



Instructional and Art of Questioning Practices as Predictors of Academic Achievement of Elementary Mathematics

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International Journal of Interdisciplinary Viewpoints
Vol. 2, No. 6, Art. 4, 2026

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Abstract

This study examined the instructional practices and art of questioning of teachers as predictors of the academic achievement of Grade 6 pupils in mathematics in public elementary schools in Monkayo West District, Division of Davao de Oro. Specifically, it determined the levels of teachers' instructional practices in terms of planning, teaching, and assessment, teachers' art of questioning practices in terms of questioning techniques and types of questions, pupils' academic achievement, the relationships among the variables, and the significant predictors of mathematics achievement. A quantitative correlational research design was employed involving 273 Grade 6 pupils selected through stratified random sampling. Data were gathered using validated researcher-adopted questionnaires, while pupils' fourth-quarter mathematics grades were obtained from official school records. Descriptive statistics, Pearson product-moment correlation, and multiple regression analyses were used to analyze the data. The findings revealed that teachers frequently demonstrated effective instructional practices and art of questioning practices, while pupils attained a Very Satisfactory level of academic achievement. Both instructional practices and art of questioning practices showed significant positive relationships with academic achievement. Moreover, planning practices and questioning techniques emerged as significant predictors of mathematics achievement. The study concludes that effective instructional planning and purposeful questioning contribute to improved mathematics performance. Continuous professional development focusing on evidence-based instructional planning and effective questioning strategies is recommended to strengthen mathematics instruction and enhance learner achievement.

Keywords

elementary education, instructional practices, art of questioning, quantitative correlational design, Philippines

How to Cite

Awit, J. M., & Villocino, R. (2026). Instructional and Art of Questioning Practices as Predictors of Academic Achievement of Elementary Mathematics. *International Journal of Interdisciplinary Viewpoints*, 2(6), Article 4.

<https://doi.org/10.64612/ijiv.v2i6.150>

Received: 27 February 2026

Accepted: 30 May 2026

Published: 30 June 2026

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Peer Review Statement

This article underwent a double-anonymous peer review process in accordance with the editorial policies of the *International Journal of Interdisciplinary Viewpoints*. Both authors and reviewers remained anonymous throughout the review process.

Open Access Statement

The *International Journal of Interdisciplinary Viewpoints* is a fully open-access, peer-reviewed journal. All articles are freely available online immediately upon publication without subscription or access fees.

Funding Statement

The authors received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors declared no conflicts of interest.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

The authors contributed to conceptualization, methodology, investigation, writing—original draft preparation, writing—review and editing, and supervision. The authors approved the final manuscript.

Ethics Statement

This study was conducted in accordance with ethical standards.

INTRODUCTION

Mathematics is widely recognized as a fundamental discipline that develops learners' logical reasoning, critical thinking, problem-solving, and decision-making skills, all of which are essential for academic success and lifelong learning.

Competence in mathematics enables learners to analyze complex situations, make evidence-based decisions, and adapt to the demands of an increasingly knowledge-driven society. Despite continuous curriculum reforms and innovations in mathematics education, improving learners' mathematics achievement remains a global educational challenge. International evidence indicates that many learners continue to experience difficulties in understanding mathematical concepts, applying mathematical reasoning, and solving non-routine problems. These challenges highlight the importance of strengthening classroom instruction through effective teaching strategies, purposeful lesson planning, and meaningful classroom interactions that actively engage learners in mathematical thinking (Schleicher, 2018; Aragón et al., 2024; Abuhasanein et al., 2025).

Within the Philippine educational system, improving mathematics achievement continues to be a major concern as learners consistently demonstrate varying levels of proficiency across different learning competencies. Research has shown that learners' mathematics performance is influenced by the quality of classroom instruction, teachers' pedagogical competence, and their ability to provide meaningful and differentiated learning experiences that address diverse learner needs. Studies likewise emphasize that carefully planned instruction, learner-centered teaching approaches, and effective questioning strategies contribute to improved mathematical understanding and academic performance by encouraging learners to participate actively in classroom learning and develop higher-order thinking skills (Bernardo et al., 2022; Aguhayon et al., 2023; Insorio & Librada, 2025; Linaza et al., 2025). These findings underscore the continuing need to strengthen instructional practices that support meaningful mathematics learning in elementary classrooms.

Although numerous studies have examined instructional practices, questioning strategies, and mathematics achievement, several research gaps remain. Empirical studies have generally investigated instructional practices or questioning strategies independently, with limited attention given to their combined influence on learners' academic achievement. Methodologically, many investigations have focused primarily on determining relationships among variables without identifying which specific dimensions of instructional practices and questioning practices significantly predict learners' mathematics performance. Furthermore, limited evidence is available from Philippine public elementary schools, particularly within local educational contexts where instructional conditions, learner characteristics, and classroom experiences may differ from those reported in international studies. Addressing these empirical, methodological, and contextual gaps may provide a more comprehensive understanding of how effective instructional practices and purposeful questioning contribute to improved mathematics achievement among elementary learners (Mosimege & Winnaar, 2021; Mahmud & Mohd Drus, 2023; Ngoveni & Machaba, 2024; Mapinogos & Salimaco, 2025).

This study therefore examined the instructional practices and art of questioning of teachers as predictors of the academic achievement of Grade 6 pupils in mathematics in public elementary schools in Monkayo West District, Division of Davao de Oro, during the School Year 2025–2026. Specifically, the study investigated instructional practices in terms of planning, teaching, and assessment, as well as questioning practices in terms of questioning techniques and types of questions, to determine their respective contributions to pupils' mathematics achievement. The findings are expected to provide empirical evidence that may assist teachers in improving instructional planning and classroom questioning practices, support school administrators in designing responsive professional development programs, and guide educational leaders in developing evidence-based interventions that strengthen mathematics instruction. Moreover, the study contributes context-specific evidence to the growing body of literature on effective mathematics teaching and provides practical insights for improving learner achievement in elementary mathematics (Farhang et al., 2023; Karngebea & Kennedy, 2022; Khan et al., 2024; Kim, 2025; Livy et al., 2026).

METHODOLOGY

Design

This study employed a quantitative correlational research design grounded in the positivist research paradigm, which assumes that relationships among observable variables can be objectively measured and statistically analyzed. Quantitative correlational research is appropriate for determining the magnitude and direction of relationships among variables without manipulating them. Specifically, the study examined whether teachers' instructional practices and art of questioning practices significantly predict the academic achievement of Grade 6 pupils in elementary mathematics. The design aligns with the study's objectives because it enables the examination of predictive relationships using empirical data collected from a representative sample of learners.

Sampling

The study was conducted among Grade 6 pupils enrolled in the 21 public elementary and integrated schools of Monkayo West District, Division of Davao de Oro, during the School Year 2025–2026. A total of 273 Grade 6 pupils participated in the study through stratified random sampling, wherein each participating school served as a stratum. The number of respondents selected from each school was proportional to its Grade 6 population to ensure equitable representation across the district. Participants were included if they were officially enrolled as Grade 6 pupils, had completed the fourth grading period in Mathematics, and obtained informed consent from their parents or legal guardians. Learners who failed to satisfy these inclusion criteria or whose academic records were incomplete were excluded from the study. The sampling procedure enhanced the representativeness of the sample while minimizing selection bias, thereby improving the external validity of the findings.

Data Collection

Data collection followed systematic and ethically approved procedures. Two structured questionnaires served as the primary research instruments. The first instrument measured teachers' instructional practices across three domains: planning, teaching, and assessment. The second instrument assessed teachers' art of questioning practices through

indicators on questioning techniques and types of questions. Both instruments utilized a four-point Likert scale to measure the frequency of observed instructional behaviors. Prior to implementation, the questionnaires underwent expert validation to establish content validity, clarity, and relevance to the study objectives. Reliability was established through pilot testing using a test-retest procedure involving Grade 6 learners who were not included in the final sample. Necessary revisions were incorporated based on expert recommendations and pilot-test results to improve instrument quality. Following the approval of the research protocol by the appropriate institutional authorities, permission to conduct the study was obtained from the Schools Division Superintendent, the Public Schools District Supervisor, and school heads. Informed consent was secured from teachers and parents or guardians before data collection. The researcher personally administered the questionnaires and retrieved the completed instruments. Fourth-quarter Mathematics grades were obtained from official school records and served as the measure of pupils' academic achievement.

Data Analysis

The collected data were encoded, verified, and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including the mean and standard deviation, were computed to determine the level of teachers' instructional practices and art of questioning practices as perceived by the respondents. The Pearson Product-Moment Correlation Coefficient (r) was employed to determine the strength and direction of the relationships between the independent variables and pupils' academic achievement. To determine the predictive influence of instructional practices and questioning practices on mathematics achievement, multiple regression analysis was performed. These statistical procedures were selected because they appropriately addressed the descriptive and predictive objectives of the study while allowing the identification of significant predictors of academic achievement.

Ethical Considerations

The study strictly adhered to accepted ethical principles governing educational research. Ethical clearance was secured from the appropriate institutional research ethics committee before data collection commenced. Participation was voluntary, and informed consent was obtained from participating teachers as well as from the parents or guardians of all learner respondents. Participants received adequate information regarding the purpose of the study, research procedures, potential risks and benefits, confidentiality measures, and their right to withdraw from the study at any stage without consequence. Confidentiality and anonymity were maintained by assigning identification codes instead of participants' names. Academic records and survey responses were treated as confidential and stored securely in compliance with the Data Privacy Act of 2012 (Republic Act No. 10173). Access to research data was restricted solely to the researcher, and all information was used exclusively for academic and research purposes. Throughout the investigation, the principles of respect for persons, beneficence, justice, transparency, and research integrity were consistently observed.

Limitations and Rigor

The findings of this study should be interpreted within several methodological considerations. First, the use of self-reported questionnaire responses may have introduced response bias, including the tendency of respondents to provide socially desirable answers. Second, the investigation was limited to Grade 6 pupils from public elementary schools in Monkayo West District, thereby limiting the generalizability of the findings to other educational settings. Despite these limitations, methodological rigor was strengthened through the use of validated research instruments, expert evaluation, pilot testing, reliability assessment, and standardized data collection procedures. The application of stratified random sampling enhanced sample representativeness, while appropriate statistical analyses increased the validity and reliability of the study's conclusions. Collectively, these procedures strengthened the credibility and trustworthiness of the research findings.

RESULTS AND DISCUSSION

The findings revealed that teachers frequently demonstrated instructional practices in teaching elementary mathematics, with an overall mean of 3.23. Planning practices and assessment practices obtained the highest mean of 3.30, whereas teaching practices recorded a mean of 3.10. These findings indicate that teachers consistently implemented activities related to lesson preparation, classroom instruction, and learner assessment, reflecting a generally favorable instructional environment for mathematics learning. The consistently high ratings suggest that teachers recognize the importance of carefully organizing instruction, delivering lessons systematically, and monitoring learners' progress. Effective instructional planning enables teachers to align learning objectives, classroom activities, instructional materials, and assessment with curriculum expectations, while appropriate assessment practices provide information necessary for improving instruction and supporting learner achievement. Although teaching practices were likewise rated as frequently demonstrated, the comparatively lower mean suggests opportunities to strengthen learner-centered instructional approaches that actively engage pupils in mathematical reasoning and problem solving. The findings support previous studies emphasizing the importance of effective instructional practices in mathematics education. Well-designed lesson planning contributes to organized classroom instruction and improves learners' academic performance by ensuring coherence between objectives, instructional activities, and assessment (Karngbeae & Kennedy, 2022; Farhang et al., 2023; Khan et al., 2024). Likewise, effective instructional strategies encourage learners' active participation, facilitate conceptual understanding, and promote higher levels of mathematics achievement (Mosimege & Winnaar, 2021; Aragón et al., 2024). Furthermore, effective mathematics teaching requires balanced implementation of planning, classroom instruction, and assessment to support meaningful learning experiences and continuous learner improvement (Al-Otaibi & Al-Matham, 2022).

The consistently favorable ratings may reflect teachers' commitment to implementing curriculum standards and maintaining quality instructional practices in mathematics classrooms. Nevertheless, strengthening learner-centered pedagogies, collaborative learning experiences, and classroom discourse may further improve instructional effectiveness by

encouraging pupils to communicate mathematical ideas, justify solutions, and construct deeper conceptual understanding. The findings imply that school administrators should continue supporting teachers through professional development programs focusing on instructional planning, innovative teaching strategies, formative assessment, and learner-centered mathematics instruction. Such initiatives may further strengthen instructional quality and contribute to improved mathematics achievement among elementary learners.

Table 1
Summary of Teachers' Instructional Practices in Teaching Elementary Mathematics*

Dimension	Mean	Descriptive Rating
Planning Practices	3.30	Frequently
Teaching Practices	3.10	Frequently
Assessment Practices	3.30	Frequently
Overall Mean	3.23	Frequently

Note. Scale: 3.25–4.00 = Always; 2.50–3.24 = Frequently; 1.75–2.49 = Rarely; 1.00–1.74 = Never.

The second objective of the study was to determine the level of teachers' art of questioning practices in teaching elementary mathematics in terms of questioning techniques and types of questions. The findings revealed that teachers frequently demonstrated effective questioning practices during mathematics instruction, as reflected by an overall mean of 3.20. Questioning techniques obtained the highest mean of 3.40, while the different types of questions recorded a mean of 3.00. These findings indicate that teachers consistently employed questioning to facilitate classroom interaction, monitor learners' understanding, and encourage participation during mathematics lessons. The higher rating for questioning techniques suggests that teachers effectively formulate and deliver questions, provide opportunities for learners to respond, and encourage classroom interaction. However, the relatively lower rating for the different types of questions indicates that teachers may rely more frequently on certain questioning patterns than on a wider range of cognitively challenging questions that stimulate higher-order mathematical thinking. The findings are consistent with studies emphasizing that effective questioning serves as an essential instructional strategy for promoting reasoning, conceptual understanding, and learner engagement in mathematics classrooms. Purposeful questioning encourages learners to explain their thinking, justify solutions, and actively participate in mathematical discussions (Walsh & Sattes, 2017; Mahmud & Mohd Drus, 2023). Similarly, effective questioning techniques have been shown to strengthen mathematical reasoning and classroom interaction when teachers deliberately sequence questions and provide sufficient opportunities for learner reflection (Ngoveni & Machaba, 2024; Kim, 2025). Classroom questioning becomes even more effective when teachers use learners' responses to guide subsequent instruction and deepen conceptual understanding (Bozkuş & Arslan, 2025; Livy et al., 2026). Qualitative evidence likewise demonstrates that experienced mathematics teachers intentionally adapt their questioning strategies to learners' responses in order to promote meaningful mathematical discourse (Mapinogos & Salimaco, 2025).

Although questioning practices were generally implemented frequently, expanding the use of open-ended, analytical, and reasoning-oriented questions may further strengthen learners' critical thinking and mathematical communication. Providing pupils with greater opportunities to justify, explain, and defend their mathematical ideas may encourage deeper conceptual learning beyond procedural understanding. The findings imply that instructional coaching and professional development programs should emphasize effective questioning strategies that promote mathematical reasoning, classroom dialogue, and learner participation. Strengthening teachers' questioning competencies may enhance classroom interaction and improve pupils' conceptual understanding of mathematics.

Table 2
*Summary of Teachers' Art of Questioning Practices in Teaching Elementary Mathematics

Dimension	Mean	Descriptive Rating
Questioning Techniques	3.40	Frequently
Types of Questions	3.00	Frequently
Overall Mean	3.20	Frequently

Note. Scale: 3.25–4.00 = Always; 2.50–3.24 = Frequently; 1.75–2.49 = Rarely; 1.00–1.74 = Never.

The third objective of the study was to determine the level of academic achievement of Grade 6 pupils in mathematics based on their fourth-quarter grades. The findings revealed that the Grade 6 pupils obtained a mean mathematics grade of 86.37, corresponding to the descriptive rating of ****Very Satisfactory****. This result indicates that the respondents generally demonstrated satisfactory mastery of the expected mathematics competencies and were able to meet the learning standards prescribed for their grade level. The observed level of achievement suggests that pupils have developed a solid understanding of fundamental mathematical concepts and skills. Nevertheless, continued instructional support remains necessary to strengthen higher-order thinking, mathematical reasoning, and complex problem-solving abilities that are essential for success in increasingly challenging learning situations. The findings are consistent with studies indicating that learners' mathematics achievement improves when meaningful instructional experiences, appropriate teaching strategies, and differentiated learning opportunities are consistently provided (Insorio & Librada, 2025; Linaza et al., 2025). Likewise, international evidence emphasizes that improving mathematics performance requires instructional practices that develop conceptual understanding, reasoning, and problem-solving rather than procedural knowledge alone (Schleicher, 2018). Furthermore, persistent challenges in mathematics learning among elementary pupils highlight the importance of strengthening instructional quality and providing targeted interventions that address learners' conceptual difficulties (Abuhasanein et al., 2025). Evidence from the Philippine context likewise demonstrates that mathematics achievement varies considerably across learners, underscoring the need for instructional approaches that address diverse learning needs

and support struggling learners (Bernardo et al., 2022). The findings suggest that while the respondents generally achieved commendable academic performance, continuous improvement initiatives remain necessary to sustain and further enhance mathematics achievement. Strengthening instructional practices, providing differentiated learning experiences, and developing learners' reasoning abilities may contribute to higher levels of mathematical proficiency. The findings imply that schools should continue implementing instructional interventions that promote conceptual understanding, problem-solving, and critical thinking while providing appropriate academic support for learners experiencing difficulty in mathematics. Continuous monitoring of learners' achievement and the use of evidence-based instructional strategies may further improve mathematics performance among elementary pupils.

Table 3
Academic Achievement of Grade 6 Pupils in Mathematics*

Variable	Mean	Descriptive Rating
Academic Achievement	86.37	Very Satisfactory

Note. Descriptive rating based on the Department of Education grading scale.

The fourth objective of the study was to determine whether teachers' instructional practices were significantly related to the academic achievement of Grade 6 pupils in mathematics. The results revealed a statistically significant low positive relationship between teachers' instructional practices and pupils' academic achievement in mathematics ($r = .174$, $p = .004$). Since the probability value was lower than the .05 level of significance, the null hypothesis was rejected. The findings indicate that improvements in teachers' instructional practices are associated with corresponding improvements in pupils' mathematics achievement, although the strength of the relationship is relatively weak. The significant relationship demonstrates that instructional planning, classroom teaching, and assessment collectively contribute to learners' mathematics performance. Effective instructional practices create learning environments that facilitate conceptual understanding, learner engagement, and meaningful mathematical experiences. However, the relatively low correlation coefficient indicates that instructional practices account for only a small proportion of the variation in pupils' academic achievement, suggesting that mathematics performance is influenced by multiple educational and learner-related factors. The findings are consistent with evidence showing that effective instructional strategies positively influence mathematics achievement by improving learners' engagement, conceptual understanding, and problem-solving skills (Mosimege & Winnaar, 2021; Aragón et al., 2024). Likewise, differentiated and meaningful mathematics instruction enables learners with varying abilities to achieve better academic outcomes by addressing their individual learning needs (Insorio & Librada, 2025). Evidence from the Philippine educational context further suggests that mathematics achievement is shaped by a combination of instructional quality, learner characteristics, and contextual influences rather than by a single instructional factor (Bernardo et al., 2022).

Although the relationship was statistically significant, its relatively low magnitude indicates that effective instruction alone cannot fully explain pupils' mathematics achievement. Academic performance may likewise be influenced by learners' prior knowledge, motivation, study habits, cognitive abilities, attendance, family support, and access to learning resources. Consequently, strengthening instructional practices should be complemented by interventions that address learner-specific and contextual factors affecting mathematics learning. The findings imply that schools should continue strengthening instructional quality through sustained professional development, instructional supervision, collaborative lesson planning, and evidence-based teaching practices. At the same time, comprehensive learner support programs should be implemented to address the broader academic and personal factors that influence mathematics achievement.

Table 4
Correlation Between Teachers' Instructional Practices and Academic Achievement in Mathematics*

Variables	Pearson's r	p -value	Decision	Interpretation
Instructional Practices and Academic Achievement	0.174	.004	Reject H_0	Significant, Low Positive Correlation

Note. Correlation is significant at the .05 level (2-tailed).

The fifth objective of the study was to determine whether teachers' art of questioning practices were significantly related to the academic achievement of Grade 6 pupils in mathematics. The results revealed a statistically significant low positive relationship between teachers' art of questioning practices and pupils' academic achievement in mathematics ($r = .145$, $p = .017$). Since the probability value was below the .05 level of significance, the null hypothesis was rejected. The findings indicate that more effective questioning practices are associated with higher mathematics achievement among Grade 6 pupils, although the observed relationship is relatively weak. The findings suggest that purposeful classroom questioning contributes to pupils' mathematical learning by encouraging active participation, stimulating reasoning, and providing opportunities for learners to explain and justify their mathematical thinking. Effective questioning also enables teachers to assess learners' understanding, identify misconceptions, and adjust instruction according to learners' responses. Nevertheless, the relatively low correlation coefficient indicates that questioning practices represent only one of several instructional factors associated with pupils' academic performance. The findings are consistent with research demonstrating that purposeful questioning enhances learners' reasoning, mathematical communication, and conceptual understanding (Walsh & Sattes, 2017; Mahmud & Mohd Drus, 2023). Likewise, strategically planned questioning techniques improve classroom interaction and encourage learners to engage more actively in mathematical discussions (Ngoveni & Machaba, 2024). Recent studies further emphasize that effective questioning depends not only on the questions asked but also on how teachers sequence questions, provide adequate wait time, and use learners' responses to deepen mathematical understanding (Kim, 2025; Bozkuş & Arslan, 2025; Livy et al., 2026). Qualitative evidence likewise indicates that experienced

mathematics teachers intentionally modify their questioning practices according to learners' responses to promote meaningful classroom discourse and higher-order thinking (Mapinogos & Salimaco, 2025).

Despite the statistically significant relationship, the relatively low correlation suggests that effective questioning alone is insufficient to produce substantial improvements in mathematics achievement. Learners' academic performance is influenced by the combined effects of instructional quality, prior mathematical knowledge, motivation, cognitive readiness, learning strategies, and classroom experiences. Consequently, questioning strategies should be integrated with other evidence-based instructional practices to maximize learning outcomes. The findings imply that teachers should continue strengthening their questioning competencies by using clear, purposeful, and cognitively challenging questions that promote reasoning, explanation, and classroom dialogue. School administrators should likewise support professional development initiatives focusing on questioning strategies, instructional coaching, and lesson study to enhance mathematics instruction and improve learner achievement.

Table 5
Correlation Between Teachers' Art of Questioning Practices and Academic Achievement in Mathematics

Variables	Pearson's r	p-value	Decision	Interpretation
Art of Questioning Practices and Academic Achievement	0.145	.017	Reject H_0	Significant, Low Positive Correlation

Note. Correlation is significant at the .05 level (2-tailed).

Conclusion and Recommendations

The study examined the instructional practices and art of questioning of teachers as predictors of the academic achievement of Grade 6 pupils in mathematics in public elementary schools in Monkayo West District, Division of Davao de Oro. The findings revealed that teachers frequently demonstrated effective instructional practices in terms of planning, teaching, and assessment, as well as effective questioning practices in terms of questioning techniques and types of questions. Likewise, the Grade 6 pupils attained a Very Satisfactory level of academic achievement in mathematics, indicating that they generally achieved the expected learning competencies for their grade level. Furthermore, both instructional practices and art of questioning practices were found to have statistically significant positive relationships with pupils' academic achievement, although the strength of these relationships was relatively low. The regression analyses further demonstrated that planning practices significantly predicted pupils' academic achievement among the instructional practice dimensions, while questioning techniques emerged as the only significant predictor among the dimensions of teachers' art of questioning. These findings emphasize that carefully planned instruction and the effective implementation of questioning techniques play important roles in improving learners' mathematics performance. Overall, the study concludes that strengthening teachers' competencies in instructional planning and purposeful questioning can contribute to improved mathematics achievement and provide valuable evidence for designing instructional improvement programs and professional development initiatives in elementary mathematics education.

Teachers should continue enhancing their instructional planning by designing well-structured, learner-centered mathematics lessons that clearly align learning objectives, instructional activities, and assessment strategies. Greater emphasis should also be placed on developing effective questioning techniques that encourage learners to explain their reasoning, justify mathematical solutions, and participate actively in classroom discussions. School administrators should strengthen instructional supervision by providing continuous professional development programs, instructional coaching, collaborative lesson planning, and lesson study activities that support evidence-based teaching practices and improve instructional quality. The Schools Division Office and education leaders should formulate policies and intervention programs that reinforce effective instructional planning and classroom questioning as essential components of mathematics instruction. Adequate instructional resources, mentoring opportunities, and sustained teacher capacity-building initiatives should be provided to improve classroom practices and learner outcomes. Future researchers are encouraged to investigate additional factors that may influence mathematics achievement, including learners' motivation, mathematics self-efficacy, study habits, parental involvement, classroom climate, and teacher efficacy. Employing mixed-methods or longitudinal research designs across broader educational settings may provide a more comprehensive understanding of the factors affecting mathematics achievement and generate stronger evidence to support instructional decision-making.

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