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Research Article

Filipino Language as an Auxiliary Medium of Instruction in Teaching Physics

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ABSTRACT

This study investigated the effectiveness of using the Filipino language as an auxiliary medium of instruction in teaching Physics among Grade 10 students at Mindanao State University–Maguindanao Integrated Laboratory Science High School. The research employed an experimental pre-test and post-test design involving two groups: a control group taught through conventional English instruction and an experimental group taught with Filipino as a supplementary language during lessons on problem-solving and computations. Data were collected using validated and reliable test instruments and analyzed through mean scores, t-tests, and standard deviations. Findings revealed that the control group obtained a mean score of Fair, while the experimental group achieved a higher mean score of Good. Statistical analysis showed no significant difference between the two groups before instruction, but a significant difference after instruction. These results indicate that incorporating the Filipino language as an auxiliary medium significantly enhances students' comprehension and performance in Physics, particularly in solving numerical and conceptual problems. The study concludes that bilingual instruction, where Filipino complements English, can serve as an effective pedagogical approach in Physics education. It aligns instruction with learners' linguistic and cognitive capacities, promoting inclusivity, confidence, and academic achievement. The researchers recommend further integration of Filipino in science classrooms and a review of language policies to strengthen equitable and meaningful science learning.

Keywords: *Auxiliary medium of instruction, Bilingual learning, Filipino language, Physics education, Students' performance*

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Introduction

The Filipino language traces its roots to the Tagalog language, historically spoken by the Tagalog people in the Manila region. With the colonization of the Spaniards in the 16th century, Spanish influence deeply shaped the Tagalog language. Spanish loanwords and grammatical structures were integrated into Tagalog, resulting in the birth of the modern Filipino language (Komisyon sa Wikang Filipino, n.d.).

Globally, few studies have examined the effectiveness of using a national or native language as an auxiliary medium for teaching physics, particularly in improving students' problem-solving and computational skills. Most existing research focuses on broader issues of language of instruction, translanguaging, and STEM education, often emphasizing English while overlooking languages such as Filipino (Bernhofer & Tonin, 2022; Pierson, Clark, & Brady, 2021).

In the Philippine context, there remains a limited body of empirical studies exploring the use of Filipino in science education, especially in physics. Research on mother-tongue-based multilingual education (MTB-MLE) indicates that instruction in a familiar language enhances students' comprehension and metacognitive learning, but its application in upper-level science subjects remains understudied (Santiago & Dagdag, 2021; Diestro, 2023).

In linguistically diverse regions such as Maguindanao, there is a strong need for studies that consider the unique cultural and linguistic context of learners to determine how Filipino as an auxiliary medium may enhance physics learning outcomes. Scholars emphasize that local and culturally relevant language use can strengthen conceptual understanding and participation in science learning (Karlsson, Nygård Larsson, & Jakobsson, 2020; Morales, 2017).

Several studies have shown that mother-tongue and bilingual instruction can improve students' academic performance and engagement, particularly when used strategically in complex subjects (Santiago & Dagdag, 2021; Bernhofer & Tonin, 2022). Similarly, translanguaging approaches where teachers flexibly shift between languages have been found to support learners' sense-making and conceptual reasoning in science (Pierson et al., 2021; Karlsson et al., 2020).

Moreover, experimental studies in the Philippines suggest that using a lingua franca such as Filipino in science classes can yield better understanding and performance, especially for learners with limited English proficiency (Diestro, 2023). These findings align with the goals of this research, which seeks to determine the performance of students before and after the use of Filipino language as an auxiliary medium of instruction in teaching physics at MSU-Maguindanao Integrated Laboratory Science High School.

This approach aims to align physics instruction with the cognitive and linguistic abilities of Filipino learners, fostering inclusivity and comprehension. By utilizing Filipino as a supplementary instructional medium, teachers can simplify complex concepts, encourage student participation, and enhance engagement. Furthermore, examining how Filipino effectively conveys technical and mathematical aspects of physics ensures that instructional strategies are both clear and equitable.

National education policies, such as the K to 12 curriculums and the Mother Tongue-Based Multilingual Education (MTB-MLE) framework, promote the use of learners' first language in early education and encourage a gradual transition to English in higher grades. However, implementation in subjects like physics remains inconsistent, as many teachers still prefer English, which may limit access to meaningful learning for students who struggle with it (Department of Education [DepEd], 2012, 2016).

Thus, this study is grounded on the belief that language is not merely a vehicle of communication but also a key to learning complex scientific concepts. By using the Filipino language as an auxiliary medium of instruction in teaching Physics, educators can make the subject more inclusive, comprehensible, and engaging. The findings of this research will provide valuable insights into improving instructional strategies, promoting equity in science education, and supporting national goals of accessible and quality learning for all Filipino students.

Statement of the Problem

This study aimed to determine the performance of the students before and after the used of Filipino language as an auxiliary medium of instruction in teaching physics specifically in solving problems at Mindanao State University-Maguindanao Integrated Laboratory Science High School.

To achieve this goal, it sought to answer the following questions:

1. What was the performance of the control group before and after the use of conventional method in teaching physics?
2. What was the performance of the experimental group before and after the use of Filipino language as an auxiliary medium of instruction in teaching physics?
3. Was there a significant difference between the performance of the control group and experimental group before teaching physics?
4. Was there a significant difference between the performance of the control group and experimental group after teaching physics?

Hypotheses of the Study

Null Hypothesis (H_0)

H_{01}: There is no significant difference between the post-test scores of students taught using conventional instruction (control group) and those taught using Filipino as an auxiliary medium of instruction (experimental group).

H_{02}: The use of Filipino as an auxiliary medium of instruction does not significantly improve students' performance in physics compared with the conventional method.

Alternative Hypothesis (H_1)

H_{11}: There is a significant difference between the post-test scores of students taught using conventional instruction and those taught using Filipino as an auxiliary medium of instruction.

H_{12}: The use of Filipino as an auxiliary medium of instruction significantly improves students' performance in physics compared with the conventional method.

Methodology

This study utilized an experimental research design using a pre-test and post-test design, which was well-suited for quantifying the performance of the students before and after the utilization of the Filipino language as an auxiliary medium of instruction in Mindanao State University-Maguindanao Integrated Laboratory Science High School. The Experimental research design is quantitative research that compare two groups, the control group and the experimental group to determine the performance of the students. The study involved two Grade 10 sections from the selected school, Integrated Laboratory Science High School, as the subjects of the study. Both sections underwent pre-test and post-test assessments. The study was conducted during the first quarter of the academic year 2024- 2025, specifically covering lessons 3 to 8 of the first quarter.

The study employed pre-test and post-test assessments as tools for quantifying and gathering the necessary data. The researchers conducted a pilot testing with 50 made test questionnaires in section A, ILSHS MSU- Maguindanao, the researchers used the KR20 reliability format to determine the reliability of the test questionnaires and to analyze which test questions are reliable, the result of KR20 results in 0.81 internal consistency which is described as good. In addition, the researchers sought permission to the three experts to examine the content validity of the test questionnaires.

The researchers formulated a 30-item test based on the competencies outlined in the syllabus of Integrated Laboratory Science High School. A table of specifications was created to ensure alignment with the competencies. The researchers also sought assistance from their research adviser to review the appropriateness and coherence of the test questions.

The pre-test was administered to both the experimental and control groups to assess their prior knowledge before the intervention. Throughout the study, the same competencies were followed when presenting topics to both groups. After completing the lessons, a post-test was administered to both groups to evaluate the performance of the students. The learning outcomes from the pre-test and post- test were compared to measure the performance of using the Filipino language as an auxiliary medium of instruction, particularly in solving physics problems.

The statistical tools used in this study included tabulations, frequency counts, t-tests, standard deviation, and percentages to analyze the data from the pre-test and post-test assessments. Mean scores were also calculated to identify the performance of the students before and after the use of the Filipino language as an auxiliary medium of instruction in teaching physics.

To determine the statement of the problem 1, the test scores, Frequency counts, and Percentage are used to analyze and interpret the data from the pre-test and post- test assessments. Verbal description is also used to determine the performance level of the students.

To determine the statement of the problem 2, the test scores, Frequency counts, and Percentage are used to analyze and interpret the data from the pre-test and post- test assessments. Verbal description is also used to determine the performance level of the students.

To determine the statement of the problem 3, the mean score, standard deviation, t-test, critical value, and p-value is used to determine the significant difference between the performance of the control group and experimental group before teaching physics.

To determine the statement of the problem 4, the mean score, standard deviation, t-test, critical value, and p-value is used to determine the significant difference between the performance of the control group and experimental group after teaching physics.

To categorized the performance of the students, the following scale was used.

Legend:

25-30	Very good
19-24	Good
13-18	Fair
7-12	Low
0-6	Very low

Results and Discussion

Table 1. Performance in Physics Before and After

Performance in Physics (based on test scores)	Before		After		Description
	f	*f %*	*f*	*f %*	
25-30	0	0	3	6.52	Very Good
19-24	0	0	18	39.13	Good
13-18	12	26.08	2	4.34	Fair
7-12	11	23.91	0	0	Low
0-6	0	0	0	0	Very Low
Total	23	100%	23	100%	
Over-all Mean Score: 22.09 (Good)					**SD: 14.41**

As shown in Table 1, the performance of the control group before the use of the conventional method in teaching Physics indicates that most students scored within the range of 13–18, with a frequency count of 12, representing 26.08% of the group. This percentage is slightly higher than the next most frequent range of 7–12, which had a frequency count of 11 or 23.91%. The standard deviation reflects the degree of variability in students' test scores, indicating how widely the scores are distributed from the mean.

This implies that the performance of the students in the control group before the use of the conventional method in teaching Physics, based on the test scores, indicates a fair level of performance. However, conventional instruction has often been linked to low levels of student engagement and motivation. According to Redish (2003), the passive nature of traditional lectures can result in student disengagement and reduced learning outcomes. Students frequently report feelings of boredom and disconnection from the material, which can negatively influence their academic performance. Similarly, Alhamami (2023) emphasized that traditional lecture- based instruction often fails to foster interactive communication, leading to decreased learner motivation and understanding.

Additionally, the performance of the control group after the use of the conventional

method in teaching Physics showed a frequency count of 3 (6.52%) within the 25–30 score range, which is much lower than the 18 (39.13%) frequency within the 19–24 range but higher than the 2 (4.34%) frequency within the 13–18 range. This indicates that the students' performance improved slightly after instruction but still reflected only a moderate understanding of the material.

This suggests that while the conventional method may help students grasp basic concepts, it may not sufficiently develop their higher-order thinking and problem-solving skills. Studies show that alternative instructional approaches, particularly those that incorporate the learners' first language, can enhance conceptual understanding. For example, Buar and Aure (2022) found that students taught Physics using their mother tongue exhibited better comprehension and engagement compared to those taught solely in English. Similarly, Domingo (2016) and Deauna-Eusebio (2007) concluded that bilingual or Filipino-mediated instruction in science and physics enables students to relate more effectively to the content, leading to improved understanding and performance outcomes.

Furthermore, Dizon (2025) reported that the use of Filipino as a supplementary language of instruction increases classroom participation and comprehension in science classes, as students feel more confident expressing their thoughts. These findings are consistent with the current study, where despite slight improvement in test scores after traditional instruction, the overall performance of the control group represented by a mean score of 22.09 and described as fair suggests that language familiarity and interactive pedagogy are key factors in achieving deeper learning.

Consequently, while the conventional method provided some improvement, it did not produce a significant enhancement in the students' overall understanding of Physics. The results indicate that more student-centered and language-inclusive instructional strategies may lead to greater comprehension, engagement, and academic success.

Table 2. Performance in Physics Before and After

Performance in Physics (based on test scores)	**Before**		**After**		
	f	***f %***	***f***	***f %***	**Description**
25-30	0	0	17	36.95	Very Good
19-24	0	0	6	13.04	Good
13-18	12	26.08	0	0	Fair
7-12	11	23.91	0	0	Low
0-6	0	0	0	0	Very Low
Total	23	100%	23	100%	
Over-all Mean Score: 25.30 (Very Good) SD: 11.94					

Filipino language as an auxiliary medium of instruction in teaching Physics revealed that most students scored within the 13–18 range, with a frequency count of 12 or 26.08%. This is slightly higher than the next frequency counts of 11, which falls within the 7–12 range and represents 23.91% of the group. The standard deviation indicates the degree of variation in the students' scores, reflecting differences in their levels of understanding prior to the intervention. This suggests that, before the use of the Filipino language as an auxiliary medium of instruction, the experimental group's performance in Physics was generally fair, indicating an average understanding of the subject matter.

According to Rossell and Baker (1996), bilingual education has consistently shown positive effects on students' academic performance, supporting the idea that the integration of two languages can enhance comprehension and cognitive development. In the Philippine context, where many students are bilingual or multilingual, Domingo (2016) found that using Filipino Alongside English helps bridge the gap between students' home language and the language of instruction, leading to better comprehension and retention of complex scientific

concepts. This supports the integration of Filipino as an auxiliary medium of instruction in teaching physics as a promising approach for improving students' understanding and problem-solving skills.

While the benefits of bilingual or auxiliary-language instruction are notable such as increased comprehension and confidence in problem-solving issues of teacher preparedness and instructional resources must still be addressed. Baniqued and Bautista (2024) emphasized that the success of science education depends on teachers' readiness and availability of adequate teaching materials. Hence, future research should focus on developing effective training programs for educators and creating accessible instructional resources in Filipino to support this instructional model.

Furthermore, the performance of the experimental group after the use of Filipino as an auxiliary medium of instruction in teaching Physics based on the test scores showed a frequency count of 17 (36.95%) within the 25–30 range, described as very good, and a frequency of 6 (13.04%) within the 19–24 range, described as good performance. The use of Filipino in Physics instruction also appears to enhance student engagement. Minoza et al. (2024) found that bilingual instruction increases student motivation and participation, as learners are more comfortable expressing ideas and engaging in discussions when they can use their native language. This active engagement is crucial in subjects like Physics, which often require collaborative problem-solving and conceptual understanding.

Consequently, the performance of the experimental group before and after the use of Filipino as an auxiliary medium of instruction in teaching Physics resulted in an overall mean score of 25.30, which indicates a very good level of performance. This implies that the integration of Filipino as an auxiliary medium of instruction contributed positively to the students' comprehension and problem-solving ability in Physics. The relatively high mean score suggests that students were able to grasp the concepts and computations more effectively when taught in a language they were comfortable with, leading to improved performance. Although the most frequent correct answers were in the 13–18 range (26.08, Fair), the students' overall performance was categorized as Very Good, demonstrating the potential of bilingual instruction to improve learning outcomes in Physics.

Table 3. The t-test between the Performance of the Control Group and Experimental Group before Teaching Physics.

Group	Mean	t-value	Critical value	p-value
Control	12.65	0.097	2.074	0.924*
Experimental	12.57			

Table 3 shows the paired variable of the students' scores of the control and experimental groups before teaching Physics. The computed t-value of 0.097 is less than the critical value of 2.074 (p- value = 0.924 > 0.05), indicating no significant difference between the performance of the control and experimental groups before teaching Physics. This means that the null hypothesis is accepted, and the study can proceed to determine the performance of the students using the Filipino language as an auxiliary medium of instruction in teaching Physics. A t-test was used to compare the two groups, and since the critical value was higher than the t-value, it was described as not significant. To further determine the performance of the two groups, mean scores were computed to evaluate their performance.

Several case studies demonstrate the effectiveness of using Filipino in Physics instruction. For instance, Domingo (2016) found that students learning through Filipino as a medium of instruction exhibited better comprehension and improved test scores compared to those taught entirely in English. This practical application suggests that integrating Filipino can enhance student engagement and academic success.

Additionally, language serves as a primary tool for communication and understanding in educational contexts. According to Vygotsky's (1978) Social Development Theory, language is

fundamental to cognitive development, facilitating interactions that enhance learning. In the Philippine context, where English is often the primary medium of instruction, the use of Filipino can bridge comprehension gaps for students who may struggle with English terminology.

Furthermore, Duterte and Llorente (2025) emphasized that translanguaging in science classrooms can strengthen students' grasp of complex concepts by allowing them to use both their first and second languages strategically. This supports the idea that bilingual instruction helps student's express ideas more clearly and develop deeper understanding in subjects such as Physics. Students generally favor the use of Filipino as it allows them to express their thoughts and questions more freely. A survey conducted by Domingo (2016) also indicated that students felt more comfortable discussing scientific concepts in Filipino, which contributed to a more interactive and dynamic learning environment.

Table 4. The t-test between the Performance of the Control Group and Experimental Group After Teaching Physics.

Group	Mean	t-value	Critical value	p-value
Control	22.09			
Experimental	25.30	4.357	2.074	0.00*

Table 4 shows the paired variable of the students' scores of the control and experimental groups after teaching physics. The computed t-value of 4.357 is greater than the critical value of 2.074 ($p = 0.00 < 0.05$). This implies that there is a significant difference between the performance of the control group and the experimental group after teaching physics. Thus, the alternative hypothesis is accepted because the computed t- value is much higher than the critical value, indicating that the study is significant at the 0.05 level. Accordingly, using Filipino as an auxiliary medium of instruction appears effective in improving the performance of students in physics, particularly in solving problems and computations.

The mean score of the experimental group (25.30) is higher than that of the control group (22.09), and the standard deviations of the two groups differ noticeably. This indicates that the intervention is more effective than the conventional method. Using Filipino as an auxiliary medium of instruction can facilitate better understanding of complex physics concepts, allowing students to relate theoretical ideas to practical applications more easily. Recent research supports these findings. Igarashi, Maulana, and Suryadarma (2024) found that the use of mother-tongue-based education in the Philippines significantly enhances foundational skills and learning outcomes when effectively implemented. Similarly, Velasco (2024) emphasized that the success of mother- tongue instruction depends on teachers' positive language ideologies and classroom practices, which help learners engage more deeply with content. Earlier, Walter and Dekker (2011) documented that mother-tongue instruction in Philippine classrooms led to stronger comprehension and retention of science-related material compared to English-only instruction.

Beyond the Philippines, Sultana and Fang (2024) showed that combining English and the mother tongue through translanguaging supports students' ability to reason through complex scientific concepts. Related work on translanguaging in science education also demonstrates that students can articulate problem-solving strategies more effectively when allowed to use familiar linguistic resources (Translanguaging in Science, 2024). These findings align with the present study's results, suggesting that using Filipino as an auxiliary medium of instruction can significantly improve students' understanding and performance in physics problem-solving tasks.

Conclusion

Based on the summary of findings, the researchers conclude that the use of the Filipino language as an auxiliary medium of instruction in teaching Physics is effective in enhancing students' performance, particularly in solving numerical and conceptual problems. The use of

Filipino helped students grasp computational concepts more easily, leading to better understanding and higher achievement in Physics. Furthermore, the study revealed a significant difference between the performance of the control and experimental groups after instruction, indicating that incorporating the Filipino language in teaching contributes positively to students' learning outcomes and comprehension in Physics.

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