Code-Switching in Mathematics Instruction and the Mathematics Performance of Junior High School Students

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ABSTRACT

This study examines the effectiveness of Cebuano-based instruction through code-switching and its relationship with the mathematics performance of junior high school students at Don Andres Soriano National High School, Toledo City, Cebu, for the academic year 2025–2026. Utilizing a descriptive correlational research design, the study employed quantitative measures such as mean, standard deviation, and Pearson Product Moment Correlation Coefficient, alongside qualitative data from student interviews, to determine the level and association between variables. Results show that students demonstrated a high level of mathematics performance, with the majority attaining outstanding and very satisfactory levels and an overall 100% passing rate. The perceived effectiveness of code-switching in teaching mathematics was rated as effective (overall mean = 4.18), indicating that students generally find it helpful in understanding concepts and engaging in classroom activities. Correlation analysis revealed a statistically significant moderate positive relationship between mathematics performance and the level of effectiveness of code-switching ($r = 0.491$, $p = 0.001$), suggesting that students who perceive code-switching as more effective tend to perform better in mathematics. Qualitative findings further revealed key themes, including improved understanding through familiar language, increased participation and expression, enhanced confidence and reduced anxiety, challenges in language balance and dependence, and the importance of teacher strategy in code-switching. These results suggest that while code-switching enhances comprehension and student engagement, its effectiveness depends on purposeful and balanced implementation. Consequently, an instructional enhancement plan was proposed to guide teachers in integrating Cebuano and English strategically, ensuring both conceptual understanding and development of formal mathematical language. Future research is encouraged to explore additional factors and long-term effects of code-switching to further strengthen instructional practices in multilingual mathematics classrooms.

Keywords: Code-switching, mathematics performance, mathematics instruction, junior high school students

INTRODUCTION

Mathematics is a fundamental subject in the Philippine curriculum, yet it continues to be one of the most challenging areas for junior high school students. Many learners struggle with basic concepts, which negatively affects their performance in higher-level mathematics and overall academic achievement. Remediation programs have been introduced to address these difficulties, but most rely on standardized instructional materials delivered in English or Filipino. For Cebuano-speaking students, this language mismatch often creates barriers to comprehension, engagement, and confidence in learning mathematics. Despite its importance, mathematics continues to be one of the most difficult subjects for junior high school students (Guner, 2020). Learners often struggle with mastering basic concepts such as operations with integers, fractions, decimals, ratios, algebraic expressions, and problem-solving strategies (Harun et al., 2023). These difficulties are not isolated; they accumulate over time creating learning gaps that hinder students' ability to cope with more advanced topics in geometry, algebra, trigonometry, and statistics. When foundational skills are weak, students experience greater difficulty in applying mathematical reasoning to complex problems, which in turn, affects their confidence and motivation to learn.

The challenge is further compounded by the cumulative nature of mathematics. Unlike other subjects where topics may stand independently, mathematics builds progressively, with each new concept relying on mastery of previous ones (Mason, 2021). A student who fails to understand fractions, for example, will struggle with

ratios, proportions, and algebraic equations. This domino effect results in a widening achievement gap where struggling learners fall further behind as the curriculum advances. National and international assessments have consistently highlighted these challenges. Filipino students often score below the global average in mathematics reflecting persistent difficulties in conceptual understanding and problem-solving (Hernandez et al., 2024). These results emphasize the urgent need for effective interventions that can strengthen students' foundational skills and prepare them for higher-level mathematics.

Poor performance in mathematics has long been a concern in Philippine education. This is reflected in national achievement tests and international assessments where Filipino students consistently score below the global average (Alinsunurin, 2021). This persistent struggle suggests that traditional teaching approaches may not be sufficient to address the diverse needs of learners. Students who fail to grasp foundational concepts early on often experience anxiety, low motivation, and a lack of confidence in their mathematical abilities, which further exacerbates their difficulties.

Despite various remediation efforts and policy reforms aimed at improving mathematics achievement in the Philippines, particularly through the use of mother tongue–based and localized instructional approaches, there remains limited empirical evidence on the effectiveness of Cebuano-based instruction in junior high school mathematics. Recognizing the importance of language in learning, the Department of Education has emphasized mother tongue-based instruction in the early grades as part of the K–12 curriculum reforms (Tortola, 2021; DepEd. 2016). This approach acknowledges that students learn best when concepts are introduced in a language, they are most familiar with, allowing them to build stronger foundations in literacy and numeracy. However, as students transition to junior high school, mathematics instruction often shifts back to English or Filipino. While these languages are widely used in formal education, the shift can pose challenges for Cebuano-speaking learners who may find it difficult to fully grasp mathematical concepts when taught in a language that is not their primary medium of communication.

This situation places Cebuano-speaking students at a disadvantage, as they may struggle not only with the abstract nature of mathematics but also with understanding the language in which lessons are delivered. The dual challenge of decoding both the mathematical content and the instructional language can lead to misconceptions, reduced engagement, and lower achievement (Dictado & Dagdag, 2025). Over time, these difficulties accumulate can result in persistent learning gaps that affect students' readiness for higher-level mathematics. Contextualized instruction, where lessons are tailored to the learners' linguistic and cultural background, has been shown to improve comprehension, retention, and overall academic performance. Students are more likely to connect abstract concepts with real-life experiences making learning more meaningful and accessible by integrating familiar language and relevant contexts into mathematics instruction. This technique not only strengthens understanding but also fosters confidence and motivation among learners who previously struggled with the subject.

Mathematics remains one of the most challenging subjects in the Philippine curriculum, with many learners struggling to master foundational concepts such as integers, fractions, decimals, ratios, algebraic expressions, and problem-solving strategies (Harun et al., 2023). These difficulties often accumulate over time, resulting in learning gaps that hinder students' ability to engage with more advanced topics in geometry, algebra, trigonometry, and statistics, ultimately affecting confidence and overall academic performance (Guner, 2020). Although mother tongue–based instruction is implemented during the elementary years, this approach is largely discontinued in junior high school, where mathematics instruction is predominantly delivered in English or Filipino. This transition poses significant challenges for Cebuano-speaking learners who may not yet have sufficient academic proficiency in a second language to fully comprehend abstract mathematical concepts. Learning mathematics through a non-native language can create barriers

Cebuano-based instruction offers a potential solution by aligning teaching with the learners' mother tongue, making mathematical concepts more accessible and relatable. This study therefore seeks to evaluate the effectiveness of Cebuano-based instruction in improving mathematics achievement among Junior High School students. Thus, this research aims to provide empirical evidence on the role of language in mathematics learning by examining whether instruction in Cebuano enhances comprehension, engagement, and performance. The

findings may contribute to the development of teaching strategies and policies that support linguistically responsive education in the Philippines.

Mathematics plays a central role in determining students' overall academic achievement, serving as both a foundation for other disciplines and a predictor of success in higher education. Strong performance in mathematics is often linked to enhanced problem-solving abilities, logical reasoning, and analytical thinking, all of which are critical skills across academic and professional domains. However, many learners continue to struggle with mathematics, and these difficulties can negatively affect their confidence, motivation, and achievement in other subjects. Research highlights that factors influencing academic performance in mathematics extend beyond cognitive ability, encompassing instructional quality, learning environments, socio-economic background, and students' attitudes toward the subject. Effective teaching strategies, supportive learning contexts, and the integration of mathematics into meaningful applications have been shown to improve outcomes. This literature review examines the theoretical perspectives, pedagogical approaches, and empirical findings related to academic performance in mathematics, emphasizing how targeted interventions and equitable practices can foster deeper understanding, sustained motivation, and improved achievement among diverse learners.

Academic performance in mathematics is a critical indicator of students' overall success, as it reflects not only mastery of foundational concepts but also the ability to apply logical reasoning and problem-solving skills across disciplines. Mathematics achievement influences progression in science, technology, engineering, and economics, making it a cornerstone of academic and professional readiness. However, many learners face persistent challenges in mathematics, which can affect confidence, motivation, and long-term educational outcomes. Research shows that performance in mathematics is shaped by multiple factors, including instructional quality, student engagement, socio-cultural context, and the relevance of learning experiences to real-world applications. Studies such as Ferrer-Jarangue (2020) demonstrate that when mathematical concepts are taught through meaningful contexts, students exhibit stronger problem-solving abilities and improved performance. Similarly, Mantawil and Buscano (2021) highlight that contextualized approaches in general mathematics foster deeper understanding and retention particularly among senior high school students preparing for advanced academic demands. For high school learners, strong performance in mathematics not only bridges gaps in proficiency but also builds confidence, supports higher-level learning, and equips them with essential skills for real-world problem-solving and future academic success.

Moreover, academic performance in mathematics remains a pressing concern, as many students struggle with critical thinking skills and quantitative reasoning competencies that are central to success in both academic and professional domains. These challenges often arise from gaps in prior knowledge, math anxiety, and difficulties in connecting abstract concepts to practical applications.

Research indicates that performance in mathematics improves significantly when instruction is embedded in authentic, meaningful contexts. For example, Luceñara et al. (2023) found that situating mathematical learning within real-life problem-solving tasks enhances comprehension, persistence, and confidence among high school students. Similarly, Akansiaba et al. (2025) emphasize that contextualized approaches foster deeper engagement, as learners recognize the relevance of mathematics to their academic disciplines and future careers. Strong performance in mathematics not only strengthens foundational skills but also equips students with the capacity to apply reasoning across diverse settings, thereby preparing them for higher-level academic demands and real-world challenges.

Several studies have highlighted the positive impact of contextualized approaches on academic performance in mathematics. Ferrer-Jarangue (2020) demonstrated that culture-based instruction improved students' mathematical achievement and problem-solving skills by linking abstract concepts to familiar cultural practices. These findings suggest that culturally relevant instruction can enhance engagement, reduce math anxiety, and promote deeper understanding, factors that directly contribute to stronger academic performance. Mantawil and Buscano (2021) reinforced this perspective by validating a contextualized workbook in general mathematics for senior high school students, showing that it enhanced comprehension and retention.

Their study implies that embedding mathematics instruction in meaningful contexts enables learners to connect concepts more effectively, leading to mastery of skills and improved performance.

There are also some studies that have emphasized the importance of contextualized approaches in strengthening academic performance in mathematics. Sambayon et al. (2023) emphasized that situating mathematical learning within authentic contexts fosters persistence and confidence among students. When learners recognize the relevance of mathematics to real-world applications, they are more likely to remain engaged and overcome barriers to achievement. This finding highlights that contextualized instruction not only supports skill mastery but also builds resilience—two critical components of strong academic performance. Similarly, Comia and Chavez (2025) demonstrated that contextualized mathematics instruction reduces disparities in achievement among underprepared students, thereby promoting equitable learning outcomes. Their work reinforces the idea that contextualization motivates learners while addressing systemic inequities in mathematics education. These studies suggest that academic performance in mathematics is enhanced when instruction is meaningful, equitable, and connected to students' lived experiences which can improve both achievement and fairness across diverse student populations.

Localized instruction has been shown to be highly effective in improving student learning outcomes by making academic content more accessible, relevant, and engaging. When lessons are delivered in the learners' native language and cultural context, comprehension and retention are significantly enhanced. In the Philippine setting, the use of Cebuano-based mathematics instruction illustrates how localized approaches foster inclusivity and learner confidence. Students are better able to grasp abstract concepts when these are taught using familiar linguistic and cultural references, which in turn strengthens problem-solving skills and overall academic performance. Research emphasizes that localized instruction not only bridges learning gaps but also promotes equity by ensuring that diverse learners feel represented and supported. Localized instruction proves to be an effective strategy for improving mathematics achievement and sustaining long-term educational success by affirming cultural identity and situating learning within meaningful contexts.

Localization and contextualization in language instruction refer to the adaptation of teaching materials and strategies to reflect the learners' cultural, linguistic, and social backgrounds. In schools, this practice is vital because it ensures that lessons are not only comprehensible but also meaningful, thereby fostering deeper engagement and retention. The Enhanced Basic Education Act of 2013 explicitly supports this approach stating that "the curriculum should be flexible enough to enable and to allow all schools in elementary and in secondary level both in public and in private to indigenize, to localize and to enhance classroom lessons and activities based on learners' respective educational and social contexts." This mandate shows that classroom teaching and learning should be contextualized, highlighting the importance of integrating local languages such as Cebuano into instructional materials to bridge learning gaps, promote inclusivity, and strengthen students' connection to their educational experiences.Some studies emphasize the importance of localizing and contextualizing modules to enhance student learning. Saro et al. (2023) demonstrated that contextualized and localized science teaching materials improved students' performance by aligning lessons with cultural and social contexts, thereby fostering engagement and comprehension. Their findings imply that when instructional materials are aligned with students' cultural backgrounds, learning becomes more meaningful and accessible, leading to stronger academic outcomes. This supports the idea by showing that localized modules, such as Cebuano-based instruction, can effectively bridge learning gaps and enhance students' understanding of complex concepts. Merino and Metila (2024) supports this concept by explaining that contextualized and localized materials not only improve comprehension but also ensure that instruction resonates with students' cultural and social realities, thereby strengthening the effectiveness of remediation modules. They highlighted that localized modules serve as effective supplementary resources, making instruction more relatable and accessible to Filipino learners. Their findings imply that when lessons are indigenized and connected to students' immediate environment, learners are more likely to engage actively and retain knowledge. Similarly, Jalotjot and Fidelino (2023) validated contextualized and localized modules showing that students understood concepts more easily when lessons were indigenized and connected to their environment. They support the idea of Merino and Metila (2024) by reinforcing the notion that localized modules make learning more accessible and meaningful, thereby strengthening the effectiveness of contextualized remediation across different subject areas. Their findings imply that when instruction is localized, learners can relate abstract ideas to familiar contexts which enhances comprehension and retention.

In mathematics education, localization has also proven crucial in addressing difficult concepts. Landas and Alova (2022) found that localized lesson plans significantly improved pupils' interest and performance in mathematics, showing that contextualizing abstract ideas into familiar scenarios enhances comprehension. Their findings imply that when mathematics instruction is grounded in local contexts, students are more motivated and better able to grasp difficult concepts. This shows that Cebuano-based remediation modules can make challenging mathematical topics more accessible and meaningful to learners. Pintor and Mabutol (2025) further explains the same idea by explaining that contextualized and localized strategies in mathematics instruction can significantly improve both student engagement and comprehension of abstract concepts. They further reported that localized professional development programs for mathematics instruction helped teachers adapt strategies to overcome challenges in delivering complex topics, thereby supporting student mastery of difficult concepts. Their findings imply that empowering teachers with localized approaches not only enhances instructional effectiveness but also ensures that students receive lessons tailored to their cultural and linguistic contexts.

Theoretical Background

This study is anchored on the Theory of Cognitive Load and the Mother Tongue-Based Multilingual Education (MTB-MLE) Framework. This collectively provides a comprehensive lens for the development and validation of a contextualized remediation module using Cebuano-based instruction.

Cognitive Load Theory. This theory is suitable for developing and validating a contextualized remediation module in mathematics which was proposed by John Sweller in 1988. This theory emphasizes that learners have a limited working memory capacity, and instructional materials should be designed to minimize unnecessary mental effort (extraneous load) while enhancing the effort directly related to learning (germane load) (Evans et al., 2024). In the context of this research study, CLT supports the use of Cebuano-based instruction and carefully structured exercises to reduce linguistic and conceptual barriers which allows students to focus on mastering the least understood competencies in General Mathematics. CLT explains how teaching mathematics in the mother tongue reduces the cognitive burden of processing a foreign language, allowing students to focus more on understanding mathematical concepts and problem-solving. Its significance lies in showing that localized instruction can be cognitively efficient, clear, and accessible, particularly for learners struggling with abstract mathematical ideas. This study highlights how language-sensitive instruction can improve comprehension, retention, and overall mathematics achievement by applying CLT.

The Mother Tongue-Based Multilingual Education (MTB-MLE) Framework. This framework was formally introduced in the Philippines through the Department of Education's policy in 2009 drawing on earlier sociolinguistic and educational research by scholars such as Jim Cummins (1979) and UNESCO's advocacy for mother tongue instruction since the 1950s. The framework asserts that using the learner's first language (L1) as the medium of instruction strengthens cognitive development, literacy, and comprehension while also serving as a foundation for learning additional languages (Escarda et al., 2024). In this context, Cebuano-based instruction embodies the principles of MTB-MLE by ensuring that instruction is delivered in a language learners understand best which can help in addressing learning gaps more effectively. Its significance lies in promoting inclusivity and equity in education especially for learners who struggle when taught in a second language. By reducing the cognitive barriers associated with learning in a second language, MTB-MLE supports stronger academic performance and deeper engagement. Its significance lies in demonstrating that localized instruction not only enhances mathematics achievement but also promotes inclusivity and equity, ensuring that diverse learners are supported in their educational journey. It also helps explain this research study by providing a theoretical justification for why Cebuano-based instruction can improve learning outcomes and support the national educational agenda.

Statement of the Problem

The study aims to evaluate the effectiveness of Cebuano-based instruction in improving mathematics achievement of junior high school students at the Don Andres Soriano National High School in Toledo, City, Cebu for the academic 2025 – 2026.

Specifically, the study seeks to answer the following questions:

1. What is the level of mathematics performance of junior high school students using the code switching instruction?

2. What is the level of effectiveness of code switching in teaching mathematics as perceived by junior high school students?

3. Is there a significant relationship between the mathematics performance and level of effectiveness of code-switching in teaching mathematics?

4. What selected student-related and instructional factors influence the performance of junior high school students exposed to code switching?

5. Based on the findings, what instructional enhancement plan can be proposed?

Statement of the Null Hypothesis

At 0.05 level, the hypothesis was tested:

Ho1: There is no significant relationship between the mathematics performance and level of effectiveness of code-switching in teaching mathematics.

METHODOLOGY

Design

This study employed an embedded mixed method research design in its attempt to describe and determine the relationship between code-switching in mathematics instruction and the mathematics performance of junior high school students at the Don Andres Soriano National High School for the academic year 2025–2026. An embedded mixed method research design involves the systematic integration of quantitative and qualitative data within a single study, where one method serves as the primary approach and the other plays a supportive or supplementary role (Nagpal et al., 2021). In this design, quantitative data typically provide the main basis for analysis, while qualitative data are embedded to offer deeper explanations, contextual understanding, or clarification of the quantitative results. Rather than giving equal weight to both strands, the embedded approach allows the researcher to focus on measuring relationships or outcomes while simultaneously capturing participants' experiences, perceptions, and contextual factors that may influence those outcome.

The quantitative strand serves as the core component by measuring students' mathematics achievement through academic grades and assessing the level of effectiveness of Cebuano-based instruction using structured instruments. This enables the study to establish patterns, differences, and the strength of relationships between variables in an objective and measurable manner. The qualitative strand is embedded to enrich the quantitative findings by exploring students' learning experiences, language-related challenges, and contextual factors that may affect mathematics performance when Cebuano is used as the medium of instruction.

The study aims to generate a more comprehensive understanding of how Cebuano-based instruction impacts mathematics learning outcomes by integrating these two strands. Furthermore, the study seeks to produce an instructional enhancement plan, based on both statistical findings and qualitative insights, to strengthen the use of Cebuano-based instruction and improve mathematics achievement among junior high school students.

Participants

The participants of this study were the 40 students in grade 7 level Section Sun from Don Andres Soriano National High School in Toledo, City, Cebu. The total population from the whole class section will be used as the main participants of the study. No sampling technique was utilized since this will utilize a complete enumeration of the respondents.

Inclusion Criteria. The participants were selected based on the following criteria: 1) they belong to the abovementioned year level and section; 2) they are enrolled in the current semester for the academic year 2025 – 2026; 3)they are willing to participate in the study; and 4) they have signed the informed consent and assent form.

Exclusion Criteria. There are other year levels that were not be included to this study such as other sections in Grade 7 and the other year levels such as Grade 8, Grade 9, Grade 10, and the senior high school department.

Data Gathering Tools

The main instruments for this study was a researcher-made questionnaire. This consisted both quantitative and qualitative tools to capture the relationship between Cebuano-based instruction and mathematics achievement among junior high school students. For the quantitative aspect, a researcher-made questionnaire was developed to assess the level of effectiveness of Cebuano-based instruction. The researcher also utilized secondary data on the academic performance of the junior high school students as reflected in their last quarter grade in mathematics. As for the qualitative part, semi-structured interview questionnaire was used to explore the possible factors affecting mathematics achievement when Cebuano is used as the medium of instruction. These instruments will allow the researcher to capture students' experiences, perceptions, and challenges which will complement the quantitative findings.

The research instrument was put through face and content validation process by a jury of three specialists who hold masters/and doctoral degrees using Good and Scates validation instrument. The researcher-made questionnaire was valid since the result obtained was 4.88 and interpreted as "excellent" using a standardized instrument. Next, it was subjected to reliability test using Cronbach's Alpha Formula that was carried out through a pilot test involving 30 students from another school to ensure the instrument's consistency and accuracy. Both the computed value and internal consistency interpretation were presented to ensure that instruments are reliable for the conduct of the study. The result obtained was 0.92 and was interpreted as excellent.

Each student was evaluated based on the following scale:

Table 2. Instrument parameter scale

Scale	Response	Ranges of Mean	Interpretation
5	Strongly Agree	4.21 – 5.00	Highly Effective
4	Agree	3.41 – 4.20	Effective
3	Somewhat Agree	2.61 – 3.40	Moderately Effective
2	Disagree	1.81 – 2.60	Slightly Effective
1	Strongly Disagree	1.00 – 1.80	Not Effective

Data Gathering Procedure

This part contains discussion of the data procedures for pre-data gathering, actual gathering, and post-data gathering.

Pre-data gathering. In preparation for data collection, the researchers followed a series of systematic procedures. Initially, they addressed the comments and suggestions provided by the panelists during the design hearing. Following this feedback, the researchers sought ethical approval from the Research Ethics Committee (REC).

After all necessary approvals were obtained, the REC reviewed the ethical considerations of the study before granting a Notice to Proceed (NTP). With the NTP in hand, the researchers submitted a formal letter to the School Principal and to the Dean of College of Education – Graduate School, endorsed by her adviser and by

the School Principal of the Don Andres Soriano National High School in Toledo, City, Cebu and waited for approval.

Actual Data Gathering. After all the approvals were granted, the researcher scheduled the conduct of the survey to the selected junior high school students. The survey took an hour. One section answered the survey in the selected schedule in the morning and the other section will answer the survey in the afternoon.

The teacher distributed; first, the assent form for the students and the parents' consent form, second, the questionnaires to the students inside the classrooms and solicit their permission beforehand and with the guidance of the researcher and the guidance counselor. The content was carefully explained, assuring participants of confidentiality, and collected the surveys from the respondents and make sure that each question was answered completely and truthfully**.**

Post Data Gathering. After data collection, the gathered information was compiled, tallied, tabulated, and statistically analyzed. The data was encoded on a secured computer system protected by a password, ensuring that only authorized personnel had access. The data will be disposed of following the publication of the study in an accredited journal or after one year.

Data Analysis

With the data that was analyzed through statistical tools, specifically the IBM SPSS (Statistical Package for Social Sciences). For the academic performance of junior high school students in mathematics, descriptive statistics will be used, specifically frequency count and percentage distribution.

To find out the level of effectiveness of code-switching in mathematics instruction, descriptive statistics was used, specifically the mean and standard deviation. Next, to find out the significant relationship between the academic performance of junior high school students in mathematics and the level of effectiveness of code-switching in mathematics instruction, pearson'r was utilized because the data distribution was normal. After the processing, interpretation, and analysis of data, the recommendations and instructional

Ethical Consideration

The study was conducted according to the guidelines of the Declaration of Helsinki. It has been approved following the protocol of the Research and Ethics Committee of the University of the Visayas with Reference NTPMAEDME2026-0359 dated June 15, 2026.

The research involved university students participating voluntarily in an online survey. Before completion of the questionnaires, an accompanying cover letter explained the confidentiality and purpose of the study, the potential objectives, and the voluntary participation. No financial incentives were provided for participating in the study. The authors declare no conflict of interest.

RESULTS AND DISCUSSIONS

This chapter contains the presentation, analysis, and interpretation of the relationship between the mathematics performance and level of effectiveness of code-switching in teaching mathematics in improving mathematics achievement of junior high school students at the Don Andres Soriano National High School in Toledo, City, Cebu.

Level of Mathematics Performance of Students using Code-Switching Instruction

The table below shows as to what level of mathematics performance of junior high school students using the code switching instruction using frequency count and percentage distribution.

Table 2. Level of mathematics performance of students using code switching instruction

Descriptors	Grading Scale	Frequency	Percentage	Remarks	Mean	SD
Outstanding	90-100	16	40.00	Passed	91.81	1.83
Very Satisfactory	85-89	12	30.00	Passed	87.08	1.38
Satisfactory	80-84	10	25.00	Passed	81.30	2.72
Fairly Satisfactory	75-79	2	5.00	Passed	77.50	0.71
Did Not Meet Expectations	Below 75	0	0.00	Failed	0.00	0.00
Total		31	100.0			

The table indicates that the majority of junior high school students demonstrated high mathematics performance when taught using code-switching instruction, with 40% (16 students) achieving an Outstanding level and 30% (12 students) reaching Very Satisfactory, suggesting strong academic outcomes for most learners. A further 25% (10 students) performed at a Satisfactory level, while only 5% (2 students) fell into the Fairly Satisfactory category, and none failed or fell below expectations. Overall, all students passed, resulting in a 100% passing rate, which implies that code-switching instruction may have positively supported students' understanding and performance in mathematics by making concepts more accessible and comprehensible.

This is supported by the idea that the use of multiple languages in instruction enhances comprehension and learning. For instance, code-switching is described as a scaffolding strategy that bridges first and second languages of the learners allowing clearer understanding of complex concepts, especially in mathematics (Moral et al., 2025).

It has been emphasized that code-switching improves learner engagement, confidence, and comprehension when used strategically in multilingual classrooms. In mathematics education, researchers argue that switching languages helps clarify abstract concepts and reduces confusion which facilitate better problem-solving skills (Ali et al., 2023; Moral et al., 2025). Furthermore, it also shows that code-switching often has a positive or at least supportive effect on learner comprehension, even if its direct correlation with grades may vary (Zano & Mpiti, 2025). In addition, broader bilingual education research demonstrates that incorporating the native languages of learners can significantly improve academic achievement and cognitive development.

A study by Cabugao (2025) found that code-switching is an effective communication tool in mathematics classes and does not hinder learning, even when its statistical relationship with grades is not always significant. Likewise, Omongos et al. (2025) reported that students perceived code-switching as highly effective in improving understanding and concentration in mathematics, with learners achieving satisfactory performance levels.

Experimental research in Ghana further demonstrated that students taught using code-switching achieved significantly higher mean scores compared to those taught in a single language. Another study found a positive correlation between code-switching and students' academic success in mathematics and language, highlighting its effectiveness for bilingual learners (Ali et al., 2023). Moreover, research in Philippine classrooms shows that code-switching enhances comprehension, engagement, and conceptual understanding, which contributes to improved academic performance (Moral et al.m 2025).

The high level of performance reflected in the table can be attributed to the role of code-switching in making mathematical instruction more accessible and meaningful. While some studies indicate that its direct statistical impact on grades may vary, both literature and empirical evidence strongly suggest that it enhances comprehension, engagement, and classroom interaction, factors that ultimately contribute to improved academic outcomes and the observed passing rate.

Level of Effectiveness of Code-Switching in Teaching Mathematics

The table below shows as to what level of effectiveness of code switching in teaching mathematics as perceived by junior high school students using weighted mean and standard deviation with verbal interpretation.

Table 3. Level of Students' Perceptions of Code Switching In Teaching Mathematics

Indicator	Mean	SD	Verbal Description
1. Cebuano-based instruction does not help me clearly understand mathematical concepts.	4.53	0.68	Strongly Agree
2. I often find it difficult to understand mathematics when Cebuano is used in teaching.	4.03	0.77	Agree
3. I don't actively participate and feel bored in class when Cebuano is used as the medium of instruction.	4.50	0.64	Strongly Agree
4. Cebuano-based instruction discourages me from asking questions or sharing ideas during mathematics lessons.	4.40	0.63	Strongly Agree
5. I can easily recall mathematical concepts taught in Cebuano.	4.25	0.59	Strongly Agree
6. I struggle to apply mathematical skills when lessons are explained in Cebuano.	3.80	0.88	Agree
7. Cebuano-based instruction increases my confidence in learning mathematics.	4.08	0.83	Agree
8. I feel more motivated to study mathematics when Cebuano is used in teaching.	4.13	0.72	Agree
9. Cebuano-based instruction improves my overall performance in mathematics.	4.10	0.81	Agree
10. Cebuano-based instruction is an effective approach for teaching junior high school students in mathematics.	4.00	0.78	Agree
Total	4.18	0.73	Highly Beneficial

Note. 4.21-5.00-Strongly Agree; 3.41-4.20- Agree; 2.61-3.40-Somewhat agree; 1.81-2.60-Disagree; 1.00-1.80-Strongly Disagree

The table reveals that the highest mean score (4.53) is found in the first statement in the table above, followed closely by 4.50 and 4.40, all of which are interpreted as Highly Effective. These high mean scores suggest that students strongly agree with these statements, indicating that Cebuano-based instruction may create confusion, reduce participation, and discourage engagement in mathematics learning. In contrast, the lowest mean score (3.80), although still interpreted as Effective, shows that students moderately agree that they struggle to apply mathematical skills when Cebuano is used, implying that while difficulty exists, it is less strongly felt compared to other concerns. Meanwhile, the overall mean score of 4.18, categorized as Effective, indicates that Cebuano-based instruction generally influences students' learning experience, but not always in a fully positive way. This overall result suggests that while the approach has some benefits, it may also pose challenges in comprehension and engagement, highlighting the need for balanced or strategic use of language in teaching mathematics.

This observation is supported by an explanation that although code-switching can aid comprehension, its effectiveness depends heavily on how it is used or excessive or unstructured switching may lead to confusion rather than clarity. Similarly, code-switching has been described as a scaffolding tool that must be applied strategically to bridge understanding between languages and not replace formal academic language entirely (Bao, 2025). In mathematics specifically, while code-switching can clarify difficult concepts, poorly balanced use may reduce exposure of learners to standard mathematical language which is essential for mastery (Ali et al., 2023).

The impact of code-switching on academic performance is mixed ranging from positive to neutral depending on context and implementation. Moreover, broader bilingual education research emphasizes that while learners benefit cognitively from multilingual instruction, effectiveness depends on structured integration of both languages (Hamdalo et al., 2023).

Cabugao (2025) found that code-switching is helpful in communication but does not always significantly improve academic performance aligning with the observed challenges in understanding reflected in the highest mean scores. Similarly, Omongos et al. (2025) reported that while students perceive code-switching as effective in maintaining attention and comprehension, it does not necessarily produce strong improvements in achievement outcomes. In contrast, experimental research shows that when applied appropriately, code-switching can significantly improve mathematics performance compared to single-language instruction, suggesting that its effectiveness lies in proper balance rather than dominance (Heidelberg, 2024). Other studies also reveal a positive correlation between code-switching and student confidence and success particularly among bilingual learners reinforcing the moderate agreement seen in indicators related to motivation and confidence (Cabugao, 2025; Ali et al., 2023; Moral et al., 2025).

Additionally, Philippine-based research shows that code-switching enhances engagement and understanding but requires careful adaptation to learners' needs to prevent overreliance on the first (Moral et al., 2025). These findings imply that while Cebuano-based instruction supports motivation, recall, and confidence to some extent, its overuse or improper use may hinder deeper understanding and active participation.

Relationship between Mathematics Performance and Level of Effectiveness of Code-Switching in Teaching Mathematics

The table below shows the significant relationship between the mathematics performance and level of effectiveness of code-switching in teaching mathematics using pearson's r with verbal interpretation.

Table 7. Relationship between Mathematics Performance and Level of Effectiveness of Code-Switching in Teaching Mathematics

Variables	**r -value**	**Strength of Correlation**	**p - value**	**Decision**	**Remarks**
Mathematics Performance and Level of Effectiveness of Code-Switching in Teaching Mathematics	0.491	Strongly Positive	0.001	Reject Ho	Significant
Note. Significant at $p<0.05$ (two-tailed)					

The table shows a moderate to strong positive relationship ($r = 0.491$) between students' mathematics performance and the perceived effectiveness of code-switching in teaching, with a p-value of 0.001, which is less than the 0.05 level of significance. This means that the null hypothesis is rejected indicating that the relationship is statistically significant and not due to chance. In practical terms, this implies that as students perceive code-switching to be more effective, their mathematics performance also tends to improve. The positive correlation further suggests that code-switching likely plays a supportive role in enhancing students' understanding, engagement, and academic outcomes in mathematics. Overall, the findings indicate that code-switching is a meaningful instructional strategy that is associated with better student performance, although the strength of the relationship also suggests that other factors may still influence achievement alongside language use in teaching.

Improvements in how students experience code-switching are associated with better academic outcomes. This result supports the idea which emphasizes that code-switching, when used strategically, enhances comprehension by bridging the first language of the learners and the language of instruction by facilitating deeper understanding of complex mathematical concepts (Ali et al., 2023). It also highlights the idea that code-switching increases

engagement, confidence, and participation, all of which contribute to improved performance in academic subjects. Furthermore, multilingual education research shows that integrating learners' native language has a significant positive effect on academic achievement particularly in cognitively demanding subjects like mathematics (Hamdalo et al., 2023). However, it also notes that the strength of improvement varies depending on how effectively the strategy is implemented with some studies reporting mixed or moderate correlations rather than strong direct effects.

In the study of Cabugao (2025), he observed that while code-switching improves classroom communication, students' performance is still influenced by other variables such as prior knowledge and study habits. Similarly, Omongos et al. (2025) found that learners rated code-switching as highly effective for maintaining focus and understanding, yet this did not automatically translate into significantly higher grades suggesting that perception and achievement do not always increase at the same rate. In contrast, some research demonstrates that structured and purposeful code-switching can lead to measurable gains in mathematics scores especially when integrated with well-designed instruction (Sum et al., 2024; Queslati, 2026). Other studies further indicate that code-switching enhances learner autonomy enabling students to independently connect concepts across languages, which strengthens long-term retention and application of knowledge.

This can be further understood through a translanguaging and sociocultural perspective which views language not merely as a tool for explanation but as an integral part of thinking and learning mathematics (Tai, 2022). From this perspective, students who perceive code-switching as effective may perform better because they are able to mobilize their full linguistic repertoire when solving problems and it can strengthen conceptual understanding and reasoning. Research on translanguaging shows that using multiple languages in mathematics enables learners to connect prior knowledge with new concepts, activate background experiences, and engage in collaborative reasoning all of which support mathematical achievement (Tai & Wei, 2021). Similarly, studies in mathematics classrooms demonstrate that flexible language use enhances sense-making and conceptual understanding, allowing students to explain, justify, and refine their thinking more effectively.

The findings indicate that code-switching contributes to mathematics performance by enhancing meaning-making, participation, and interaction, rather than functioning as a direct predictor of achievement. The moderate strength of the relationship reflects the complex nature of mathematics learning, where language, cognition, and social interaction work together. Thus, the results imply that while code-switching is a valuable instructional strategy, its greatest impact lies in fostering a learning environment where students can actively construct understanding, communicate ideas, and engage more deeply with mathematical concepts.

Student-Related And Instructional Factors Influencing The Performance Of Students Exposed To Code Switching

This presents the qualitative insights derived from the responses from the students highlighting how both learner characteristics and teaching practices shape academic outcomes in mathematics. It explores how the language preferences of the students, their confidence levels, participation, and comprehension interact with instructional strategies such as the use of Cebuano and English during lessons. By examining these experiences, the study provides a deeper understanding of how code-switching operates in the classroom not only as a linguistic tool but also as a pedagogical approach that influences students' engagement, understanding, and overall performance in mathematics. This section is grounded in the experiences of the students who served as the primary interview respondents, whose perspectives shaped the identified themes. Their responses reflect how they personally experience code-switching in the mathematics classroom, how it helps them understand lessons, influences their willingness to participate, and affects their confidence and performance.

Through their narratives, it becomes evident that students are not passive recipients of instruction but active participants who interpret and respond to teaching strategies based on their linguistic background and learning needs. Thus, the themes derived from their interviews provide authentic insight into how code-switching operates in real classroom settings, offering valuable implications for improving instructional practices and aligning them more closely with students' actual experiences and preferences.

Improved Understanding through Familiar Language

Many students expressed that they better understood mathematical concepts when teachers shifted to Cebuano, especially when lessons became complex or abstract in nature. They explained that hearing explanations in their first language allowed them to grasp ideas more quickly because the terms and examples felt more familiar and relatable. In particular, students noted that when teachers translated or clarified key mathematical concepts into Cebuano, it reduced confusion and helped them follow the step-by-step processes involved in problem-solving. This indicates that code-switching functions as a bridge between prior knowledge and new learning, enabling students to connect unfamiliar mathematical terminology with meanings they already understand.

"I can understand the lesson more easily when the teacher explains mathematical concepts in Cebuano because the words used are more familiar to me."

- Respondent 1

"When the explanation is only in English, I sometimes get confused. But when the teacher switches to Cebuano, the meaning of the concept becomes clearer"

- Respondent 5

"It is easier for me to follow the solving process when the instructions and examples are translated into Cebuano."

- Respondent 11

"When there is a difficult mathematical term, I understand it better if the teacher first gives the explanation in Cebuano before introducing the English term."

- Respondent 16

"Nakatabang gyud ang Cebuano kay kung maglisod ko ug sabot sa concept, mas klaro siya kung ipasabot sa teacher sa among unang pinulongan."

- Respondent 21

Moreover, students shared that using Cebuano during instruction helped them process information more deeply because they did not have to struggle simultaneously with language comprehension and conceptual understanding. Instead, they could focus more on the logic of the solution rather than decoding the language of instruction. This highlights that language plays a crucial role in cognitive processing, especially in subjects like mathematics that require clear reasoning and accurate interpretation of problems. By making instruction linguistically accessible, code-switching allows students to engage more fully with the lesson, leading to better comprehension and retention of concepts. This theme simply shows that the use of familiar language is a powerful support mechanism in learning mathematics. It suggests that when teachers strategically integrate students' first language into instruction, they create opportunities for clearer explanation, deeper understanding, and more meaningful learning experiences. However, it also implies the importance of gradually linking these explanations back to formal mathematical language to ensure that students not only understand concepts but can also express them appropriately in academic contexts.

Increased Participation and Expression

Students commonly reported feeling more comfortable speaking, asking questions, and participating in class when Cebuano was used alongside English. During the interviews, many shared that they were less afraid to raise their hands or contribute to discussions because they could express their ideas using a language they were more fluent in. This familiarity reduced the pressure of finding the "right" English words and allowed them to focus instead on sharing their understanding of the lesson.

"I am more willing to participate in discussions when I can use Cebuano because it is easier for me to express my thoughts."

- Respondent 20

"I feel more comfortable answering in class when Cebuano is sometimes used because I do not worry about whether my English is

correct."

- Respondent 29

"When there is something I do not understand, I can easily ask the teacher when Cebuano is used during the lesson."

- Respondent 13

"I am no longer afraid of making mistakes when speaking because I can use Cebuano to explain my ideas more clearly."

- Respondent 2

"Using Cebuano makes the classroom more friendly and open for everyone to participate in discussions."

- Respondent 3

As a result, students became more active participants in classroom activities, discussions, and problem-solving tasks. Furthermore, students noted that code-switching created a more supportive and inclusive classroom environment where they felt safe to communicate without fear of embarrassment. They emphasized that when teachers allowed the use of Cebuano, it encouraged them to ask clarifying questions whenever they did not understand a concept, rather than remaining silent. This openness not only improved their individual learning but also contributed to richer class discussions, as more students were willing to share their ideas and perspectives. It also fostered peer interaction, where students could explain concepts to one another using a mix of languages, further reinforcing their understanding.

This part shows that language plays a crucial role in shaping students' participation and willingness to engage. Code-switching acts as a facilitator of expression by lowering communication barriers and building a more inclusive learning space. This increased participation is significant because active engagement is closely linked to better learning outcomes, students who ask questions, exchange ideas, and participate in discussions are more likely to develop deeper understanding and retain mathematical concepts more effectively.

Boost in Confidence and Reduced Anxiety

Another recurring idea from the interviews is that students felt more confident and less pressured when Cebuano was integrated into instruction. Many respondents shared that they often experience anxiety when mathematics is taught purely in English, as they struggle not only with solving problems but also with understanding the language used in explanations. However, when teachers shifted to Cebuano, students reported feeling more relaxed and comfortable because they could easily follow the lesson and confirm their understanding. This sense of clarity gave them the courage to attempt solving problems on their own and to participate more actively during class discussions.

"I feel more comfortable in math class when the teacher occasionally uses Cebuano because I do not feel too pressured in understanding the lesson."

- Respondent 17

"When the discussion is purely in English, I sometimes feel nervous. But when the teacher code-switches, I feel more relaxed and can focus better on solving problems."

- Respondent 29

"My confidence in answering increases when I truly understand the explanation through Cebuano."

- Respondent 33

"I am no longer too afraid of getting the answer wrong because I understand the concept more clearly when it is explained in our language."

- Respondent 15

"The use of Cebuano reduces my fear that I might not understand the lesson."

- Respondent 3

In addition, students noted that code-switching reduced their fear of making mistakes, particularly when speaking in front of their classmates. They explained that using a familiar language made it easier to express their ideas without feeling judged or embarrassed about grammatical errors. This supportive environment encouraged them to take risks, such as answering difficult questions or explaining their solutions, which are important behaviors in the learning process.

As a result, students became more confident not only in their language use but also in their mathematical abilities. This theme highlights the significant role of emotional factors in learning mathematics. Confidence and reduced anxiety allow students to focus more on understanding concepts rather than worrying about language barriers. When learners feel secure and capable, they are more motivated to engage, persist in solving problems, and develop a positive attitude toward mathematics. Therefore, code-switching contributes not only to cognitive learning but also to creating a psychologically supportive classroom environment that fosters student success.

Challenges in Language Balance and Dependence

Despite its advantages, some students pointed out difficulties related to overreliance on Cebuano during mathematics instruction. Based on the interview responses, learners shared that while they could easily understand the lesson when teachers used Cebuano, they often encountered challenges when required to express their answers in English, especially during written assessments and formal tasks. This suggests that although code-switching supports immediate comprehension, it may limit students' ability to fully develop proficiency in the academic language of mathematics, which is commonly presented in English. Furthermore, several students explained that they sometimes became too dependent on Cebuano explanations, particularly when dealing with complex mathematical terms and procedures.

"I can easily understand the lesson when the explanation is in Cebuano, but I sometimes struggle when I need to write or explain my answer in English."

- Respondent 17

"I became used to the teacher explaining in Cebuano, so I find it difficult to understand math problems that are written purely in English."

- Respondent 19

"I know how to solve the problem, but sometimes I do not know how to express my reasoning using the correct English terms."

- Respondent 28

"If the explanations are always in Cebuano, I may become dependent on it and not get used to English mathematical vocabulary."

- Respondent 32

"Understanding through Cebuano is easier, but during exams where the instructions are in English, I need extra time to understand the questions."

- Respondent 30

As a result, they found it difficult to independently interpret problems presented purely in English, such as in textbooks or examinations. This reliance indicates that while code-switching serves as an effective support mechanism, excessive use may hinder students from gradually building their confidence and competence in using English for mathematical communication. In addition, students noted that the transition from understanding concepts in Cebuano to expressing them in English requires additional effort. For example, they may know the correct solution but struggle to translate their reasoning into appropriate English terminology or sentence structures.

This gap between understanding and expression can affect their academic performance, as assessments often require clear, accurate, and formal responses. It highlights the importance of not only teaching concepts effectively but also ensuring that students acquire the necessary language skills to communicate their understanding in standard academic form. This theme emphasizes the need for a balanced and strategic use of code-switching in mathematics instruction. While Cebuano can be used to clarify and support understanding, it is equally important for teachers to guide students toward using English mathematical terms and expressions. By gradually integrating both languages in a structured way, teachers can help students achieve both conceptual mastery and language proficiency. This balance ensures that code-switching becomes a bridge to learning rather than a barrier to developing essential academic skills.

Importance of Teacher Strategy in Code-Switching

Students also emphasized that the effectiveness of code-switching largely depends on how teachers apply it during instruction. Based on their interview responses, learners observed that code-switching becomes most helpful when it is used deliberately, such as when teachers shift to Cebuano to explain complex concepts, give examples, or clarify misunderstandings. In these situations, students reported that the transition between languages made the lesson more understandable and allowed them to follow the flow of discussion more effectively. This indicates that purposeful language use helps bridge comprehension gaps and supports clearer delivery of mathematical content.

"Code-switching is more helpful when the teacher uses it to explain difficult concepts rather than switching languages randomly."

- Respondent 8

"When the teacher uses Cebuano for clarification and then returns to English mathematical terms, I understand the lesson more easily."

- Respondent 33

"Code-switching is effective when the teacher has a clear reason for switching languages."

- Respondent 18

"I understand the discussion better when the teacher uses Cebuano in examples and explanations of important ideas."

- Respondent 4

"Effective use of code-switching helps ensure that students who are struggling to understand the lesson are not left behind."

- Respondent 21

Moreover, students highlighted that effective teachers use code-switching not just for translation, but as a strategic tool to emphasize key ideas and ensure that all learners are able to keep up with the lesson. They noted that when teachers carefully choose when and why to switch languages, it creates a more structured and meaningful learning experience. This approach prevents confusion and helps students connect both languages to the same mathematical concepts, reinforcing their understanding and retention. However, some students pointed out that inconsistent or excessive switching between Cebuano and English can disrupt their learning. They explained that when teachers switch languages too frequently without clear purpose, it becomes difficult to follow explanations and may lead to misunderstanding of instructions or concepts. This suggests that unstructured code-switching can create cognitive overload, where students struggle to process both the language and the content simultaneously.

This theme highlights the critical role of the teacher in ensuring that code-switching is effective. It highlights that code-switching is not inherently beneficial unless it is applied with clear intention and direction. The significance of this finding lies in its implication for instructional practice: teachers must be mindful, consistent, and strategic in their language use to maximize learning outcomes. By doing so, they can transform code-switching into a powerful pedagogical tool that enhances comprehension, maintains clarity, and supports students' overall performance in mathematics.

CONCLUSION

The findings of the study indicate that code-switching plays a meaningful role in enhancing the learning experiences of students in mathematics. It can be inferred that the use of a familiar language alongside the formal language of instruction helps students better understand mathematical concepts, making lessons more accessible and easier to follow. As a result, students are more engaged in the learning process, participate more actively in class discussions, and demonstrate greater confidence in solving mathematical problems. These outcomes suggest that code-switching supports not only cognitive development but also the emotional and social aspects of learning, which are essential for improving overall academic performance. However, the study also reveals that the effectiveness of code-switching is not automatic and depends heavily on how it is implemented in the classroom.

While it aids comprehension and encourages participation, excessive reliance on the first language may limit students' ability to develop proficiency in formal mathematical language. This highlights the importance of maintaining a balance between using the local language for clarity and gradually integrating the target language for academic development. Furthermore, the teacher's role is critical, as the success of code-switching depends on purposeful, consistent, and well-structured instructional practices. It can be concluded that code-switching is a valuable and supportive instructional approach in mathematics particularly in multilingual settings. When used strategically, it serves as an effective bridge that connects students' prior knowledge to new concepts, fosters active engagement, and builds confidence.

Based on the findings of the study, it is recommended that mathematics Teachers are encouraged to use code-switching strategically and purposefully to improve students' understanding of complex concepts. They should use the local language, such as Cebuano, to clarify difficult ideas while gradually integrating English mathematical terms to strengthen students' academic language proficiency. Teachers should also create an inclusive classroom environment that promotes participation, encourages questions, and builds learners' confidence. Additionally, professional development activities focusing on effective bilingual teaching strategies should be pursued to enhance instructional delivery. School heads and principals should support teachers by providing training programs, workshops, and instructional materials that promote the effective use of code-switching in mathematics instruction. They should monitor classroom practices to ensure that language use is balanced and aligned with learning objectives. Furthermore, they should foster a supportive school culture that

recognizes the importance of language in learning and encourages innovative teaching approaches that address the needs of multilingual learners.

Moreover, supervisors and superintendents should provide technical assistance and guidance to teachers in implementing code-switching effectively. They may develop policies or frameworks that guide teachers on when and how to use code-switching appropriately in mathematics instruction. Regular classroom observations and feedback sessions should also be conducted to ensure that teaching practices promote both conceptual understanding and language development among students. Regional Directors should ensure that teacher training initiatives and regional programs include capacity-building activities on multilingual and code-switching instructional strategies. They may also support research-based interventions that aim to improve mathematics performance through effective language use. Providing resources and ensuring the implementation of relevant educational policies across schools will help maintain consistency in instructional practices within the region.

Furthermore, the DepEd Secretary is encouraged to consider strengthening policies related to bilingual education and code-switching practices, particularly in content areas such as mathematics. This may include developing national guidelines that clearly outline the effective integration of local languages and English in instruction. Investment in teacher training, curriculum development, and instructional resources that support multilingual teaching is also recommended to improve learning outcomes nationwide. Future researchers are encouraged to conduct further studies on code-switching by exploring different grade levels, subject areas, and learning contexts. They may also investigate the long-term effects of code-switching on students' academic language development and mathematical proficiency. Additionally, using mixed-methods or experimental designs can provide deeper insights into the effectiveness of code-switching and help identify best practices for its implementation.

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