incorporating a comprehensive approach to teaching activities (Miyoshi et al., 2012; Hockly, 2012; Kaklamanou et al., 2012).

Table 6. Difference in the performance of respondents in post-test.

Group	Mean	SD	t-value	P-value	Interpretation	Implication
Control	13.07	3.53	-1.687	0.049	Significant	Reject Null Hypothesis
Experimental	14.68	3.53				

CONCLUSION AND RECOMMENDATION

In light of the outcomes derived from this investigation, the researcher has drawn the subsequent conclusions. The observed statistical significance in the disparity of academic performance between the control group's post-test and pre-test indicates that the control group exhibited improved performance following traditional classroom discussions, even in the absence of math clips. Similarly, the experimental group demonstrated enhanced performance after engaging in both traditional classroom discussions and the use of math clips. This underscores the positive impact of both traditional classroom discussions and the incorporation of math clips on learners' academic achievements. Moreover, the evidence indicating significantly higher scores in the post-test for the experimental group compared to the control group suggests that learners utilizing math clips outperformed those solely exposed to traditional classroom discussions. Finally, there is substantial evidence supporting the efficacy of math clips as a learning aid in grasping concepts related to functions in general mathematics.

Based on the study's findings, the researcher proposes the following recommendations: (1) mathematics teachers should integrate math clips as a learning aid for tackling equations, inequalities, and functions within the general mathematics curriculum; (2) conduct a survey among learners, focusing on their feedback and suggestions for enhancing the use of math clips in lesson discussions; (3) advocate for the exploration of additional interventions, besides math clips, in the teaching of general mathematics; (4) Expand the study to a larger population to further validate the effectiveness of math clips as a learning aid; (5) identify other factors that may influence the efficacy of math clips as a learning aid; (6) evaluate other aspects of learning or skills that may be impacted by the utilization of math clips, such as computational speed or time dedicated to mastering competencies.

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