Improving Academic Achievement of Students in Mathematics 10 through Contextualized Learning Worksheet

Jun Pablo H. Kindica., Regie M. Gumanoy

Esperanza Integrated School, North Eastern Mindanao State University

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ABSTRACT

This study evaluated the effectiveness of contextualized learning worksheets in enhancing the performance of Grade 10 students in statistics at Esperanza Integrated School in Carmen, Surigao del Sur. A quasi-experimental design was employed, with groups assigned based on a verified variable to minimize selection bias (Shuttleworth, 2023). The study revealed the following key findings related to performance improvement, mathematical proficiency and teaching method comparison. A statistically significant difference was observed between pre-test and post-test mean scores for students taught using both conventional and experimental methods with the experimental approach demonstrating a greater impact, particularly for students with lower mathematical proficiency, particularly for students with lower mathematical proficiency. Furthermore, students' initial mathematical levels significantly influenced their academic achievement with higher achieving students outperforming their peers, though notable improvements were observed across all proficiency levels. However, when analyzed independently of students' mathematical levels, no significant difference was found between the conventional and experimental methods in terms of overall academic achievement. This suggests that while both methods contributed to performance improvement neither demonstrated a distinct advantage over the other. No significant interaction was found between the teaching method and students' mathematical proficiency levels, indicating that the method's impact on student achievement remained consistent across different proficiency levels. The findings highlight that students' pre-existing mathematical proficiency plays a critical role in academic achievement, with higher achieving students performing better overall. While both teaching methods led to improvements, the experimental method had a more pronounced effect on students with lower mathematical proficiency. However, no significant interaction between teaching method and proficiency level was observed, suggesting that the effectiveness of the method did not vary considerably across different mathematical levels. The researcher calculated the mean scores and standard deviation by comparing the pre-test and post-test scores of students grouped according to their mathematical ability. The mean scores provided insight into the students' academic progress under both teaching methods. Researcher used ANCOVA to determine whether a statistically significant difference existed between the mean scores of students in the lecture group and the experimental group. This analysis helped identify which teaching method more effectively improved students' mathematical achievement. Moreover, the researcher applied a two-way ANOVA to examine the interaction effect between the teaching methods (lecture vs. experimental) and the students' mathematical ability levels (low, average, and not numerate). This statistical test determined whether the teaching methods had different effects on student achievement depending on their mathematical ability.

INTRODUCTION

Statistics is an important subject within the mathematics curriculum, helping students develop a deeper understanding of key concepts such as data analysis, probability, and statistical interpretation. However, many students struggle with these topics resulting in significant learning difficult grasp. To address this issue this research explores the potential of using contextualized worksheets that incorporate examples and scenarios from students' local environments to bridge these gaps and enhance learning outcomes. This study aims to evaluate effectiveness of contextualized learning worksheets in improving the statistical performance of Grade 10 students at Esperanza Integrated School, Carmen, Surigao del Sur.

There is substantial evidence that self-learning modules and contextualized materials can positively influence students' mathematical performance. According to Lapinid (2021), self-learning modules have been found effective in enhancing student outcomes by providing tailored support. Similarly, Anggraeni and Suryanti (2020) argue that learning should begin with concrete experiences from students' immediate surroundings, making the abstract concepts more relatable. Contextualized learning materials not only capture students' interest by making the content more relevant but also help deepen their understanding. Janer (2022) further supports this idea, emphasizing that activity sheets can strengthen the connection between teachers and students, leading to better engagement and improved academic outcomes. These findings suggest that using contextualized learning materials may be an effective strategy for enhancing student success, particularly in subjects like statistics.

Despite the potential benefits of contextualized activity sheets, there remains a noticeable gap in research regarding this application in teaching specific mathematical topics in mathematics, especially in post-pandemic classrooms. While there is broad support for the effectiveness of these materials, few studies have examined their implementation in local contexts, such as at Esperanza Integrated School, or in specific subjects like statistics. Recent pre-assessments in the Carmen District revealed a concerning Mean Percentage Score (MPS) of just 39.71% for Grade 10 students in mathematics, indicating significant gaps in their understanding—particularly in statistics. This highlights a clear need for targeted interventions. The lack of specific research on contextualized worksheets in teaching statistics, combined with the academic challenges faced by students in this school, forms the basis for this study. This research explores whether the use of contextualized learning worksheets can enhance students' understanding of statistical concepts such as data interpretation, probability, and statistical analysis. The primary objective of this study is to determine whether contextualized learning worksheets can help address the learning gaps identified in Grade 10 students' performance in statistics. The research focused on key topics such as measures of position, statistical mini research, and statistical methods in analyzing and interpreting research data. The results provided useful insights for mathematics teachers, school administrators, and curriculum developers, offering evidence-based recommendations on the use of contextualized materials to enhance student engagement and achievement. Ultimately, it aims to improve teaching practices and support students in recovering from learning losses, particularly in core statistical concepts that are essential for their academic success.

Theoretical/Conceptual Framework

This study is grounded in two theoretical frameworks: Experiential Learning Theory (ELT) and Constructivist Theory, both of which emphasize the importance of experience in the learning process. Experiential Learning Theory posits that knowledge is constructed through student's active engagement with real-world experiences, linking the curriculum to practical situations. Constructivist Theory, on the other hand, suggests that learning is an active process in which learners build knowledge through their own experiences, with prior knowledge playing a crucial role in shaping new understanding.

According to Kolb, Baker, and Jensen (2022), the core principle of Experiential Learning Theory is that experience serve as the primary driver of learning. Knowledge is constructed through the reflective transformation of one's experiences. Kolb's model of experiential learning highlights two distinct modes of gaining experience—concrete experience (apprehension) and abstract conceptualization (comprehension)—as well as two modes of transforming that experience—reflective observation (intension) and active experimentation (extension). These modes are interrelated along a continuum, requiring learners to navigate between them to effectively process their experiences (Kolb, Baker, & Jensen, 2022). For instance, a learner whom perceive information concretely and engages in active experimentation must also incorporate abstract conceptualization and reflective observation to complete the learning cycle. This interplay between these modes facilitates the integration of various learning approaches, fostering a more comprehensive learning process.

In line with this, Constructivist Theory emphasizes that learners actively construct their own knowledge through experience. As Piaget (1973) and Vygotsky (1978) have demonstrated learning is not a passive process but one in which meaning is based upon the learner's prior knowledge and experiences. Furthermore, research has shown that the constructivist approach can significantly enhance academic achievement. For example, Ayaz and Şekerci (2024) conducted a meta-analysis on the effects of constructivist learning on students' academic performance, concluding that constructivist methods contribute more substantially to student success than traditional teaching approaches. Their findings suggest that constructivist learning is particularly effective across various subjects, except for religious instruction. Thus, constructivist methods are broadly applicable in enhancing academic performance in many areas, including mathematics. The application of these theories in the context of this study suggests that integrating contextualized learning activities, particularly in mathematics, can foster more effective, inclusive, and collaborative learning environments. By engaging students in real-world mathematical tasks and encouraging active reflection on their experiences, these activities may boost students' confidence, narrow learning gaps, and enhance academic performance in mathematics. The theories underpinning this study serve as a foundation for exploring how experiential and constructivist learning principles can be leveraged to promote high academic achievement in mathematics.

The lecture method follows a traditional approach in which the teacher utilizes the division-validated learning activity sheet to guide instruction. In contrast, the experimental method is more interactive, engaging learners in active participation and problem-solving, with the teacher using the contextualized learning worksheet to facilitate the learning process. Academic achievement, which serves as the primary outcome variable. This is measured to assess the effectiveness of the two teaching methods in enhancing learners' mathematical skills and understanding. Academic achievement is evaluated through assessments that reflect the learners' ability to apply mathematical concepts and problem-solving strategies. The covariate, which in this study is the pre-test. Administered before the intervention, the pre-test helps established baseline levels of learners' mathematical abilities, providing a point of comparison to assess the impact of the teaching methods on academic achievement. Overall, the schematic diagram offers a clear representation of the key variables and procedures involved in the study. It illustrates how different study components are interconnected and how academic achievement is measured. The use of a covariate in the study design is also an important consideration, as it helps to control for any confounding variables that may affect the results.

RESEARCH METHODOLOGY

This study employed a quasi-experimental design. Which involves selecting groups without random pre-selection (Shuttleworth, 2023). The experiment was conducted by comparing the variables between different groups. This research design was chosen because it allows the researcher to maintain a substantial control over the study while enabling strong statistical analyses for identifying causal relationships. The primary objective of this design was to determine the effect of contextualized learning activity sheets on students' academic achievement in mathematics.

The study included 69 Grade 10 students enrolled in the Basic Education Curriculum of Esperanza Integrated School (EIS). The researcher used two sections: one as a controlled group and the other one as an experimental group. The researcher selected these sections since they are under their class. The table below presented the distribution of the respondents based on the teaching methods used in teaching mathematics. Respondents were further categorized based on their performance in mathematics as determined by the pre-assessment in numeracy conducted in school. In the conventional group, 9 respondents were classified as having an average performance, 15 had a low performance, and 10 were not numerate. In the experimental group,9 respondents had an average performance, 16 had a low performance, and 9 were not numerate.

The research was conducted at Esperanza Integrated School (EIS) in Carmen District, Division of Surigao del Sur as it is the institutional where the researcher had been teaching. Esperanza Integrated School is a public school located in the rural area of Barangay Esperanza, Carmen, Surigao del Sur, Philippines. The school accommodates to students from kindergarten to Grade 12, with a total student population of approximately 313. It has a diverse student body, with learners coming from various socio-economic backgrounds. Esperanza Integrated School is known for its commitment to quality education to its strong focus on character and leadership development. The school is well-equipped with classrooms, and library, to support the academic activities of its students. This study utilized contextualized learning worksheets and an adopted quarterly test questionnaire from the division unified test for grade 10 for the pre-test/post-test. The learning worksheet underwent validation by experts in the field of Mathematics to ensure its reliability and effectiveness. To conduct the study, the researcher followed a step-by-step approach, beginning with obtaining necessary approvals from the relevant authorities. The researcher formally requested approval from the school principal to conduct the study. Upon receiving the approvals, the researcher proceeded by implementing the contextualized learning

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strategy in the lesson. Students in the experimental group were provided with learning worksheets, while the other group followed the conventional method. The researcher personally administered the pre-test before the lesson and the post-test after the instructional intervention, using the same questionnaire for both assessments. The researcher calculated the mean scores and standard deviation by comparing the pre-test and post-test scores of students grouped according to their mathematical ability. The mean scores provided insight into the students' academic progress under both teaching methods. The researcher used ANCOVA to determine whether a statistically significant difference existed between the mean scores of students in the lecture group and the experimental group. This analysis helped identify which teaching method more effectively improved students' mathematical achievement. The researcher applied a two-way ANOVA to examine the interaction effect between the teaching methods (lecture vs. experimental) and the students' mathematical ability levels (low, average, and not numerate). This statistical test determined whether the teaching methods had different effects on student achievement depending on their mathematical ability.

RESULTS AND DISCUSSIONS

The Pre-Test and Post-Test Mean Scores of Students Using Conventional and Experimental Method

Table 2. Students' Mean scores in the Pre-test and Post-test

	Pre-Test		Post-Test	
	Mean	SD	Mean	SD
Experimental	23.147	4.831	40.088	3.895
Conventional	21.55	5.298	35.32	5.655

The table presents the mean scores and standard deviation of students in the pre-test and post-test for both the conventional and experimental groups. The pre-test mean scores suggest that students in both instructional method had a limited prior understanding of the subject matter. Both groups demonstrated fairly similar mean scores, with the experimental group slightly outperforming the conventional group. The standard deviation (SD) indicates the variability in scores. The experimental group has a lower SD, which meant that scores were more consistent compared to the conventional group, which had a higher SD. After the lesson was delivered by the researcher using a particular method, the post-test result revealed the mean score and standard deviation of the students. The experimental group significantly outperformed the conventional group, a higher mean score (40.088) compared to the conventional group (35.32). This finding suggests that the experimental method led to a better learning outcome. Furthermore, the SD in the post-test for the experimental group decreased (from 4.831 to 3.895), indicating that the post-test scores were even more consistent among students in this group. In contrast, the SD in the conventional group increased (from 5.298 to 5.655), suggesting greater variability in the students' post-test scores.

Significant difference between the mean score of the students in the pre-test and post-testusing the conventional and experimental methods.

Table 2. Difference between the Mean Score of the Students in the Pre-test and Post-test Using the Conventional and Experimental Methods

Method	F-value	p-value	Decision
Conventional (Pre-test vs Post-test)	103.86	0.000	Reject
Experimental (Pre-test vs Post-test)	253.36	0.000	Reject

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The results presented in the table demonstrate a significant difference between the mean scores of students in the pre-test and post-test for both the conventional and experimental teaching methods. In both cases, the p-values are 0.000, which is well below the commonly accepted significance level of 0.05. This finding provides strong statistical evidence to reject the null hypothesis, which suggests that there is no difference between the pre-test and post-test scores. Therefore, the data support the conclusion that both teaching methods had a significant impact on student performance, leading to improvements in post-test scores. Examining the F-values, reveals a notable difference between the two methods. The conventional method produces an F-value of 103.86, while the experimental method yielded an F-value of 253.36. The F-value represents the ratio of variance between-groups, indicating a greater impact on the experimental method on students' performance. This suggests that the experimental teaching method had a stronger and more pronounced effect on improving the students' scores compared to the conventional method. In conclusion, while both teaching methods significantly enhanced student performance, the experimental method appears to have a greater impact on score improvement. The statistically significant difference in the F-values indicates that the experimental approach may be more effective in promoting student learning and performance than the conventional method. These findings suggest that adopting the experimental method could potentially yield better academic outcomes for students compared to traditional teaching techniques.

Pre-test and post-test mean scores of the students when grouped according to their mathematical level.

The following table shows the mean scores of pre-test and post-test results using the two instructional methods when grouped according to their mathematical level.

Table 3. Students' Mean scores in the Post-test According to Mathematical Level

	Experimental		Conventional	
	Pre-Test	Post Test	Pre-Test	Post Test
Average	28.33	44.88	27.78	39.78
Low	22.56	38.06	21.73	35.13
Not numerate	19.00	38.88	15.70	31.60

The table presents the pre-test and post-test mean scores of students grouped according to their mathematical level, comparing the experimental and conventional teaching methods. For the experimental method, students at the "Average" mathematical level improved from a pre-test score of 28.33 to a post-test score of 44.88, resulting in an overall mean of 36.60. In the "Low" mathematical level group, the mean score increased from 22.56 in the pre-test to 38.06 in the post-test, with an overall mean of 30.31. The "Not numerate" group also demonstrated an improvement score increasing from 19.00 in the pre-test to 38.88 in the post-test, with an overall mean of 28.94. In comparison, the conventional method followed in a similar trend of improvement, but the scores were generally lower. The "Average" group increased from a pre-test mean of 27.78 to a post-test mean of 39.78, with an overall mean of 33.78. The "Low" group exhibited a rise from 21.73 in the pre-test to 35.13 in the post-test, resulting in an overall mean of 28.43, while the "Not numerate" group increased from 15.70 in the pre-test to 31.60 in the post-test, with an overall mean of 23.65.

These results reveal that the experimental method led to a greater improvement in scores across all mathematical levels compared to the conventional method. Notably, "Average" students in the experimental group achieved the highest post-test mean of 44.88, whereas those in the conventional group had a post-test mean of 39.78. The experimental method also resulted in more significant improvements for both the "Low" and "Not numerate" students, with post-test scores of 38.06 and 38.88, respectively, compared to the conventional group's post-test scores of 35.13 and 31.60. These findings suggest that the experimental method was more effective in improving students' mathematical performance, particularly for those at lower levels of proficiency.

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Significant interaction effect on students' academic achievement using the two teaching strategies and grouped according to their mathematical level.

Table 5. Interaction Effect on the Students' Academic Achievement Using the Two Teaching Strategies when Grouped According to their Mathematical Level

	F Value	p-value	Decision
Level	73.52	0.000	Reject
Method	0.039	0.147	Failed to Reject
Level*Method	37.519	0.079	Failed to Reject

The results presented in Table 5 assess the interaction effect on students' academic achievement based on two different teaching strategies (experimental and conventional) and their mathematical level. The table presents the F-value, p-value, and the decision for each factor and their interaction. Regarding the main effect of mathematical level (Level), the F-value is 73.52 with a p-value of 0.000, which is less than the standard significance level of 0.05. This result indicates a statistically significant difference in academic achievement based on students' mathematical levels, suggesting that students' performance varies significantly depending on their initial mathematical proficiency. Therefore, the null hypothesis is rejected, confirming that students' mathematical level has a significant impact on their academic achievement. For the main effect of teaching method (Method), the F-value is 0.039 with a p-value of 0.147, which is greater than 0.05. This finding indicates that there is no statistically significant difference in the academic achievement between the experimental and conventional teaching methods. Consequently, the null hypothesis fails to be rejected, suggesting that the choice of teaching strategy does not significantly affect students' overall academic performance. Similarly, the interaction effect between level and method (Level*Method) has an F-value of 37.519 and a p-value of 0.079, which is also greater than 0.05, meaning that there is no significant interaction effect between the students' mathematical level and the teaching method. This implies that the impact of the teaching method on academic achievement does not significantly vary based on students' mathematical proficiency.

CONCLUSION

There was a statistically significant difference between the pre-test and post-test mean scores of students who were taught using conventional and experimental teaching methods. Both methods resulted in improvements, but the experimental method showed a greater effect, particularly for students with lower mathematical proficiency. The students' mathematical level had a significant impact on their academic achievement. Students with higher mathematical levels performed better overall, but improvements were observed across all groups. The teaching method itself (experimental vs. conventional) did not have a statistically significant effect on students' academic achievement when analyzed independently of mathematical level. This suggests that while both methods contributed to student performance, neither method demonstrated clear superiority across the entire student population. There was no significant interaction effect between the teaching method and students' mathematical levels. This implies that the teaching method's impact on achievement did not differ significantly across students' different mathematical proficiency levels.

Students' pre-existing mathematical proficiency significantly influenced their academic achievement, with higher-level students performing better both before and after the intervention. While both the experimental and conventional methods led to improvements in student performance, the experimental method demonstrated a greater effect in terms of score improvement, particularly for students at lower mathematical proficiency levels. There was no significant interaction between the teaching method and mathematical level, suggesting that the effectiveness of the teaching method did not vary significantly based on students' initial proficiency.

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