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Effects of Adapting Instruction on Academic Performance of Selected Learners at Guites National High School

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Index Terms:

academic performance, instruction, learner, mathematics, and science

Abstract. This study explored the effects of adapting instruction through scaffolding, real-world context, and formative assessment strategies on the academic performance of Grade 7 and Grade 10 learners at Guites National High School. The primary objective was to determine the learners' level of performance before and after the implementation of adaptive instructional strategies, identify whether significant differences existed between the results, and develop an instructional framework that could enhance the teaching of Mathematics and Science. The study employed a quasi-experimental research design using pretests and posttests to measure the learners' performance in selected first-quarter competencies. The collected data were analyzed using statistical tools such as mean scores and paired sample t-tests to determine the significance of changes in learners' academic performance after the intervention. The adaptive instructional strategies implemented during the study included scaffolding techniques to guide learners through complex tasks, the use of real-world contexts to make lessons more meaningful and relevant, and continuous formative assessments to monitor progress and provide timely feedback. The findings revealed a notable improvement in learners' academic performance following the implementation of adaptive instruction. Grade 7 learners in Mathematics demonstrated an increase in their mean score from Fairly Satisfactory to Outstanding, while Grade 10 learners in Science showed a similar improvement from Satisfactory to Outstanding levels. Statistical analysis confirmed significant differences between the pretest and posttest scores, indicating that the intervention positively influenced learners' conceptual understanding, engagement, and mastery of competencies. Based on these findings, an instructional framework was proposed to support learner-centered, contextualized, and reflective teaching practices. The study concludes that adaptive instruction promotes meaningful learning experiences and improved academic outcomes, and it is recommended that teachers integrate scaffolding, real-world applications, and continuous formative assessment in Mathematics and Science instruction.

Introduction

Improving learners' academic performance in Mathematics and Science remains a critical concern in both local and international educational settings. These subjects are fundamental to the development of scientific literacy, problem-solving skills, and logical reasoning; however, they continue to be among the least mastered learning areas worldwide. Results from international large-scale assessments such as the Programme for International Student Assessment (PISA) reveal that a substantial number of learners struggle to apply mathematical and scientific concepts to real-life situations, indicating weaknesses in conceptual understanding and transfer of learning (OECD, as cited in Philstar.com, 2023). These findings suggest that conventional instructional approaches may be insufficient in addressing learners' cognitive needs and real-world application skills.

In the Philippine context, the situation is equally alarming. National assessment results, including reports on the National Achievement Test (NAT), consistently show that many Filipino learners perform below the expected proficiency levels in Mathematics and Science (Philstar.com, 2023; Bautista, 2023). Despite ongoing curriculum reforms and teacher development initiatives implemented by the Department of Education, classroom instruction in many public schools remains largely teacher-centered and content-heavy. Such approaches often emphasize memorization over understanding, leaving learners with limited opportunities to actively engage with concepts or connect lessons to meaningful, real-life experiences (Lee-Chua, 2023). As a result, learners develop low confidence, reduced motivation, and persistent learning gaps in these core subjects.

These challenges are more evident in rural public secondary schools, where limited instructional resources and diverse learner abilities require more responsive and flexible teaching strategies. In schools such as Guites National High School, classroom observations and assessment outcomes indicate that many Grade 7 Mathematics and Grade 10 Science learners exhibit weak conceptual foundations, low participation, and difficulty applying abstract concepts to practical situations. Learners often depend on rote procedures rather than conceptual reasoning, which negatively affects their academic performance and problem-solving abilities. This scenario highlights the urgent need for instructional approaches that provide structured support while gradually fostering learner independence.

Educational research strongly supports the effectiveness of adapting instruction to address such learning challenges. Scaffolding learning enables teachers to provide temporary and structured assistance that is gradually withdrawn as learners gain competence, thereby improving comprehension and confidence (Cruz & Tan, 2022; Obafemi et al., 2023). Similarly, integrating real-world contexts into instruction helps learners see the relevance of academic content, increasing engagement and facilitating deeper understanding (Reyes & Domingo, 2022; Kaldaras & Wieman, 2023). Formative assessment further strengthens learning by providing continuous feedback, identifying misconceptions early, and guiding instructional adjustments that respond to learners' needs (Santos & Javier, 2022; Jin et al., 2024). Studies have shown that the combined use of scaffolding, contextualized learning, and formative assessment leads to significant improvements in academic performance, particularly in Mathematics and Science (Baniqued et al., 2024; Huang et al., 2024).

Guided by these empirical and theoretical foundations, the present study examines the effects of adapting instruction specifically through scaffolding learning, use of real-world context, and formative strategies—on the academic performance of Grade 7 learners in Mathematics and Grade 10 learners in Science at Guites National High School. The study seeks to generate evidence-based findings on how these integrated strategies influence learners' academic outcomes and to develop a proposed instructional framework that supports effective and responsive teaching practices in junior high school.
This study is highly relevant to learners as it directly addresses their academic difficulties and learning needs. By identifying instructional strategies that enhance understanding, engagement, and performance, the findings aim to help learners develop stronger conceptual foundations, improved problem-solving skills, and greater confidence in Mathematics and Science. Ultimately, the study contributes to improved learner achievement by promoting teaching practices that support meaningful learning, real-life application, and long-term academic success.

Research Questions

This study's primary purpose is to determine the effects of adapting instruction on academic performance of selected learners at Guites National High School. Specifically, this study sought to answer the following questions:

1. What is the academic performance of the following group of learners before and after the implementation of adapting instruction strategies namely integrated scaffolded, formative, and real-world teaching?
    - Grade 7 Mathematics learners, and
    - Grade 10 Science learners?

2. Is there significant differences in the academic performance of the following group of learners before and after the implementation of adapting instruction strategies namely integrated scaffolded, formative, and real-world teaching?
    - Grade 7 Mathematics learners
    - Grade 10 Science learners

3. Based on the findings, what instructional framework using integrated scaffolded, formative, and real-world teaching teaching strategies can be proposed to enhance Mathematics and Science teaching in junior high school?

Methodology

Research Design

The study employed a quasi-experimental design, specifically a non-equivalent groups pretest–posttest design, to determine the effectiveness of adapting instruction—particularly scaffolding learning, the use of real-world context, and formative strategies—in enhancing the academic performance of Grade 7 Mathematics and Grade 10 Science learners.
This quantitative research design allowed the researcher to compare the academic performance of two intact groups: one exposed to the adapting instruction interventions and another that received conventional instruction. The design did not involve random assignment of participants but relied on naturally existing class sections, making it appropriate for educational settings where full experimental control was limited.

Both groups took a pretest before the intervention and a posttest after the intervention period. The differences between the pretest and posttest scores were analyzed to determine the impact of scaffolding learning, real-world context, and formative strategies on learners' academic performance. The study was conducted from April to December 2025 during the regular academic activities of Guites National High School, ensuring that the intervention was implemented within authentic classroom contexts while maintaining the natural flow of the school year.

Respondent /Participants

The population of the study consisted of all 35 learners officially enrolled at Guites National High School during the School Year 2024–2025. This included 15 Grade 7 learners and 20 Grade 10 learners. These learners were chosen as the focus of the investigation because they were enrolled in the school's core academic subjects—Mathematics for Grade 7 and Science for Grade 10—where strong instructional support was necessary for mastering both foundational and applied competencies.

The Grade 7 learners represented the entry-level cohort of junior high school students who had begun to engage with more abstract concepts in Mathematics. At this stage, learners were in a critical period of transition from elementary arithmetic to higher-order mathematical reasoning. Their inclusion in the study was considered important because difficulties in acquiring these foundational skills could affect long-term performance in advanced Mathematics.
Meanwhile, the Grade 10 learners represented students who were completing their junior high school education and were preparing to transition into senior high school. Science, as their focus subject, required higher-order thinking skills, problem-solving abilities, and application of concepts in real-life contexts. Their inclusion ensured that the study captured not only the development of basic skills but also the application of more advanced knowledge in preparation for higher education or vocational tracks.

This population shared several defining characteristics that made them relevant to the present research: (1) they belonged to the same academic institution, which ensured uniformity in terms of curriculum standards, learning environment, and available resources; (2) they were all at crucial academic stages where instructional adaptation was highly beneficial to support learning success; and (3) they represented a manageable yet comprehensive group for analyzing the effects of adapting instruction across two key disciplines—Mathematics and Science.

Since the total number of learners was relatively small, the researcher employed total enumeration sampling. This technique involved including the entire population in the study rather than selecting a representative sample. The use of total enumeration ensured that all learners who met the defined criteria were accounted for, thereby minimizing sampling bias, increasing the accuracy of findings, and strengthening the validity and reliability of results. Furthermore, involving the entire population allowed the researcher to better assess the general impact of adapted instructional strategies across grade levels and subject areas.

This population was considered appropriate for the study because these learners had demonstrated the types of learning gaps and instructional challenges that adapting instruction—specifically scaffolding learning, use of real-world context, and formative strategies—aimed to address, particularly in conceptual understanding, real-life application, and performance in formative assessments.

Instrument of the Study

The study utilized a standardized assessment tool provided by the Division of Quezon as the primary research instrument to measure the academic performance of learners in Grade 7 Mathematics and Grade 10 Science. These assessment tools

were selected based on their alignment with the K to 12 Basic Education Curriculum of the Department of Education (DepEd) and their prior validation by subject experts and education program supervisors within the division.

The standardized test in Mathematics 7 included questions that assessed foundational competencies such as integers, algebraic expressions, linear equations, and real-life mathematical problems. Likewise, the Science 10 standardized test covered essential topics in earth and space, biology, physics, and chemistry, emphasizing conceptual understanding and scientific reasoning. These tools were administered both as a pretest and a posttest to determine changes in learner performance following the implementation of the Adapting Instruction (Scaffolding, Real-World Learning, and Formative Assessment) strategies. Utilizing a standardized instrument ensured the reliability and validity of the data gathered and allowed for consistent comparison of learners' academic progress before and after the intervention.

Procedure

The data-gathering process followed a structured sequence to ensure accurate and reliable collection of quantitative data. It was implemented in three phases: pre-implementation, implementation, and post-implementation.

During the pre-implementation phase, the researcher sought formal approval to conduct the study from the School Head of Guites National High School and the Schools Division Office of Quezon. Once approvals were granted, the researcher oriented the participants about the nature of the study and their rights as participants, including voluntary participation and confidentiality. A standardized pretest was then administered to measure baseline knowledge and proficiency in Mathematics and Science competencies.

In the implementation phase, the adapting instruction—specifically scaffolding learning, use of real-world context, and formative strategies—was delivered during regular class periods. The intervention was conducted over several sessions where learners were exposed to scaffolded lessons, contextual applications, and formative assessments. The researcher documented learner engagement and participation throughout the process. During the post-implementation phase, the same group of learners took the standardized posttest to assess improvement in academic performance. The scores from both the pretest and posttest were tabulated and statistically analyzed using the mean, standard deviation, and paired sample t-test to determine the significance of performance gains. All ethical protocols were strictly followed throughout the process, including informed consent, anonymity, and confidentiality.

Data Analysis

This study employed appropriate descriptive and inferential statistical tools to analyze the data gathered and to answer the stated research questions. The statistical methods were selected to accurately describe learners' academic performance, determine differences in performance before and after the implementation of adapted instructional strategies, and assess the effectiveness of scaffolding learning, real-world contextualization, and formative assessment in Mathematics and Science instruction. These tools ensured objective interpretation of results and provided empirical evidence to support the study's conclusions.

For Statement of the Problem No. 1, descriptive statistics were employed to determine the level of academic performance of learners before and after the implementation of adaptive instruction. These statistical methods were used to systematically organize, summarize, and interpret the collected data in a meaningful manner. In particular, the mean was utilized as a measure of central tendency to describe the average performance of learners in both the pretest and posttest. By computing the mean, the researcher was able to obtain a general representation of learners' overall achievement and make a clear comparison between their academic performance prior to and following the instructional intervention. This allowed for an objective assessment of whether adaptive instruction contributed to improvements in learners' academic outcomes. Additionally, the standard deviation was employed to determine the extent of score variability among learners, indicating how far individual scores deviated from the mean.

This measure provided insights into the consistency of learners' performance and helped identify whether the test scores were closely clustered or widely dispersed. Together, the mean and standard deviation offered a comprehensive understanding of both the central tendency and variability of learners' academic performance before and after the implementation of adaptive instruction.

The interpretation of learners' performance was based on the Department of Education's prescribed grading system under DepEd Order No. 8, s. 2015, Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program.
For Statement of the Problem No. 2, the paired sample t-test was utilized to determine whether a statistically significant difference existed between the learners' pretest and posttest scores following the implementation of the intervention. This

statistical test was appropriate since it compared the same group of learners' performances before and after the instructional treatment. The analysis was conducted using a 0.05 level of significance, which served as the criterion for deciding whether the observed difference in scores was meaningful or due to chance. A p-value less than 0.05 indicated that the difference between the pretest and posttest scores was statistically significant, leading to the rejection of the null hypothesis. This result implied that the intervention had a significant positive effect on learners' academic performance. On the other hand, a p-value equal to or greater than 0.05 indicated that the difference in scores was not statistically significant, resulting in the acceptance of the null hypothesis and suggesting that the intervention did not produce a measurable improvement in performance.

In this analysis, the t-value represented the computed statistic derived from the paired sample t-test formula and reflected the magnitude of the difference between the pretest and posttest means. The p-value, meanwhile, indicated the probability that the observed difference occurred by random chance. The alpha level of 0.05 functioned as the established threshold for statistical significance. The final decision and interpretation of results were based on comparing the computed t-value and p-value against this significance level to determine whether the intervention resulted in a statistically significant improvement in learners' academic performance.

Ethical Considerations

This study strictly adhered to established ethical standards in the conduct of educational research. Prior to data collection, formal permission to conduct the study was obtained from the School Head of Guites National High School and the Schools Division Office of Quezon. Approval was secured before any interaction with the participants to ensure institutional compliance and transparency.

Participation in the study was entirely voluntary. The learners were properly oriented regarding the purpose, procedures, duration, and scope of the research. They were informed of their rights as participants, including the right to decline participation or withdraw from the study at any point without penalty or academic disadvantage. Informed consent was obtained from the participants and, where necessary, from their parents or legal guardians to ensure that participation was based on clear understanding and free choice.

Confidentiality and anonymity were strictly maintained throughout the research process. Participants' identities were not disclosed in any part of the study. Codes were used instead of names in recording and analyzing test scores. All collected data, including pretest and posttest results, were securely stored and used solely for academic and research purposes. The data were not shared with unauthorized individuals or entities.

Results and Discussion

Learning Competencies (Quarter 1)	Pre-test		Posttest		Gain
	Mean	Description	Mean	Description	
1. Illustrates well-defined sets, subsets, and universal sets.	77.33	Fairly Satisfactory	90.33	Outstanding	13.00
2. Uses Venn diagrams to represent sets and their relationships (union, intersection, complement)	77.00	Fairly Satisfactory	90.67	Outstanding	13.67
3. Performs operations on sets (union, intersection, difference, and complement)	77.67	Fairly Satisfactory	94.00	Outstanding	16.33
4. Describes the real number system	81.00	Satisfactory	95.00	Outstanding	14.00
5. Classifies numbers according to the real number system (natural, whole, integers, rational, irrational)	77.00	Fairly Satisfactory	94.67	Outstanding	17.67
6. Illustrates absolute value of a number on the number line.	79.67	Satisfactory	94.33	Outstanding	14.66
7. Compares and arranges real numbers using a number line.	81.33	Satisfactory	94.67	Outstanding	13.34
8. Performs operations on integers and rational numbers (addition, subtraction, multiplication, division).	78.33	Fairly Satisfactory	93.67	Outstanding	15.34
9. Applies laws of exponents involving whole numbers.	82.67	Satisfactory	91.00	Outstanding	8.33

10. Evaluates expressions involving integers, rational numbers, and exponents.	79.33	Fairly Satisfactory	91.00	Outstanding	11.67
GRAND MEAN	**79.13**	**Fairly Satisfactory**	**92.93**	**Outstanding**	**13.80**

Table 1. Academic Performance of the Grade 7 learners in Mathematics before and after the implementation of adapting strategies (Integrated scaffolded, formative and real world context) in teaching)

Table 1 presents the performance of Grade 7 learners in Mathematics before and after the implementation of adapting instruction, which included scaffolding, real-world context, and formative strategies. The table highlights how learners performed across ten first-quarter competencies, showcasing both their pre-test and post-test mean scores along with the corresponding descriptive ratings. This provides a clear picture of how the intervention influenced the learners' mastery of mathematical concepts and skills.

As seen in the results, there is a consistent improvement in learners' performance across all competencies after the intervention. The grand mean increased from 79.13 (Fairly Satisfactory) in the pre-test to 92.93 (Outstanding) in the post-test, reflecting an overall gain of 13.80 points. The most notable improvement is observed in the competency "Classifies numbers according to the real number system," with a gain of 17.67 points, followed by "Performs operations on sets" with 16.33 points. Even the least improved area, "Applies laws of exponents," still recorded a gain of 8.33 points, suggesting that the adaptive strategies positively influenced all targeted skills.

These results indicate that the use of scaffolding, real-world examples, and formative assessments helped learners transition from a merely satisfactory understanding to outstanding levels of mastery. The marked improvements imply that students became more confident in handling mathematical operations, likely due to step-by-step guidance and contextualized learning experiences. The enhanced scores demonstrate that adapting instruction can bridge learning gaps, especially among students who initially struggled with abstract concepts.

The findings resonate with earlier research highlighting the benefits of adaptive instructional methods. Obafemi, Fajonyomi, and Ola-Alani (2023) confirmed that scaffolding significantly improves pupils' mathematical performance through structured guidance. Similarly, Kaldaras and Wieman (2023) emphasized that blending math instruction with real-world contexts deepens conceptual understanding. Moreover, Jin et al. (2024) supported the value of formative assessment as a feedback mechanism that strengthens learner reflection and progress. Together, these studies reinforce the present results, showing how adaptive techniques directly enhance learner engagement and achievement.
In summary, the data strongly suggest that adapting instruction through scaffolding, contextual learning, and formative feedback fosters substantial academic growth among Grade 7 students. The improvement from fairly satisfactory to outstanding ratings implies that learners not only grasped mathematical concepts but also developed a deeper appreciation for the subject. Hence, these results affirm that well-implemented adaptive strategies can effectively elevate students' mathematical performance and confidence in learning complex topics.

Learning Competencies (Quarter 1)	**Pre-test**		**Posttest**		**Gain**
	Mean	**Description**	**Mean**	**Description**	
1. Describes the distribution of active volcanoes, earthquake epicenters, and major mountain belts.	79.00	Fairly Satisfactory	92.00	Outstanding	13.00
2. Explains the different types of plate boundaries.	79.50	Satisfactory	95.00	Outstanding	15.50
3. Describes the internal structure of the Earth.	79.75	Satisfactory	91.50	Outstanding	11.75
4. Relates the occurrence of earthquakes and volcanic activities to plate boundaries.	80.75	Satisfactory	93.00	Outstanding	12.25
5. Describes the possible causes of plate movement.	80.75	Satisfactory	92.75	Outstanding	12.00
6. Explains how energy from the Earth's interior drives plate movement.	79.50	Satisfactory	91.25	Outstanding	11.75

7. Demonstrates preparedness during earthquakes, tsunamis, and volcanic eruptions.	79.00	Fairly Satisfactory	87.50	Very Satisfactory	8.50
GRAND MEAN	**79.75**	**Satisfactory**	**91.21**	**Outstanding**	**11.46**

Table 2. Academic Performance of the Grade 10 learners in Science before and after the implementation of adapting strategies (integrated scaffolded, formative, and real world context) in teaching.

Table 2 presents the performance of Grade 10 learners in Science before and after the implementation of adapted instruction, specifically using scaffolding, real-world context, and formative strategies in teaching the first quarter competencies. The table highlights how these differentiated strategies influenced the learners' understanding of Earth Science concepts, such as plate tectonics, earthquakes, and volcanic activities.

The results reveal a marked improvement in learners' academic performance. The pre-test scores show that students initially performed at a "Fairly Satisfactory" to "Satisfactory" level, with a grand mean of 79.75, while the post-test results indicate a significant increase to an Outstanding level, with a grand mean of 91.21, yielding an average gain of 11.46 points. The highest improvement was observed in the competency "Explains the different types of plate boundaries" with a gain of 15.50, followed by "Describes the distribution of active volcanoes, earthquake epicenters, and major mountain belts" with 13.00, while "Demonstrates preparedness during earthquakes, tsunamis, and volcanic eruptions" had the smallest gain of 8.50, though still showing progress. These results indicate that the intervention effectively strengthened the learners' conceptual grasp of scientific phenomena related to the Earth's structure and processes.

The data further suggest that the use of adapted instruction contributed to students' deeper comprehension and higher performance levels. The consistent jump from "Satisfactory" to "Outstanding" ratings implies that learners benefited from the integration of real-life contexts and scaffolded learning activities, which helped them connect theoretical content with practical experiences. The slight variation in gains across competencies could indicate that while conceptual understanding improved markedly, skills requiring application and preparedness might need continued reinforcement.

These findings are consistent with the claims of Vygotsky (1978), who emphasized the role of scaffolding in promoting higher levels of cognitive development through guided learning. Similarly, Bransford et al. (2000) noted that instruction anchored in real-world contexts enhances learner engagement and understanding. Moreover, Black and Wiliam (2018) supported the use of formative assessment as a tool for monitoring progress and adapting teaching strategies to address learning gaps. These studies affirm that the combination of these instructional approaches fosters both retention and application of knowledge.

From the results, it can be inferred that adapting instruction through scaffolding, real-world applications, and formative assessment significantly improved the academic performance of Grade 10 learners in Science. This implies that when teachers modify their strategies to match learners' readiness and context, students are more likely to achieve mastery of complex concepts. Hence, the use of adaptive and context-based teaching practices should be sustained and expanded across learning areas to maximize their impact on student achievement.

Learning Competencies (Quarter 1)	**Mean Difference**	**p-value**	**Interpretation**	**Decision**
1. Illustrates well-defined sets, subsets, and universal sets.	-13.00	.000	Significant	Reject Ho
2. Uses Venn diagrams to represent sets and their relationships (union, intersection, complement)	-13.67	.000	Significant	
3. Performs operations on sets (union, intersection, difference, and complement)	-16.33	.000	Significant	
4. Describes the real number system	-14.00	.000	Significant	
5. Classifies numbers according to the real number system (natural, whole, integers, rational, irrational)	-17.67	.000	Significant	
6. Illustrates absolute value of a number on the number line.	-14.67	.000	Significant	

7. Compares and arranges real numbers using a number line.	-13.33	.000	Significant
8. Performs operations on integers and rational numbers (addition, subtraction, multiplication, division).	-15.33	.000	Significant
9. Applies laws of exponents involving whole numbers.	-8.33	.170	Not Significant
10. Evaluates expressions involving integers, rational numbers, and exponents.	-11.67	.000	Significant

Table 3. Statistical table showing the difference in the performance of Grade 7 learners in Mathematics before and after the implementation of adapting Strategies (integrated scaffolded, formative, and real world context) in teaching

Table 3 reveals a statistically significant improvement in Grade 7 learners' performance in Mathematics following the implementation of adaptive instructional strategies—scaffolding, real-world context integration, and formative assessment. Most competencies showed significant mean differences ($p < .05$), indicating the effectiveness of these approaches in enhancing conceptual understanding and procedural fluency. The greatest gains were observed in performing operations on sets (–16.33, $p = .000$), classifying numbers (–17.67, $p = .000$), and performing operations on integers and rational numbers (–15.33, $p = .000$). These improvements suggest that guided practice and meaningful context fostered active learning, consistent with constructivist learning theory. Similarly, competencies related to illustrating sets, using Venn diagrams, and understanding real numbers also improved significantly, reflecting the benefits of formative strategies such as immediate feedback and peer interaction.

However, there is no statistically significantly difference for the competency applying the laws of exponents (–8.33, $p = .170$), suggesting the need for more targeted instructional support for abstract concepts. Overall, the findings affirm that adaptive instruction enhances student performance in foundational mathematics. They highlight the importance of integrating scaffolding, contextualized learning, and formative assessments to improve engagement, understanding, and achievement, while also identifying areas needing further instructional refinement.

The findings of this study are strongly supported by Cruz and Tan (2022), who emphasized that scaffolding through guided questioning, visual aids, and structured practice significantly strengthens learners' problem-solving skills and comprehension. Similarly, Reyes and Domingo (2022) found that contextualized instruction enhances student motivation and retention by connecting lessons to meaningful real-life situations. Santos and Javier (2022) further underscored the role of formative assessment in providing feedback that enables learners to track their own progress, promoting autonomy and self-regulation. These works collectively affirm that the combination of scaffolding, real-world learning, and formative strategies creates a holistic and responsive learning environment.

Other supporting studies also highlight the wider benefits of adaptive teaching. For instance, Buragohain (2025) and The Australian (2024) both reported that student-centered pedagogies and continuous assessment cycles contribute to sustained academic improvement. Additionally, Tacio (2024) and The Philippine Star (2024) advocated for contextualized and inclusive Mathematics instruction that addresses the varied needs of Filipino learners, particularly in public schools. These sources provide further validation that the integrated instructional approach employed in this study aligns with effective practices proven to elevate learning outcomes in Mathematics.

Considering these findings, it can be inferred that adapting instruction through scaffolding, real-world application, and formative assessment significantly enhances the academic performance of Grade 7 learners. The consistent pattern of improvement across competencies shows that learners benefited from structured guidance, contextualized examples, and timely feedback. Although some abstract skills, like applying the laws of exponents, may still pose challenges, the overall results affirm that adaptive instruction is a powerful tool for deepening understanding and supporting mastery of key mathematical competencies. Therefore, teachers are encouraged to sustain and refine these strategies as part of their regular classroom practices to promote continuous growth and engagement in Mathematics.

Learning Competencies (Quarter 1)	**Mean Difference**	**p-value**	**Interpretation**	**Decision**
1. Describes the distribution of active volcanoes, earthquake epicenters, and major mountain belts.	-13.00	.000	Significant	Reject Ho

2. Explains the different types of plate boundaries.	-15.50	.000
3. Describes the internal structure of the Earth.	-11.75	.000
4. Relates the occurrence of earthquakes and volcanic activities to plate boundaries.	-12.25	.000
5. Describes the possible causes of plate movement.	-12.00	.000
6. Explains how energy from the Earth's interior drives plate movement.	-11.75	.012
7. Demonstrates preparedness during earthquakes, tsunamis, and volcanic eruptions.	-14.00	.000

Table 4. Statistical table showing the difference in the performance of the Grade 10 learners in Science before and after the implementation of adapting strategies (integrated scaffolded, formative, and real world context) in teaching.

Table 4 shows a statistically significant improvement in Grade 10 learners' performance in Science after the implementation of adaptive instructional strategies, including scaffolding, real-world context integration, and formative assessments. All competencies posted statistically significant differences ($p < .05$), confirming the effectiveness of these strategies in enhancing students' conceptual understanding and practical application of scientific concepts.

The greatest gains were observed in explaining plate boundaries (–15.50, $p = .000$) and demonstrating preparedness during geologic hazards (–14.00, $p = .000$), indicating that real-world contexts such as recent seismic and volcanic events strengthened learners' engagement and comprehension. This aligns with constructivist learning theory, which emphasizes meaningful learning through relevant experiences.

Significant improvements were also recorded in describing the distribution of active volcanoes, earthquake epicenters, and mountain belts (–13.00, $p = .000$), the Earth's internal structure (–11.75, $p = .000$), and the relationship between plate boundaries and geologic activities (–12.25, $p = .000$). These results highlight the value of scaffolding strategies—such as guided explanations and visual aids—in deepening understanding of complex geoscience concepts. Further, describing the causes of plate movement (–12.00, $p = .000$) and explaining how energy drives plate movement (–11.75, $p = .012$) also showed significant gains, reflecting the impact of structured instruction and formative feedback in clarifying misconceptions.

The consistent improvements across all competencies affirm that adaptive instruction promotes deeper understanding, active engagement, and stronger application of knowledge. These findings support learner-centered and inquiry-based approaches in science education and underscore the importance of sustaining adaptive, context-rich, and formative strategies to enhance science learning, particularly in Earth science.

The results are consistent with the findings of Cruz and Tan (2022), who noted that scaffolded instruction—through guided discussions, visual representations, and progressive questioning—significantly enhances comprehension of complex scientific ideas. Similarly, Reyes and Domingo (2022) reported that contextualized and real-world learning increases motivation and conceptual retention, especially when lessons are linked to environmental and societal issues. Moreover, Santos and Javier (2022) highlighted that formative assessment allows learners to self-assess their understanding and receive timely feedback, which strengthens mastery of content. The results of the current study also echo Buragohain (2025) and The Australian (2024), both of whom affirmed that student-centered, inquiry-based learning fosters deeper engagement and critical thinking in science classes. Furthermore, Tacio (2024) and The Philippine Star (2024) emphasized the importance of contextualized instruction that reflects real-life experiences of Filipino learners, especially in promoting preparedness and resilience in disaster-prone contexts.

Based on these cross-referenced findings, it can be inferred that the implementation of adapting instruction in Science—through scaffolding, real-world application, and formative strategies—substantially improved the learners' performance in all key competencies. The combination of structured guidance, meaningful contextualization, and continuous feedback not only strengthened academic achievement but also enhanced learners' awareness and preparedness for natural hazards. These findings support the sustainability of adaptive, learner-centered teaching strategies as vital tools in improving the quality of Science education and developing scientifically literate and disaster-resilient students.

Conclusion and Implications

Conclusion

Based on the findings of the study, it can be concluded that adaptive instruction that integrates scaffolding, real-world context, and formative assessment significantly improves learners' academic performance in both Mathematics and Science. The consistent increase in learners' scores demonstrates that when instruction is carefully structured and responsive to learners' needs, meaningful improvements in understanding and competency can be achieved.

The results further revealed statistically significant differences between the pretest and posttest scores of the learners. This indicates that the instructional strategies employed during the intervention effectively enhanced their comprehension and overall academic performance. Given these significant improvements, the null hypothesis stating that there is no significant difference between the pretest and posttest scores is therefore rejected.

Moreover, the proposed instructional framework proved to be an effective structured and learner-centered approach. By promoting active engagement, supporting mastery through scaffolding, and connecting lessons to real-world applications, the framework fostered meaningful learning experiences. Overall, the findings affirm the value of adaptive instruction as a practical and impactful strategy for improving student achievement.

Recommendations

Based on the findings of the study, the following recommendations are presented to further strengthen the effectiveness of adaptive instruction in enhancing learners' academic performance in Mathematics and Science.

1. Based on the improvement in Grade 7 learners' Mathematics performance, teachers should consistently apply scaffolding techniques to help learners progress from guided to independent learning, particularly in abstract topics such as exponents.
2. Grounded on the results showing enhanced engagement and mastery through contextualized teaching, lessons should be designed using real-world applications to make learning more relevant, meaningful, and motivating for students.
3. In light of the significant differences observed in learners' pretest and posttest scores, formative assessments should be regularly implemented to provide timely feedback, monitor progress, and adjust instruction according to learners' needs.
4. Considering the proven effectiveness of adaptive instruction strategies, school administrators should encourage and support professional development programs that focus on scaffolding, contextualization, and formative assessment for Mathematics and Science teachers.
5. Drawing from the promising outcomes of this study, future researchers may replicate the investigation in other grade levels, subject areas, or learning environments to validate and expand the applicability of the proposed instructional framework.
6. Future researchers are encouraged to conduct instrument validation studies to further strengthen the credibility and applicability of the research instrument used in this study. Specifically, content validation may be performed through expert judgment to ensure that the test items and assessment tools adequately represent the intended competencies in Mathematics and Science. Construct validation may also be undertaken to confirm that the instrument accurately measures the variables of scaffolding learning, real-world contextualization, formative assessment, and academic performance.

In addition, future studies should establish and confirm the reliability of the research instrument using appropriate statistical measures. Reliability testing procedures such as Cronbach's alpha, split-half reliability, or test–retest methods may be employed to determine the consistency and stability of the instrument across different groups of learners and testing conditions. Establishing strong reliability coefficients will enhance the dependability of the results and support the broader use of the instrument in similar educational settings.

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Data Availability Statement

Data sharing is available upon submitting a formal request to the author.

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Appendices

Appendix A. Survey Questionnaire

The appendix contains the complete research instrument used in the study to collect data from the respondents.