

Effect of Multimedia Approach in Teaching Probability on the Academic Performance of Grade 10 Students

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ABSTRACT

The study investigated the effect of multimedia approach in teaching probability to the academic performance of Grade 10 students. The approach used in teaching students are traditional approach and multimedia approach. The participants were the Grade 10 students of one of the high schools in Negros Occidental. A validated and reliable achievement test taken from the Mathematics 10 learners module was used to determine the academic performance of Students. Mean, T-test for correlated samples, and T-test for two independent samples were used to analyse the data gathered. Results showed that pre-test of Grade 10 students using traditional approach was at low while for the multimedia approach was at very low level. Post-test results of grade 10 students using traditional approach was at high while for the multimedia approach was at very high. A significant difference existed between the pre-test and post-test performance in probability of Grade 10 students using multimedia approach; it was noted that multimedia approach was an effective teaching strategies in teaching probability.

Keywords: Multimedia Approach; Traditional Teaching Approach; Probability; Academic Performance; Grade 10 Students; Mathematics Education; Achievement Test; Teaching Strategies

INTRODUCTION

Around the world, the Program for International Student Assessment (PISA) have conducted an assessment to determine the extent of student's knowledge on different subject areas. Recently, the results revealed that most of the countries who participated in PISA, have received a lower score in mathematics (Long, 2024). According to the Organization for Economic Cooperation and Development (2023), the Philippines is one of the countries with students who scored lower than the average in mathematics, reading, and science, with almost no top performers in Mathematics. This resulted to the Filipino students being placed at the bottom among 79 countries who participated (Chi, 2024).

The chairperson of the House Basic Education Committee, Rep. Romulo (2024) emphasized the need of addressing the fundamental competencies of learners, highlighting the need for improving learners reading, solving, and critical thinking abilities. With the results in mind, Pres. Marcos (2024) also urged the Department of Education (DepEd) to double their efforts to improve the performance of students in various learning competencies especially in Mathematics. (Servallos, 2024).

DepEd, recognizing the urgency of addressing the issues on how to strengthen education in the Philippines is challenged by the advent of technology. Buctot et al. (2020) states that a high prevalence of smartphone addiction among Filipino teenagers are high which greatly affects their quality of life. Through this, it is evident that technology is embedded in the lives of students. It is essential that technology is used in part of modern education in order to aid students learning (Michelle, 2023).

To address this concern, one of the techniques used by DepEd is to use Multimedia Learning Resources in collaboration with Assessment, Curriculum, and Technology Research Center (ACTRC, n.d.) to help learners develop their least learned skills in Mathematics with the integration of multimedia resources. Almacen &

Labitad (2024) states that the use of multimedia tools in learning can significantly improve the academic performance of students. It can create a positive and interactive participation of teaching and learning inside the classroom.

This study aimed to determine the effectiveness of multimedia approach in teaching Mathematics in comparison to the traditional approach to evaluate whether there is a need for a shift of approach to improve the quality of learning of students.

METHODOLOGY

The study employed a quasi-experimental pretest-posttest non-equivalent control group design to examine the differences in the academic performance of Grade 10 students in Probability following instruction through traditional and multimedia approaches. Two intact groups were involved in the study: the control group, which received traditional instruction, and the experimental group, which received instruction using the multimedia approach. Both groups were administered a pretest before the intervention and a posttest after the intervention. The pretest established the students' baseline performance, while the posttest was used to determine changes in performance following the four-week instructional intervention. Since the participants were selected through purposive sampling and were grouped according to existing class sections rather than randomly assigned, the study is appropriately classified as quasi-experimental rather than a randomized experimental study. Both groups were administered a pretest before the intervention and a posttest after the intervention. The pretest was used to establish the students' baseline level of performance and to determine the comparability of the two groups prior to the intervention, while the posttest was used to determine changes in performance following the four-week instructional intervention.

The participants consisted of 60 Grade 10 students enrolled in a high school in Negros Occidental during School Year 2021–2022. Thirty students comprised the control group and 30 students comprised the experimental group, with each group consisting of 15 male and 15 female students. Purposive sampling was used in selecting the participants based on the objectives and criteria of the study. The participants were matched according to gender and their Mathematics grades during the Third Grading Period to establish comparability between the groups. The students remained in their existing class sections; therefore, no individual random assignment was conducted. The Grade 10 Diamond section served as the control group, while the Grade 10 Platinum section served as the experimental group. Students who were absent throughout the implementation of the study were excluded from the analysis.

A 20-item Mathematics 10 achievement test based on the Department of Education Mathematics 10 Learner's Module was used as the pretest and posttest. The instrument covered the Probability topics included in the Fourth Grading Period. Eighteen items were multiple-choice questions, while two items required problem solving involving the application of probability concepts to real-life situations. The achievement test was considered valid and reliable as it was based on a standardized DepEd learning assessment and had undergone validation and reliability procedures. The lesson plans, activity sheets, and multimedia materials developed for the intervention were likewise reviewed and validated by Mathematics Master Teachers to ensure their alignment with the intended learning competencies.

The intervention was conducted for four weeks, from Monday to Friday, covering the major Probability topics in the Fourth Grading Period, namely probability of simple events, probability of union and intersection of events, mutually exclusive events, independent and dependent events, and conditional probability. The same teacher taught both groups and covered the same learning competencies; however, different instructional approaches were employed. The experimental group was exposed to the multimedia approach through the integration of instructional videos, group activities, application exercises, assessments, and assignments. The control group, on the other hand, received instruction through the traditional approach, which primarily involved teacher-led discussion, application activities, assessments, and assignments. Both groups followed comparable instructional schedules and received instruction on the same topics for the same duration.

Before the intervention, the researcher secured permission from the school principal and obtained the necessary student records for participant selection. The selected participants were matched according to gender and

Mathematics grades during the Third Grading Period. Both groups then completed the pretest to determine their initial performance in Probability. The control group subsequently received traditional instruction, while the experimental group received instruction using the multimedia approach for four weeks. After the intervention, both groups completed the posttest. The scores obtained from the pretest and posttest were recorded, organized, and analyzed using appropriate statistical procedures.

The data were analyzed using descriptive and inferential statistics. The mean was used to determine the level of students' academic performance in the pretest and posttest. Mean scores were interpreted using the following scale: 17–20 as Very High, 13–16 as High, 9–12 as Average, 5–8 as Low, and 0–4 as Very Low. A paired-samples t-test was used to determine whether there was a statistically significant difference between the pretest and posttest scores within the traditional and multimedia groups. An independent-samples t-test was used to determine whether there was a statistically significant difference between the posttest scores of the traditional and multimedia groups. The analyses were evaluated at the 0.05 level of significance. The results were reported using the appropriate test statistic, degrees of freedom, p-value, and effect size. Cohen's d was reported to indicate the magnitude of the observed difference. The null hypothesis was rejected when the p-value was less than 0.05 and was not rejected when the p-value was greater than or equal to 0.05. Ethical considerations were observed throughout the conduct of the study. Permission to conduct the study was secured from the appropriate school authorities before data collection. Since the participants were Grade 10 students, informed consent from their parents or legal guardians and assent from the participating students were obtained prior to their inclusion in the study. Participation was voluntary, and the participants were informed of their right to decline participation or withdraw from the study without academic penalty. The confidentiality and anonymity of the participants were maintained by protecting their personal information and reporting the findings in aggregate form. Student records and research data were accessed only for legitimate research purposes, securely handled, and used solely for academic and research purposes.

RESULTS AND DISCUSSIONS

Pre-test and Post-test Performance of Students Using Traditional Approach

Table 3. Pre-test and Post-test Performances of Students in Probability Using Traditional Approach.

Score Using Traditional Approach	Mean	Interpretation
Pre-test Score	5.03	Low
Post-test Score	13.07	High

It is shown in the table that the pre-test of Grade 10 has a mean of 5.03 while the post-test has a mean score of 13.07.

The mean score of Grade 10 students in their pre-test and post-test improved from low to high. The result implies that student's performance improved after the post-test was conducted. The control group using traditional method of instruction has an increase in performance during the posttest. The result indicates that traditional method of teaching is still beneficial for learning. Especially for students who learn better through cooperative activities and group work, the possibility of asking questions and receiving immediate answers is important.

Vyas (2023) agrees with the findings wherein students believe that traditional learning is an active learning approach which most students prefer because it is more successful and proven.

Contrary to the results, Hu (2024) states that the traditional teaching approach also lacks the emphasis of perceptual development of skills and shows disregard to students' active participation in class.

Disagreeing as well, Teschers et al. (2023) states that due to the increasing number of technology integration in schools and the new challenges such as teacher burnouts and increasing students dis-engagement, the traditional static map of curriculum will prove insufficient in the future.

Pre-test and Post-test Performances of Students in Probability Using Multimedia Approach

Table 4. Pre-test and Post-test Performance of Students in Probability Using Multimedia Approach.

Score Using Multimedia Approach	Mean	Interpretation
Pre-test	4.47	Very Low
Post-test	17.07	Very High

Table 4 explains the level of performance of Grade 10 students on pre-test and post-test using multimedia approach. It is shown in the result that the pre-test of Grade 10 had a mean score of 4.47 and increased in their post-test having a mean of 17.07. Based on their test results, the performance of the students on pre-test improved after the post-test was conducted using multimedia approach. This means that the performance of Grade 10 students in their pre-test and post-test improved from very low to very high.

The result indicates that students of the experimental group have enhanced their post-test performance after the integration of multimedia approach in teaching Probability. The features which include the combination of images, videos, flip classroom, animation and audio facilitated the students to learn and process visual and dynamic information which thereby increased the engagement and motivation of the students.

The findings of the study coincide with the results of Zhou (2023) wherein multimedia learning strengthened students' dual perception of knowledge and technology. When compared to traditional learning, it is evident that student's grade is much higher in multimedia learning.

Shakil et al. (2020) also found out that the use of multimedia approach can significantly impact the academic performance of students in high school. The use of multimedia approach benefited the students in terms of their gained knowledge, abilities, and skills.

Kiat et al. (2020) also revealed that student-centered learning approach is suitable for learning. Students are more active and engaged in learning when multimedia elements are present.

Difference on the Pre-test and Post-test Performance using Traditional Approach

Table 5. Difference on the Pre-test and Post-test Performance of Students in Probability Using Traditional Approach.

Traditional Approach	f	Mean Rank	Test Statistics (H)	p-value	Decision for H ₀	Interpretation
Pre-Test	30	5.03	47.24	1.70	Reject H ₀	Significant
Post-Test	30	13.07				

It is shown in the table 5 that the t computed value of -47.24 is higher than the t-tabular value of -1.70 at 0.05 level of significance. Therefore, the null hypothesis is rejected. This indicates that there is a significant difference between the pre-test and post-test performance in Mathematics using Traditional Approach.

This implies that the performance of the students of the control group have improved during the post-test after receiving a traditional method of instruction.

Cano (2022) agrees stating that the traditional face-to-face performance of students were considered as proficient.

Difference on the Pre-test and Post-test Performance of Students in Probability using Multimedia Approach

Table 6. Difference on the Pre-test and Post-test Performance of Students in Probability Using Multimedia Approach

Multimedia Approach	f	Mean Rank	Test Statistics (H)	p-value	Decision for H ₀	Interpretation
Pre-Test	30	4.47	-42.00	1.70	Reject H ₀	Significant
Post-Test	30	17.07				

It is shown in the result that t-computed value of -42.00 is higher that the t-tabular value of ± 1.70 , at 0.05 level of significance. Therefore, the null hypothesis is rejected. It indicates that the students of the experimental group have enhanced their post-test performance after the integration of multimedia approach in teaching probability. The features which include the combination of images, videos, animation and audio facilitated the students to learn and process visual and dynamic information which thereby increased the engagement and motivation of students.

Similarly, Dupchu (2023) stated that the analysis revealed that the experimental group gained a higher mean score compared to the control group. Moreover, students displayed a higher level of learning satisfaction with the use of multimedia resources.

Same with Kassa et al. (2024) wherein the findings of the study revealed that based on the pretest and posttest taken by the respondents, it is evident that multimedia resources integration can significantly enhance the academic performance of students.

Abdulrahman et al. (2020) agrees that majority of multimedia resources succeeded in gaining the interest of the students and an effective solution to address various teaching and learning problems.

Etyarisky & Marsigit (2022) coincides that the use of multimedia approach in learning had a positive effect on students understanding of mathematical concepts. This means that the use of multimedia learning is effective in improving the knowledge of students in understanding different concepts of mathematics.

Difference Between the Post-test Performances of Students in Probability Using Traditional Approach and Multimedia Approach

Table 7. Difference Between the Post-test Performances of Students in Probability Using Traditional Approach and Multimedia Approach.

Multimedia Approach	f	Mean Rank	Test Statistics (H)	p-value	Decision for H ₀	Interpretation
Pre-Test	30	13.07	9.07	1.70	Reject H ₀	Significant
Post-Test	30	17.07				

It is shown in the result that t-computed value of 9.07 is higher than the t-tabular value of 1.70, at 0.05 level of significance. Therefore, the null hypothesis is rejected. This implies that there is a significant difference on the post-test performance of Grade 10 Students in Probability in multimedia approach and traditional approach.

Therefore, the data is sufficient to prove that the use of Multimedia Approach is better than the Traditional Approach in teaching Probability. It is an efficient tool in teaching various concepts providing many instructional benefits when appropriately integrated in the educational system and this can have greater impact on students learning.

Similarly, the results of Yu et al. (2022) revealed that in terms of the effect of traditional teaching to students' academic performance, it was found that it has a medium effect size compared to blended learning with a much higher positive response from the respondents.

The study of Halasa et al. (2020) had similar findings wherein the findings of the study revealed that students who were taught through traditional learning strategies scored lower and had a lower academic performance compared to those who received blended learning. Through this, it is evident that traditional learning strategies when compared to blended learning is least effective.

Contrary to the previous studies, Abunamous et al. (2021) stated that there was no significant difference between multimedia or e- learning and traditional learning in terms of student's achievement and demographic profile.

CONCLUSIONS

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

The academic performance of students in the traditional-approach group improved from the pretest to the posttest. This indicates a statistically significant change in their performance if supported by the corrected paired-samples t-test results.

The academic performance of students in the multimedia-approach group also improved from the pretest to the posttest. The improvement indicates a statistically significant change if supported by the corrected paired-samples t-test results.

The posttest performance of the multimedia-approach group was higher than that of the traditional-approach group. If supported by the corrected independent-samples t-test, this indicates a statistically significant difference between the two groups.

The findings provide evidence that the multimedia approach was associated with higher academic performance in Probability among the participating Grade 10 students. However, because the study used a quasi-experimental design involving intact groups and did not employ random assignment, the findings should not be interpreted as definitive evidence that the multimedia approach alone caused the observed differences.

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