Effectiveness of Bilingualism in Mathematics Achievement of the Grade Seven Students

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Abstract: This study investigated the impact of bilingual instruction in Filipino and English on students' Mathematics achievement and engagement, employing a quasi-experimental design with two comparable sections of 40 students each—one taught exclusively in English and the other using a bilingual approach. The methodology utilized purposive sampling to ensure initial group equivalence and incorporated pre- and post-assessments to measure academic gains, alongside structured observation checklists to quantify classroom engagement. The collected data were rigorously analyzed using statistical tools, including mean calculations, a T-test, and the Mann-Whitney U test. The results demonstrated a statistically significant advantage for the bilingual group, which outperformed their English-only counterparts in both academic performance and observed levels of engagement ($t = 2.11$, $p > 0.038$). This compelling evidence suggests that bilingual instruction serves as a more effective pedagogical strategy, potentially by leveraging the students' native language to foster a more accessible and inclusive learning environment. The use of Filipino likely enhanced conceptual clarity, reduced cognitive load, and increased student participation, thereby directly facilitating a deeper understanding of mathematical concepts and leading to superior overall learning outcomes. Consequently, the study strongly advocates for the strategic integration of bilingualism as a viable and potent tool to enhance both achievement and engagement in Mathematics education.

Keyword: Bilingualism, English-only, Instructions, Mathematics Achievement, and Student Engagement.

Introduction

The current issue in mathematics education is the significantly low performance of Filipino students compared to international standards. This is evidenced by the Philippines' ranking in the PISA 2022 assessment according to DepEd - National Report of the Philippines (2022).. Contributing factors may include difficulties in translating English language into mathematical expressions, and potentially ineffective teaching strategies. Further research would be needed to fully determine the root causes and develop effective interventions. The issue of low student performance in mathematics specifically, points out that even though the mean percent score (MPS) on the National Achievement Test (NAT) has improved, it still hasn't reached the target percentage, indicating an ongoing problem with mathematics proficiency in both elementary and secondary levels.

One major contributor to this ongoing challenge is the cognitive difficulty students face in translating mathematical problems articulated in English into symbolic expressions. This issue is especially pronounced in bilingual contexts, where learners must navigate two languages while grappling with abstract concepts. These language-related barriers can hinder comprehension, particularly when foundational literacy in both the first and second languages is still developing. Studies have emphasized that student performance and motivation are shaped by a network of

interrelated factors, including instructional quality, peer support, and access to adequate learning resources (Cordova, Maria, & Santos, 2022; Bernardo, 2005). When these elements are misaligned, meaningful learning in mathematics is compromised.

The integration of educational technology, meanwhile, presents opportunities for innovation in mathematics instruction. Mobile applications designed for solving math problems, interactive simulations, and adaptive learning platforms are increasingly accessible. However, as noted in both global and local studies, the effectiveness of these tools depends heavily on their usability, the relevance of content, and students' engagement levels (Llenada Santos, 2022; Kalloo, Mohan, & Kinch, 2016). This reveals a gap in implementation: while the tools exist, their integration into classrooms—particularly in low-resource settings—remains uneven and often unoptimized.

Instructional relevance further complicates the picture. When students perceive a disconnect between what they are learning and their personal interests or future goals, engagement tends to decline. Theories of motivation and identity development support this link (Eccles & Wigfield, 2002), and empirical studies have noted that alignment between learners' skills, interests, and educational experiences may result in improved outcomes—even when statistical significance is not always achieved (Perez & Santos, 2022). In mathematics education, this suggests a need for instruction that is not only pedagogically sound but also culturally and linguistically responsive.

Given these persistent challenges and promising avenues, it becomes imperative to explore alternative strategies that address both the cognitive and contextual barriers in mathematics learning. Bilingual instruction, for instance, offers an approach that may reduce linguistic load and improve accessibility. Anchored on well-established theories of language acquisition, motivation, and cognitive development, this study investigates how integrating bilingual strategies in mathematics teaching could help bridge the performance gap and foster deeper engagement among Filipino learners.

Philippine math education programs, while existing, are insufficient, as indicated by low National Achievement Test (NAT) scores despite some improvement. The persistent challenge of language barriers for bilingual students, particularly the difficulty translating English math terms, highlights a critical gap. Although promising, bilingual instruction remains under-researched and under-utilized, necessitating further investigation to develop more effective solutions.

This study is anchored on Jim Cummins' Common Underlying Proficiency Theory (1981), Carol Dweck's Achievement-Goal Theory (1986), and Lev Vygotsky's Theory of Student Engagement (1978). Cummins' theory suggests that both languages used by bilingual individuals operate through a shared cognitive system, allowing academic knowledge acquired in one language to support learning in another. Dweck's theory emphasizes how students' goals influence their motivation and learning behaviors, with mastery-oriented goals promoting deeper engagement and achievement. Vygotsky's theory highlights the importance of social interaction and collaborative learning, where language plays a key role in constructing understanding within a learner's Zone of Proximal Development.

The integration of bilingualism as a medium of instruction in mathematics education has been shown to be an effective teaching strategy in improving students' mathematical achievement and engagement. Bialystok (2017) introduces a developmental aspect of bilingualism, explaining that it enhances cognitive flexibility and academic achievement, particularly in Mathematics. By presenting mathematical concepts in both Filipino and English, teachers can make the subject more understandable and interesting for their students. This approach allows students to grasp complex concepts more quickly and enhances their problem-solving abilities, cognitive flexibility, and mathematical reasoning. The use of bilingualism as a medium of instruction in mathematics education is a valuable teaching strategy that can improve students' mathematical achievement and engagement. By embracing bilingualism, educators can create a more inclusive and effective learning environment that fosters students' mathematical understanding and enthusiasm.

This study aimed to determine the effectiveness of bilingualism in Mathematics achievement of the grade seven students.

Specifically, it sought answers to the following questions:

1. How may the level of Mathematics achievement of English-only and Bilingualism group be described in terms of:
   1.1 Pre-assessment; and
   1.2 Post-assessment?
2. How may the student engagement of the English-only group be described in terms of:
   2.1 Active Participation;
   2.2 Attentiveness;
   2.3 Critical Thinking; and
   2.4 Contribution to Group Dynamics?
3. How may the student engagement of the Bilingualism group be described in terms of:
   3.1 Active Participation;
   3.2 Attentiveness;
   3.3 Critical Thinking and; and
   3.4 Contribution to Group Dynamics?
4. Is there a significant difference between pre-assessment and post-assessment results of English-only group?
5. Is there a significant difference between pre-assessment and post-assessment results of Bilingualism group?
6. Is there a significant difference between the level of Mathematics achievement of the English-only and Bilingualism group?
7. Is there a significant difference between the student engagement of the English-only and Bilingualism group?
8. What action plan may be proposed to improve the effectiveness of bilingualism in the Mathematics achievement of the grade seven students?

The proposed intervention aims to enhance students' mathematical achievement and engagement through the integration of bilingualism in classroom activities. By encouraging students to switch between Filipino and English while engaging with mathematical concepts, the intervention seeks to improve students' mathematical vocabulary, comprehension, problem-solving skills, and critical thinking. It is expected to contribute to solving the problem of low mathematical achievement and engagement among students. By using bilingualism as a medium of instruction, teachers can present mathematical concepts in a more understandable and interesting way, allowing students to grasp complex concepts more quickly. The intervention's focus on collaborative learning activities, such as role-playing and game-based challenges, is also expected to increase student engagement and motivation. The use of bilingualism and collaborative learning activities is expected to increase student engagement and motivation, seeks to enhance students' bilingualism skills, which can benefit their academic and professional careers. The study can promote awareness of the benefits of bilingualism instruction and encourage educators to adopt this approach in their teaching practices.

Methods

This study employed a quasi-experimental research design to examine the cause-and-effect relationship between the use of bilingualism as a medium of instruction and students' achievement in Mathematics. The research was conducted at Sto. Rosario National High School, located in Sta. Rosa, Nueva Ecija. A total of 80 Grade 7 students were purposefully selected for the study. These students were divided into two groups: 40 students in the experimental group who received instruction using bilingual strategies (Filipino and English), and 40 students in the control group

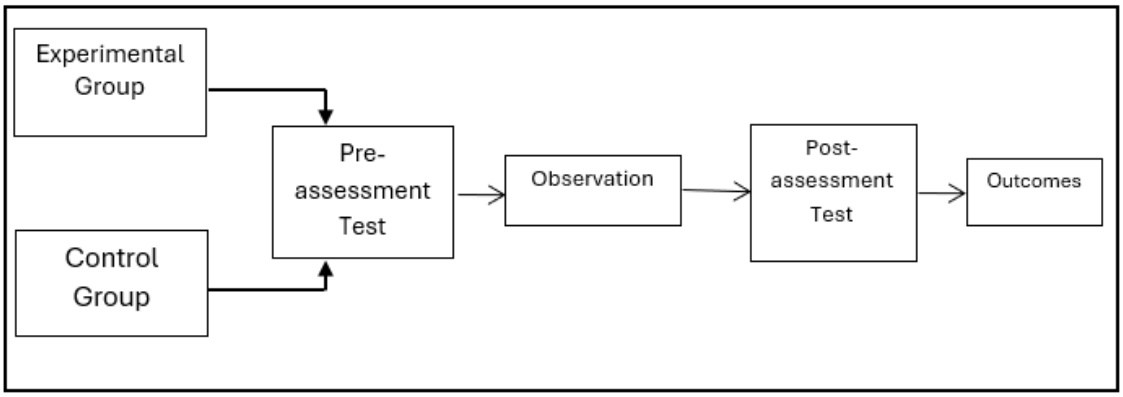
who received instruction using English only. Participant selection was facilitated by the school's Mathematics head teacher and was based on students' average performance levels to ensure group comparability.

To gather data, the researchers used two main instruments: a pre-assessment and post-assessment test adopted from Aseron et al. (2013), and an observation checklist adapted from Cassa and Jang (2010). These tools were chosen to assess students' mathematical achievement and classroom engagement, respectively.

Data collection involved two key methods: observation and examination. According to Creswell and Creswell (2018), observation involves collecting open-ended, firsthand information by directly watching people and events. Meanwhile, examination refers to formal testing methods used to assess knowledge, such as those used in classroom settings (PISA, 2019).

The process began with securing approval from the school administration, followed by a formal request to the school principal and Mathematics head teacher. The researchers explained the purpose of the study and confirmed that all selected participants met the established criteria. A pre-assessment test was administered to both groups to evaluate their prior knowledge of the selected mathematics topics. During instruction, the observation checklist was used to monitor student participation and engagement in both experimental and control groups. After the instructional period, a post-assessment test was administered to determine any differences in achievement attributable to the bilingual instructional approach.

Figure 1. - Flow Chart of the Data Gathering Procedure



The study utilized both descriptive and inferential statistical methods. To assess and compare the effectiveness of bilingual instruction in mathematics education:

- Weighted mean was used to interpret students' engagement levels based on the observation checklist.
- Mean scores were computed to evaluate student performance in the pre- and post-assessment tests.
- The independent samples t-test was used to determine if there was a statistically significant difference in Mathematics achievement between the control (English-only) and experimental (Bilingual) groups.
- The Mann-Whitney U test, a non-parametric alternative to the t-test, was used to compare the engagement levels of students in both groups, especially in relation to the variable of critical thinking..

Table 1 - Rating Scale for Student Engagement

Degree of Response	Range of Mean	Verbal Description	Verbal Interpretation

5	4.20 - 5.00	Always	81 - 100 percent of the students are actively engage in the class discussion.
4	3.40 - 4.19	Often	61 - 80 percent of the students are participated in the class discussion.
3	2.60 - 3.39	Sometimes	41 - 60 percent of the students are somewhat engaged in the class discussion.
2	1.80 - 2.59	Rarely	21 - 40 percent of the students responded in the class discussion.
1	1.00 - 1.79	Never	0 - 20 percent of the students observed in the class discussion.

This observation checklist served as a tool to measure the level of engagement among Grade 7 students and contributed to assessing the effectiveness of bilingualism as a medium of instruction in Mathematics.

Table 2 - Rating Scale for Mathematics Achievement

Descriptive Rating	Scale
Excellent	16 – 20
Above Average	12 – 15
Average	8 – 11
Below Average	4 – 7
Poor	0 – 3

The t-test and Mann-Whitney U test were used to determine the significant differences between the experimental and control groups. The t-test was used to compare the statistical results to determine whether there was a significant difference in the level of Mathematics achievement between the English-only and Bilingual groups. Meanwhile, the Mann-Whitney U test was used to analyze the differences in student engagement between the two groups in relation to the Critical Thinking variable.

Result And Discussion

Table 3 - Mean Score of the Control Group and Experimental Group

	Group	Mean	Verbal Description
Pre-assessment	**Experimental**	6.03	Below Average
	Control	8.100	Average
Post-assessment	**Experimental**	8.32	Average
	Control	9.075	Average
Difference	**Experimental**	2.30	-

Control	0.975	-

Table 3 presents the pre- and post-assessment mean scores of both the experimental and control groups. Before the intervention, the control group demonstrated a stronger understanding of the mathematics topic with a mean score of 8.10 (Average), while the experimental group scored 6.03 (Below Average).

Following the implementation of bilingual instruction, both groups exhibited improvement. The control group slightly increased its score to 9.08 (Average), whereas the experimental group showed a more notable gain, rising to 8.32 (Average). While the control group improved by 0.98 points, the experimental group recorded a larger improvement of 2.30 points, suggesting that bilingual instruction had a positive effect, particularly for students who initially performed below average.

These findings align with the work of Fung et al. (2018), who emphasized the connection between affective, behavioral, and cognitive engagement and students' mathematics performance. Moreover, Schunk and DiBenedetto (2021) define mathematical achievement as not only knowledge of mathematical concepts but also the capacity to apply them with fluency, accuracy, and critical thinking.

In light of these results, further investigation is warranted into how bilingual instruction enhances student engagement across different domains—particularly cognitive and affective engagement—and how these dimensions contribute to improved mathematical achievement. Interventions that incorporate bilingual teaching strategies may be especially beneficial for academically at-risk students, as they help bridge language barriers while simultaneously building conceptual understanding.

A review of existing literature should also explore the measurement of engagement, its differentiated impacts on achievement, and context-specific approaches that have proven effective. These insights can inform evidence-based strategies to support low-performing students and improve instructional delivery in mathematics, particularly in bilingual settings.

Table 4 - Mean Score of the Student Engagement Variables for Control Group

	Mean	Verbal Description
Active participation	3.28	Sometimes
Attentiveness	4.11	Often
Critical thinking	3.25	Sometimes
CGD	4.08	Often

Table 4 presents the engagement levels of the control group across four student engagement dimensions: active participation, attentiveness, critical thinking, and contribution to group dynamics (CGD). The results show that students in the control group were "sometimes" actively participating and engaging in critical thinking, with mean scores of 3.28 and 3.25, respectively—suggesting that 41% to 60% of the students were moderately engaged in these areas. In contrast, higher levels of engagement were noted in attentiveness (M = 4.11) and group contribution (M = 4.08), both falling under the "often" category, which reflects participation from 61% to 80% of the students.

These results indicate that while students in the control group remained attentive and contributed to group dynamics regularly, their involvement in higher-order thinking and active class participation was less consistent. This pattern may reflect limitations in the instructional

strategy used—delivered in English only—which could have hindered deeper engagement among students with lower language proficiency or confidence.

The findings support prior research emphasizing the critical role of student engagement in learning outcomes. Fung et al. (2018) identified a strong link between affective and cognitive engagement and mathematics achievement, affirming that students who are mentally and emotionally invested in learning are more likely to perform well. Fletcher (2019) further broadens this definition, describing engagement as any sustained connection a learner has with educational tasks, environments, or institutions. The control group's mixed engagement levels echo broader research indicating that engaged learners—particularly those who feel emotionally and cognitively connected to the material—tend to achieve higher academic outcomes.

These observations reinforce the importance of tailoring instructional approaches to foster all dimensions of engagement, particularly active participation and critical thinking, which were notably lower in the English-only group. Future instructional models may benefit from incorporating more inclusive strategies, such as bilingual delivery, to support a wider range of learners and encourage deeper academic involvement.

Table 5 - Mean Score of the Student Engagement Variables for Experimental Group

	Mean	Verbal Description
Active participation	4.44	Always
Attentiveness	4.72	Always
Critical thinking	3.17	Sometimes
CGD	4.92	Always

Table 5 presents the student engagement levels of the experimental group across four engagement dimensions: active participation, attentiveness, critical thinking, and contribution to group dynamics (CGD). The results indicate consistently high engagement in most areas, with mean scores of 4.44, 4.72, and 4.92 for active participation, attentiveness, and CGD, respectively. These fall under the "always" category, suggesting that 81% to 100% of students were consistently engaged in these areas during the intervention using bilingual instruction.

In contrast, critical thinking received a comparatively lower mean score of 3.17, falling under the "sometimes" category. This suggests that while students were highly engaged in observable behaviors such as participation and attentiveness, their engagement in higher-order thinking tasks was more variable. This may reflect the cognitive transition still required when navigating complex mathematical reasoning in two languages, despite increased overall engagement.

The findings support Fletcher's (2019) conceptualization of student engagement as a "sustained connection to any aspect of learning, schools, or education." High engagement in the experimental group demonstrates how bilingual instruction can strengthen that connection, particularly by making classroom discourse more accessible and inclusive. By reducing linguistic barriers, bilingual teaching appears to encourage greater participation, focus, and collaboration among students.

Overall, the results underscore the potential of bilingual instruction as an effective pedagogical strategy for enhancing student engagement, especially in affective and behavioral dimensions. However, the relatively lower score in critical thinking points to the need for explicit instructional strategies that target cognitive engagement, ensuring that students are not only

involved but are also challenged to think critically and reason mathematically within a bilingual learning environment.

Table 6 - Difference of Post-Test and Pre-assessment of Control Group using Student's T-test

Group 1	Group 2	Statistic	p	Decision	Remarks
Pre-assessment control	**Post-assessment control**	-2.27	0.029	Reject H0	Significant

Table 6 presents the result of the paired sample t-test conducted for the control group, which received instruction using English only as the medium of instruction. The computed t-statistic was -2.27, and the p-value was 0.029, which is below the significance level of $\alpha = 0.05$. This led to the rejection of the null hypothesis, indicating a statistically significant difference between the pre-assessment and post-assessment scores of the control group. In other words, the English-only instruction had a positive impact on students' mathematics achievement.

Although improvement was observed, the magnitude of change was modest compared to that of the experimental (bilingual) group. This finding suggests that while English-only instruction can be effective, its benefits may be limited for students who struggle with English as a second language.

This is supported by Barwell (2018), who emphasized that language plays a central role in mathematical comprehension. According to his research, the use of English can both support and hinder understanding depending on the learner's linguistic background and familiarity with academic vocabulary. In contrast, Ali et al. (2023) highlighted the effectiveness of code-switching—the strategic use of both first and second languages—as a means to enhance mathematical communication and conceptual understanding among bilingual learners.

Taken together, these insights suggest that while English-only instruction can yield significant gains in some contexts, bilingual or code-switched instruction may provide more equitable access to mathematics learning for students with diverse linguistic profiles. These findings contribute to the growing body of evidence supporting contextualized and linguistically responsive pedagogy in mathematics education.

Table 7 - Difference of Post-Test and Pre-assessment of Experimental Group using Student's T-test

Group 1	Group 2	Statistic	P	Decision	Remarks
Pre-assessment experimental	**Post-assessment experimental**	-5.29	< .001	Reject H0	Significant

Table 7 displays the results of the paired sample t-test conducted for the experimental group, which received instruction using bilingualism as the medium of instruction. The t-statistic was -5.29, with a p-value less than .001, which is well below the standard significance threshold of $\alpha = 0.05$. This leads to the rejection of the null hypothesis, indicating a statistically significant difference between the group's pre-assessment and post-test scores. The notable increase in performance suggests that the use of bilingual instruction had a strong positive impact on students' mathematics achievement.

This finding reinforces the growing body of research supporting bilingualism as an effective pedagogical approach in mathematics education. According to Moschkovich (2015),

bilingual instruction allows students to use their first language as a cognitive scaffold, facilitating the transition to academic proficiency in a second language. This approach not only reduces linguistic barriers but also enables students to conceptualize mathematical ideas more effectively.

Furthermore, Mukan et al. (2017) emphasized that the ability to switch between languages fosters creativity and critical thinking, which are essential for success in subjects that require problem-solving and logical reasoning, such as mathematics. The substantial improvement in the experimental group's scores supports this perspective, highlighting the value of linguistically responsive instruction for diverse learners.

Overall, the results provide compelling evidence that bilingual instruction can significantly enhance mathematical understanding, especially for students who may initially struggle with content delivered solely in English. These findings have important implications for curriculum planning and teacher training in multilingual educational contexts.

Table 8 - Independent Sample T-Test for Mathematics Achievement

	Statistic	p	Decision	Remarks
Pre-assessment	-3.58	< .001	Reject H0	Significant
Post-assessment	-1.23	0.221	Reject H0	Significant
Difference	2.11	0.038	Reject H0	Significant

Table 8 presents the results of the independent samples t-test comparing the Mathematics achievement of the control and experimental groups before and after the intervention.

The pre-assessment results show a significant difference between the two groups, with a t-value of -3.58 and a p-value < .001, indicating that the control group initially outperformed the experimental group. However, following the intervention, the post-assessment comparison revealed a t-value of -1.23 with a p-value of 0.221, which is not statistically significant. This suggests that after the implementation of bilingual instruction in the experimental group, the performance gap between the two groups narrowed considerably.

More importantly, the comparison of score gains (post-test minus pre-test) yielded a t-value of 2.11 and a p-value of 0.038, indicating a significant difference in improvement, favoring the experimental group. This result implies that while the control group began with a higher baseline, the experimental group demonstrated greater academic growth over the course of the intervention—highlighting the positive impact of bilingual instruction on Mathematics achievement.

These findings align with the work of Appiah et al. (2022), who emphasized that student achievement is shaped by a combination of factors, including teacher-student relationships, self-efficacy, and perceptions of the subject matter. Additionally, May (2016) supports the role of gradual linguistic immersion in improving students' proficiency in the language of instruction, which in turn can enhance comprehension and learning outcomes.

The observed improvement in the experimental group's performance underscores the potential of bilingual instruction as a context-sensitive educational strategy. By leveraging students' first language while gradually reinforcing English proficiency, bilingual teaching may enhance engagement, comprehension, and confidence—especially among learners who may otherwise struggle in an English-only setting. These results advocate for a more inclusive and linguistically responsive approach to instruction in mathematics education.

Table 9 - Independent Sample T-Test for Student Engagement

		Statistic	p	Decision	Remarks
Active Participation	**Student's t**	-3.900	0.003	Reject H0	Significant
Attentiveness	**Mann-Whitney U**	10.0	0.209	Reject H0	Significant
Critical Thinking	**Student's t**	1. 170	0.868	Failed to Reject H0	No Significant
CGD	**Student's t**	-4.767	<.001	Reject H0	Significant

Table 9 presents the results of independent samples tests comparing student engagement variables between the control and experimental groups, based on the observation checklist.

The results reveal statistically significant differences in active participation ($t = -3.900$, $p = 0.003$) and contribution to group dynamics (CGD) ($t = -4.767$, $p < .001$), with the experimental group scoring significantly higher in both areas. These findings suggest that students exposed to bilingual instruction were more likely to participate actively and engage collaboratively during mathematics classes.

On the other hand, no significant differences were found in attentiveness ($U = 10.0$, $p = 0.209$) and critical thinking ($t = 1.170$, $p = 0.868$), indicating that both groups performed similarly in these aspects. While the experimental group showed high levels of engagement overall, these two dimensions may require additional instructional scaffolding to foster deeper cognitive involvement and sustained attention, especially in complex tasks.

These findings are consistent with Eccles' (2016) assertion that student engagement is positively associated with academic achievement and resilience. When students are meaningfully engaged, they are not only more likely to perform better academically but also develop the perseverance needed to overcome challenges. The significant improvements in group interaction and active involvement observed in the experimental group suggest that bilingual instruction may contribute to a more inclusive and participatory classroom environment, which, in turn, strengthens student motivation and resilience.

Additionally, Ghaznavi et al. (2021) emphasize the importance of teaching strategies that reflect students' diverse learning styles. Their study supports the notion that engagement increases when instruction is personalized and culturally responsive. The experimental group's heightened involvement may reflect this responsiveness, as bilingual instruction allows students to learn in a way that resonates more with their linguistic and cognitive backgrounds.

In sum, the results reinforce the importance of adopting inclusive, student-centered approaches—such as bilingual instruction—that promote participation and peer collaboration. At the same time, they signal the need to further explore strategies to elevate attentiveness and critical thinking, ensuring a more holistic engagement profile in mathematics education.

Conclusion

This study investigated the effectiveness of bilingualism as a medium of instruction in enhancing the mathematics achievement and engagement of Grade 7 students. The findings revealed that the experimental group, which received bilingual instruction, showed greater improvement in post-assessment scores compared to the control group. Although the control group began with higher pre-assessment scores, the experimental group demonstrated a more substantial gain, indicating the positive impact of bilingual instruction on academic performance.

In terms of engagement, students in the bilingual class consistently exhibited higher levels of active participation and contribution to group dynamics. These areas showed significant improvement compared to the control group, highlighting the role of bilingual instruction in fostering student involvement and collaborative learning. While both groups displayed similar

levels of attentiveness and critical thinking, the results suggest that additional support may be needed to further enhance students' critical thinking abilities.

Overall, the use of bilingualism in mathematics instruction proved to be effective in improving student achievement and promoting more dynamic and participatory classroom interactions. The approach made mathematical content more accessible and relatable, especially for learners who may struggle with English-only instruction. These findings support the integration of bilingual teaching strategies in mathematics to create a more inclusive and effective learning environment.

Recommendations

Based on the findings of this study, several actionable steps are recommended to sustain and extend the positive effects of bilingual instruction on student performance and engagement in Mathematics.

The study revealed that bilingualism as a medium of instruction significantly improved students' mathematics achievement and fostered higher engagement, particularly in active participation and group dynamics. In response to these findings, the following Proposed Action Plan in table 10 has been developed to guide the integration of bilingual practices in mathematics classrooms.

Table 10 - Proposed Action Plan

Factors	Objective	Activities	Person in Charge	Timeline	Expected Outcome
Bilingualism	To enhance the students' comprehension by using bilingualism as medium of instruction.	Integrate activities such as Math Storytelling and reflection where it incorporates math concepts using language. Teachers may also use activity like Bilingualism Math Debates where students present their arguments in bilingualism and respond to counter-arguments.	Subject Teacher	January to March	80 percent of the students enhance their comprehension on the subject area, may able to communicate and interact with peers and teacher and effectivel and appreciate the mathematical learning in bilingualism.
Mathematics Achievement	To enhance student's proficiency in mathematical concepts, problem-solving and critical thinking, fostering logical reasoning and analytical thinking by integrating the use of bilingualism.	The Facilitator may use activities such as real-world word problem for students be able to understand the concept. They may also use activity like Bilingualism Math Flashcards where students enhance mathematical vocabulary and communication skills.	Subject Teacher	January to March	80 percent of the students approach complex mathematical problems, justify mathematical conclusion, and improved academic performance in Mathematics
Student Engagement	To encourage active involvement	Teachers may incorporate	Subject Teacher	January to March	80 percent of the students shall

-Active Participation -Attentiveness -Critical Thinking -Contribution to Group Dynamics	in the learning process. By fostering interest and enthusiasm for learning in the use of bilingualism.	educational activities and challenges that encourage student engagement by having activities such: Language Math-Swap where it is under the variable active participation and critical thinking where students collaborate on math problems, to enhance mathematical understanding and language proficiency of the students. Activity that is under the attentiveness is Bilingualism Math Songs, Poem, and Raps to facilitate conceptual understanding and illustrate mathematical concepts. Activity that can also enhance students' contribution to group dynamics is the Dual-Language Math Scavenger Hunt, that also promotes the use of bilingualism by integrating through the use of hints and phrases.	have long term retention by active participation, attentiveness, critical thinking, and contribution to group dynamics in classroom activities and increased academic motivation and performances.

This action plan promotes inclusive mathematics instruction by enabling students to access content through familiar language while developing academic English proficiency. It emphasizes translanguaging, code-switching, and contextualized language use to support both conceptual understanding and linguistic development. By incorporating activities such as bilingual math storytelling, debates, flashcards, songs, and scavenger hunts, the plan aims to enhance not only cognitive engagement but also affective and behavioral dimensions of learning. The goal is to create a classroom culture that values linguistic diversity, encourages active participation, and improves overall academic performance in Mathematics.

To further deepen the understanding and applicability of bilingual instruction in mathematics, future research is highly recommended. First, longitudinal studies should be conducted to examine the sustained effects of bilingual teaching on students' mathematics achievement and language development over multiple academic years. Such studies could provide insights into long-term academic growth and the stability of bilingual learning outcomes.

Additionally, comparative studies between urban and rural schools—or among students with varying levels of English and Filipino proficiency—can help identify context-specific strengths and challenges in implementing bilingual strategies.

Exploring the integration of bilingual instruction into other STEM subjects, such as Science and Technology, may also yield valuable cross-disciplinary insights. This could broaden the impact of bilingual pedagogy across the curriculum and support holistic academic development. Furthermore, the use of digital bilingual tools—such as mobile apps, interactive flashcards, and learning platforms—should be evaluated to determine their effectiveness in enhancing both mathematical comprehension and language fluency in a tech-integrated environment.

Lastly, future research should examine cognitive and affective outcomes related to bilingual instruction. This includes assessing how it influences students' confidence, anxiety levels, and attitudes toward Mathematics. Understanding these psychological and emotional dimensions will provide a more comprehensive view of the benefits and limitations of bilingual teaching. Collectively, these future directions can inform more nuanced and evidence-based strategies for implementing bilingual instruction, ensuring that educational practices remain responsive, equitable, and effective.

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