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Effectiveness of Flipped Classroom Approach to the Performance of Students in Mathematics 10

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ABSTRACT: This study examined and measured the effectiveness of a flipped classroom method on the performance of Grade 10 learners in mathematics at Liceo de Los Baños. Quantitative research methodology, namely Quasi Experimental Research Design, is used in this study. To discover or choose respondents, match pairing techniques were used. There were two groups of students in this study: the experimental group and the comparison group. The students in the experimental group were exposed to a flipped classroom technique in which they were given an advanced video lecture with guided activities and self-activity on the day of their lesson. Students in the comparative group were exposed to the traditional approach. The study's main findings were evident. It was found out that the pretest mean score of the experimental group and comparison group were the same. The experimental group received higher points in their posttest after gathering all the relevant data. As a result, a considerable distinction between two groups was discovered. The findings revealed that learners who had prior knowledge because of a video lecture or a flipped classroom technique were more likely to improve their mathematical and logical skills. The researcher recommended using this strategy to enhance students' ability in terms of mathematical and logical skill. Furthermore, future researchers should improve their video lesson to make it more appealing to learners to capture their attention.

KEYWORDS: Flipped Classroom Approach, Mathematics Performance, Video lecture

INTRODUCTION

Mathematics is a necessary component of human cognition and reasoning, as well as attempts to comprehend the world and ourselves. Mathematics is a fantastic instrument for fostering mental discipline as well as logical thinking and mental rigor. Furthermore, mathematical knowledge is required to understand themes in other academic areas such as physics, social studies, and even music and art [1]. Mathematical literacy is defined as having fundamental computational abilities, numeric thinking, spatial aptitude, and so forth. Further, he mentioned that Mathematics is applied in a wide range of industries and fields, including science, engineering, and economics, where mathematical concepts and techniques are used to address problems. When compared to the previously mentioned mathematical literacy, the intricacy of such challenges usually needs exceedingly difficult mathematical concepts and approaches. However, teachers face several difficulties in secondary school, particularly when it comes to teaching mathematics. Certain junior high school kids have difficulty learning Mathematics. This is a challenge that necessitates prompt attention. The focus in the classroom scenario is on students as clients in school. Teachers must be creative in their teaching to motivate students to achieve excellent learning outcomes. One effective method is to create learning augmentation activities that are novel to the learners [2].

Moreover, teachers experience dilemmas when teaching Mathematics, especially when there are many non-numerates. Learners' lack of interest in Mathematics resulted in a lack of skills in several learning competencies in this field. It is up to the teachers to increase the learners' ability to learn this subject. One of the most effective strategies is to provide remediation or enrichment activities that are tailored to the students' learning styles. This can be done using differentiated teaching. Every student approach learning in his or her own unique way. Despite the problems of teaching mathematics, teachers must accept their responsibilities and demonstrate a dedication to the progress of their students. Every teacher's mission is to assist students in becoming successful and productive citizens of the country. Teachers can turn problems into solutions. Finally, when teachers are creative in their teaching, students will be able to achieve their learning objectives [2].

Providing learners intervention in learning Math is therefore a challenge in the implementation of distance learning. Providing effective education during the pandemic is a difficulty, despite techniques that minimize physical contact and face-to-face training. To guarantee that learning is given despite the limits, teachers must be more imaginative and forward-

thinking in their approaches. The teaching options accessible during this new normal might have both advantages and downsides, and it is up to instructors and mentors to use these methods not for the teacher's profit, but for the benefit of the students and learners [3].

There are signs and glimmers of optimism among the epidemic; the general morale of the teaching staff is one of resilience rather than depression. And, just as we can only enjoy the stars in the blackness of night, we can only appreciate the dispersed rays of light in Philippine education when viewed against the backdrop of the current epidemic. Despite multiple blows to the skull, its head stays unbowed. It continues its journey despite enormous challenges and apparently insurmountable obstacles. The implementation of distance learning in the Philippines has been a great challenge to all classroom teachers. Aside from the minimal preparation of the teachers in the conduct of distance learning, another dilemma would be the best strategy to use in teaching.

This study focused on determining the effectiveness of using flipped classrooms as a strategy in teaching math. This undertaking addressed the gaps in basic education and an effort to ensure that intervention and strategy are being used in delivering quality teaching and learning processes despite distance learning.

OBJECTIVES OF THE STUDY

This study examined the Effectiveness of Flipped Classroom Approach to the Performance of Students in Mathematics 10 students of Liceo de Los Baños.

Specifically, the following are the objectives.

1. Determine the mean scores of the students in comparison and experimental group in their pretest, formative test, and posttest.
2. Identify the significant difference between the formative mean scores of the students in the comparison and experimental group.
3. Identify the significant difference between the posttest mean scores of the students in comparison and experimental groups.
4. Distinguish the significant difference between pretest mean score of each group.

MATERIALS AND METHODS

Research Design

This research used quantitative data. Quantitative research, according to Bhandari (2020), is a process of collecting and interpreting numerical data. It can be used to look for patterns and averages, make forecasts, confirm causal linkages, and extrapolate results to larger groups [4]. Because the purpose of this study was to determine the usefulness of math applications, this approach was appropriate.

Furthermore, since the students were previously selected by the school administration and the researcher worked with pre-existing streams, the researcher employed a pretest-posttest quasi-experimental design in which the dependent variable was evaluated before and after the treatment was applied.

Participants of the Study

The study's participants were the Grade 10 students of Liceo de Los Baños S.Y. 2021-2022. The experimental group were 24 learners under online-distance delivery learning and the comparison group were the 24 learners as well. They were identified through match-pairing technique. The online learners were given the pretest, the results then were analyzed, those who were identified paired, were the participants of the study.

Research Instrument

The researcher employed pre- and posttest to assess the respondents' attitudes toward the inductive and traditional approaches to teaching mathematics, particularly probability. Formative assessment was also utilized. The researcher conducted a pilot testing of the questionnaire to test if the assessment tool is reliable. The department head and the principal were the ones who validated the questionnaires.

The researcher implemented flipped classroom education by using the contextualized films as instructional resources. The films created by the researcher focused on the most important learning characteristics; the movies were delivered to the students, who watched them and their own pace. The conversation was then held at the appointed hour.

The researcher's pretest was made up of the learning competency that was addressed in the third quarter. This was subsequently distributed to the students as an approach for choosing the participating pupils. The formative test was followed by quizzes and other evaluations that focused overall quarter's topics. The posttest came last, and the findings demonstrated the efficacy of the intervention.

Further, the video materials which were used in the flipped classroom underwent validation. Table 1 shows the results of overall evaluation and the validation of the research instrument.

Table 1. Overall Evaluation and Validation Result of the Research Instrument

ASPECTS	Mean	SD	DI
I. ACCEPTABILITY	3.93	0.32	High Acceptability
II. RELEVANCE	4.13	0.32	High Relevance
III. USABILITY	3.87	0	High Usefulness
IV. APPROPIATENESS	3.87	0.43	High Appropriateness
Overall Mean	3.95	0.19	High Valid

Legend: 4.50-5.00 Very high Valid; 3.50-4.49 High Valid; 2.50-3.49 Valid; 1.50-2.49 Less Valid; 1.00-1.49 Not Valid

The results showed on overall mean of 3.95 (SD=0.19) which mean a *high valid* and therefore manifested that the validators strongly accept the video materials to be effective tool to used in the flipped classroom approach. The indicator which got the highest mean of 4.13 (SD=0.32) is the relevance which is indicated as high relevance.

RESULTS AND DISCUSSION

Table 2 shows the pretest mean scores of the experimental and comparative groups in mathematics.

Table 2. Pretest Mean Scores of Experimental and Comparison Groups

Group (n=24)	Mean	SD	DI
Experimental	14.67	4.49	Low
Comparison	14.67	4.49	Low

Legend: 27.00 – 30.00 = Very High; 24.00 – 26.00 = High; 15.00 – 23.00 = Average; 6.00 – 14.00 = Low; 1.00 – 5.00 = Very Low

The results revealed that the mean score of the experimental group and the comparison group are both 14.67 (SD=4.49). it can be perceived then that both groups show the low interpretation. Using the gathered data and low result in the pretest, intervention was made.Cevikbas and Kaiser (2020), affirmed that the Flipped Classroom (FC) has the potential to Shift the paradigm of mathematics education and inspire teachers to produce new ideas and obtain new educational experiences. However, teachers must examine whether they and their pupils are prepared for FCs, as well as whether they have the support of their families and administration.[5]

Table 3 shows the formative test mean scores of experimental and comparison groups.

Table 3. Formative Test Mean Scores of Experimental and Comparison Groups

Group (n=24)	Mean	SD	DI
Experimental	30.50	3.71	High
Comparison	20.46	5.68	Average

Legend: 36.00 – 40.00 = Very High; 30.00 – 35.00 = High; 20.00 – 29.00 = Average; 10.00 – 19.00 = Low; 1.00 – 9.00 = Very Low

Presented in table 3 is the result of the formative test of the two groups. It perceived then that the experimental groups had the higher mean score of 30.50 (SD=3.71) which had the descriptive interpretation of high and the comparison group had 20.46 mean score (SD= 5.58) with average as its descriptive interpretation. This proves the effectiveness of the intervention in the formative test.

Further, this supports the study conducted by Besser, et. al. (2021), that the impact of flipped classrooms on the students' academic performance and perception in mathematics is still equivocal. Further analysis revealed that an effective flipped classroom, which outperformed the traditional approach in terms of academic results, always included discussion, instructors feedback, and peer-collaborative work. Following that, a structure for an effective flipped classroom in mathematics is proposed.[6]

Table 4 shows the posttest mean scores of experimental and comparison groups.

Table 4. Posttest Mean Scores of Experimental and Comparison Groups

Group (n=24)	Mean	SD	DI
Experimental	24.25	4.96	High
Comparison	19.67	4.85	Average

Legend: 27.00 – 30.00 = Very High; 24.00 – 26.00 = High; 15.00 – 23.00 = Average; 6.00 – 14.00 = Low; 1.00 – 5.00 = Very Low

Table 4 presents the results of the posttest of the two groups. It shows that the experimental group had the higher mean score of 24.25 (SD=4.96) which had the descriptive interpretation of high and the comparison group had 19.67 mean score (SD=4.85) with average as its descriptive interpretation.

The results affirm the conclusion of Umam et al (2019) that the use of video lectures in the Flipped Classroom has been generally recognized as enhancing the student learning experience by allowing students to not only learn independently, but also repeat lectures outside of class. For example, if students do not comprehend the essential topic of the material, they might watch a video to help them understand what they missed. Students who comprehend the fundamental topic can also watch the video to improve their skills. Indeed, the video lecture provides students with more opportunity to watch and review the lecture in a more comfortable manner.[7]

Table 5 shows the test of significant difference of experimental and comparison groups between their formative tests.

Table 5. Test of Significant Difference of Experimental and Comparison Groups' Between their Formative Test Mean Scores

Test	Group	Mean	Mean Difference	t-value	Cohen's d
Formative	Experimental Comparison	30.50 20.46	10.04	7.253	2.09 (Large)

Table 5 indicates the significant difference between the formative mean scores of the two groups. It also showed a large interpretation of the standardized difference (Cohen's d). Consequently, it denied the null hypothesis that there is no significant difference between the formative tests mean scores of the two groups [t (46) = 7.253; $p<0.01$].

The findings of this study support Umit's (2014) assertion that one element that may rationalize the links between math video gaming and academic performance is the skills and information encouraged in a game. Mathematics encompasses a wide range of abilities and information, from basic mathematics skills through geometry, mathematics word problems, sophisticated computations, and higher-level thinking activities. The meta-analysis findings may be explained by investigating how games help the learning of abilities.[8]

Table 6 shows the test of significant difference of experimental and comparison groups between their posttest mean scores.

Table 6. Test of Significant Difference of Experimental and Comparison Groups' Between their Posttest Mean Scores

Test	Group	Mean	Mean Difference	t-value	Cohen's d
Posttest	Experimental Comparison	24.25 19.67	4.58	3.235**	0.93 (Large)

Table 6 shows the large interpretation of the standardized difference (Cohen's d) which is 0.93 and therefore revealed that the null hypothesis there is no significant difference between the posttest tests mean scores of the two groups is also rejected [t (46)= 3.235 ; $p<0.01$].

It therefore confirms the study of Sampson et al. (2016) that the flipped classroom improves the cognitive learning outcomes of students; provides the most benefit for improving the cognitive learning outcomes in the case of low-achieving

learners; and maximizes classroom investment on collaborative, hands-on activities. Further, it provides a potentially effective means for teachers to promote more engaging approaches to K-12 Math teaching and learning.[9]

Table 7 shows the test of significant difference between the pretest and posttest mean scores of each group.

Table 7. Test of significant difference between the pretest and posttest mean scores of each group

Group	Test	Mean	Mean Difference	df	t-value	Cohen's d
Experimental	Pretest Posttest	14.67 24.25	9.58	23	14.60**	2.03 (Large)
Comparison	Pretest Posttest	14.67 19.67	5.00	23	8.068**	1.07 (Large)

As shown in Table 7, the large interpretation of the standardized difference (Cohen's d) and therefore revealed that the null hypothesis there is no significant difference between the pretest and posttest mean scores of the experimental group [t (23)= 14.60 ; p<0.01] and comparison group [t(23)= 8.068 ; p<0.01] is also rejected.

This can be assumed therefore that there is significant difference between the pretest and posttest mean scores obtained by the experimental group and the comparison group. The result of this study affirms the conclusion of Shukla & Mcinnis (2021) that the flipped class structure has a promising future in terms of increasing teaching and learning in beginning level mathematics courses. This will be a new experience for many instructors, and the time necessary to adapt a course is substantial. There is more to setting up a course than just developing and distributing content videos on the website. Providing clear explanations for course design to faculty and additional technology to engage students with course material frequently and early will ultimately lead to improved student achievement.[10]

CONCLUSION AND RECOMMENDATION

On the results of pretest mean scores, both groups showed a low interpretation. On the results of the formative test of the two groups, it is perceived that the experimental group had the higher mean score which has the descriptive interpretation of high and the comparison had average as its descriptive interpretation.

On the results of the posttest of the two groups, it showed that the experimental group had the higher mean score which had the descriptive interpretation of high and the comparison group had an average as its descriptive interpretation.

On the comparative analysis of the two groups, there was a significant difference between the pretest and posttest mean scores obtained by the experimental group and the comparison group.

The results of the study revealed that students in the experimental group do better than those in the comparison group. This implied that using a flipped classroom method might assist students improve their academic performance in mathematics.

The data gathered and analyzed showed that the null hypotheses are rejected which state that, there is no significant difference between the formative tests, posttest and pretest mean scores of the two groups.

Moreover, the results show that the utilization of the Flipped Classroom approach in teaching mathematics can help strengthen the performance of the learners. Further, it can be implied that learners are into technology-based learning activities. It is therefore concluded that the intervention crafted was able to address the needs of the learners in their numeracy difficulties.

Using the findings and conclusions as bases, the following are the recommendation of the researcher.

Teacher may provide appropriate learning strategies that are applicable among his or her learners. He or she may always see to it that in addressing the learners needs, it is significant to know the learners' strengths and weaknesses.

The teachers as curriculum makers and implementers may focus on crafting intervention materials that may help in increasing the performance level of the learners and which will address the needs of the learners.

Teacher researchers may conduct studies and intervention materials for the betterment of the learners. Additionally, they may also attend training and seminars which focus on effective delivery of the lesson to learners of this pandemic.

Teachers may give emphasis on a well-designed lesson and intervention. Teachers may consider providing great teaching and learning. They may always remember to consider the requirements and problems of the students.

Future researchers may conduct further study using different approaches, lessons, and grade level of students.

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