

The Use of Filipino and English as Mediums of Instruction in the Teaching of Engineering Courses at the Tertiary Level

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Abstract

This quasi-experimental research aimed to determine which language is more effective in teaching engineering courses at the tertiary level in selected universities. The research compared the performance of the experimental and control groups by utilizing a different language as the means of instruction. The Controlled Groups utilized the English language and the Filipino language for the Experimental. The majority of the participants consisted of 135 Engineering students from four universities in Manila; 65 for the Controlled Group and 70 for the Experimental Group preferred English as their medium of instruction. Despite a strong preference for English, the Filipino language is still used as a strategic competence, especially when seeking clarifications. When it comes to concepts taught in English, the language barrier becomes an issue, and the Filipino language becomes the most accessible option when direct guidance and clarification are needed. Moreover, the two groups achieved a notable improvement in the pretest-posttest, in favor of the Experimental Group. On the other hand, the t-test revealed no significant difference in the performance of the two groups; the result shows that anything before and after the intervention had little effect on students' comprehension including the motivation and the ability to achieve their desired goals. The research, however, was limited to engineering education, with implications for other disciplines. Similar studies may be conducted on a broader range of topics and at different educational levels. Revisiting the curriculum to evaluate the inclusion of language and skill development would be essential.

Keywords: engineering education, Filipino and English, language in education, MTB-MLE, medium of instruction, quasi-experimental research, teaching engineering

Introduction

Education plays a key role in the 2030 Agenda for Sustainable Development since it is one of the goals of the United Nations Educational, Scientific, and Cultural Organization. (UNESCO, 2017) Through the 2030 Agenda for Sustainable Development, UNESCO is committed to eradicating poverty, protecting the planet, and ensuring that no one is left behind. There are 17 Sustainable Development Goals (SDGs) and 169 targets that offer universal, integrated, transformative, and human-rights-based visions applicable worldwide. One of the 17 Sustainable Development Goals (SDGs) is quality education. Quality education is the one that provides learning and opportunities to become economically productive, develop sustainable livelihoods, and achieve the full potential of human beings and members of society. Through quality education, developing human capacity and skills development will eradicate poverty. Quality schooling will become available to everyone who needs it, and participation in lifelong learning will provide anyone an opportunity to receive it. UNESCO believes that by 2030, all learners would have acquired the expertise and skills needed to

support sustainable development. Sustainable development driven by culture enhances access to education and the relevance of curricula, textbooks, and teaching methods. Strengthening national education systems ensures inclusive, high-quality, and lifelong education, promoting inclusive and sustainable cities.

In the Philippines, the educational system prepared individuals for the nation's workforce with the middle-level skills necessary for national growth and the high-level careers needed for national leadership and intellectual advancement. A step forward in human advancement occurs as new information is acquired and focuses on enhancing the standard of life. (UNESCO, 2011) The K to 12 program covers Kindergarten and 12 years of basic education, implemented to address the gap. The programs mentioned can help master knowledge and skills and train students for their entry into higher education and find jobs and become self-based entrepreneurs.

Additionally, it offers Mother Tongue-Based – Multilingual Education, which encourages learning in the school district's mother tongue rather than Filipino and English. Starting with the language spoken at home can bridge the understanding and learning the lesson better. The easiest way for students to understand is to use their first language. In the 2012-2013 academic year, Bahasa Sug, Bikol, Cebuano, Chabacano, Hiligaynon, Iloko, Kapampangan, Maguindanaoan, Meranao, Pangasinense, Tagalog, and Waray; the twelve MT languages introduced, with more to follow in following school years. Apart from the Mother Tongue, English and Filipino are taught as subjects beginning in Grade 1, emphasizing oral fluency, and subsequently adopted as a language of instruction in Grades 4 to 6, eventually becoming the main languages of instruction in Junior High School (JHS) and Senior High School (SHS). Historically, several laws concerning language usage in education have passed. According to Article 14, Section 6 of the 1987 Constitution, the Philippine national language is Filipino. The government shall establish and maintain its usage as a medium of official communication and support it as a language of instruction.

Furthermore, the official languages of communication and instruction are Filipino and English. Executive Order No. 210 was adopted during the administration of President Gloria Macapagal Arroyo to devise a policy aimed at enhancing the use of English as a tool for education. Higher education institutions are also encouraged to adopt the English language as the primary medium of instruction at the tertiary level. Almost similar to the bill was the policy on bilingual education, which characterized Filipino and English as mediums of instruction in particular subject areas. The Bilingual Education program seeks to achieve national expertise in Filipino and English by teaching both languages and their usage as instructional media at all stages. Several studies conducted demonstrating the efficacy of using the mother tongue as a means of instruction.

This study strengthened the capability and contribution of the Filipino language as a language of learning and a medium of instruction for higher education.

K to 12 MTB – MLE

UNESCO recommends Multilingual Language Education because it promotes social and gender equality and is a key to unifying countries with different languages. They initiated the Education program for All in 1990 focused on providing a basic education of the highest standards to children, youth, and adults. Despite significant progress, some people, particularly many who speak non-dominant or minority languages, continue to be denied welfare. In the vital MLE program, learners from non-dominant language groups undergo instruction in their native language while studying the official language as a subject in the early grades. (UNESCO, 2007) There are several clear indications that UNESCO's understanding of the vital connection between language and education is apparent in the organization's three-part strategy of promoting multilingual education. UN-

ESCO recognizes mother-tongue teaching, bilingual and/or multilingual education, and language as significant aspects of intercultural schooling at all stages of education.

The implementation of the MTB – MLE builds the proficiency of students through their first language – their Mother Tongue. Students can learn best through the language they are more familiar with. Early graders are being taught in their mother tongue because when beginners think, they use the language they usually use and are comfortable with. Ramirez Valencia et al. (2018) mentioned that students could be given some authority through their use of language, both verbal and nonverbal. As a result, students will take an active part in the classroom, enhancing emotional involvement and therefore creating a more responsive and positive atmosphere for language learning. According to Tewari (as cited in Ghosh, 2020), many students have suffered academically as a result of required instructional communication in English, which has disrupted the learning process. However, when explained in regional languages, particularly their mother tongue, they have a much easier time grasping the concepts. In the article “Information and Communication Technology in Education” (2021), students whose native tongue is not the official language of instruction are less likely than the majority to have computers and internet connections at home. There is less available material online in their native language, placing them at a disadvantage compared to their majority counterparts who use ICT to obtain knowledge, prepare presentations and papers, and communicate. With this, Dharmendra Pradhan (as cited in Edex Live, 2021) stressed that institutions must work together to overcome language barriers in the educational system and expand the capacity of the country’s engineering community. Engineering education in local languages will be a vehicle of empowerment, further strengthening the country’s engineering prowess. Likewise in the teaching of Mathematics, Smith (2017) found out that when instruction is delivered in the language of the students, it contributes to their conceptual understanding of the concepts in Mathematics and, eventually to an increase in students’ attainment. The language of instruction should no longer be Standard English. On the contrary, Chitera et al. (2016) noted that teaching mathematical principles in local languages appears to be more difficult. Concepts get distorted. Utilizing a local language as a medium for learning and teaching is much more difficult than using English because it requires the presence of supporting elements to be in place. Similar to the study conducted by Nkonde et al (2018) that evaluates the impact of using local or familiar language as a medium of instruction for teaching and learning mathematics and science in the Muchinga Province of Zambia. It was concluded that while respondents reported some positive outcomes, such as participation in mathematics and science class discussions, decreased rote learning, and improved memory, the findings indicate that the pedagogy has a long way to go before achieving its intended goals. The education department will need to address several critical factors which include increased availability of mathematics and science books written in a child's language of play, and increased teacher proficiency in the language of instruction, which may require careful selection of teachers. Okorie et al. (2019) determined potential strategies for incorporating indigenous languages into communication and engineering education in South African Universities. It was concluded that the adoption of indigenous language education is critical for people to interact more effectively in their communities.

The Use of Two Languages

In 2012, Espada investigated the impact of utilizing the native language in kindergarten mathematics instruction. The research discovered that kindergarten students exposed to their native language outperformed those subjected to English in Mathematics. Connectedly, using Filipino in teaching Science would be more effective than using English. When the two Sciences classes in Grade 4 – one in English and the one in Filipino, were compared, the effectiveness of using Filipino

was revealed (Reyes, 2010). A Science curriculum delivered in the mother tongue improves the academic outcomes of children from minority language groups. Additionally, it enhances the basic education standards by promoting student engagement and incorporating prior information and interactions with new learning. (Vela, 2012; Benson, 2004) Therefore, Science cannot be taught without contextualized inquiry. Letting the students talk and be engaged in facilitating the learning process through their first language – their Mother Tongue promotes the understanding of scientific principles and the necessity of scientific inquiry.

The Advantages of Teaching Specific Language

The use of the mother language as a teaching instrument enhances academic skills since it is simpler for a pupil to comprehend a lesson in their mother tongue, resulting in faster learning. Students, especially children, place a high psychological value on their mother tongue. It enhances an understanding of perspective since language and thought are inextricably linked, and thinking is complex without knowing the language (Pramod & Kad, 2013). According to Hassanzadehet & Nabifar (2011), improved language learning results from a greater comprehension of one's first language and improved language literacy. For students who are learning a second language, it is more important to be aware of and knowledgeable about the various aspects of language for them to become aware of and knowledgeable about the various aspects of the language.

More specifically, the idea of mother tongue knowledge should be identified and strengthened in the curriculum to foster fundamental metacognition in students. In addition, Walter & Dekker (2011) studied the mother tongue instruction in Lubuagan and cited the importance of communication between the teacher and pupil. When Lubuagan pupils study in their native language, they can excel in school, which fosters a passion for learning and a desire for continued education. (Dumatog & Dekker, 2003)

Most of the studies conducted dealt with comparing the effectiveness as a medium of instruction of the two languages, specifically the English language and the mother tongue. They aimed to determine which language effectively teaches Mathematics and Science subjects at primary and secondary levels. With this, the author investigates which language is more effective as a means of learning in Engineering classrooms at the tertiary level.

Methodology

This study used quasi-experimental research to determine if the outcomes of the experimental group are similar to those in the control group. Quasi-experimental research designs test causal relationships and use the methods for selecting a comparison group as close to the treatment group as possible. This design allows the researcher to purposely select the participants of the study and compare their achievements before and after the given treatment. The study utilized English for the Controlled Group and Filipino for the Experimental Group as treatment.

The participants of the study included engineering students enrolled in Electrical Engineering and Electronics and Communications Engineering programs. A total of 135 purposely selected Engineering students (65 in the Controlled Group and 70 in the Experimental Group) enrolled in two sections of Industrial Electronics from 4 universities in Manila. Participants were not randomly assigned and selected considering that the two sections have the same professor to ensure that no teacher – factor will affect the achievement of the students.

The instruments used in this research are instructional materials, pretest-posttest, and survey questionnaires. The professor handling course prepared the instructional material and the pretest-posttest for the course. This instructional material for Thermocouple in Industrial Electronics course,

written in English and the other in the Filipino language, includes objectives of the lesson, presentation of lessons, problem-solving activities, and laboratory experiments. After discussing the objectives, there will be a presentation of the lessons and problem-solving activities as a practice. The students will apply their knowledge and skills acquired from the lesson by performing laboratory experiments.

The pretest-posttest is a 20-item paralleled test written in English and in the Filipino language, a multiple-choice type of test to identify some terminologies and calculations about Thermocouples in Industrial Electronics, prepared by the professor. The content of the 20-item paralleled test is a part of the syllabus of Industrial Electronics and the scores of the participants are part of their grades in the course. Both the instructional materials and pretest-posttest were translated into Filipino by the researcher. And the professor reviewed the translated materials to parallel the ideas and concepts of Engineering in the lesson.

This study also used a survey questionnaire wherein the participants from the two groups chose English and Filipino as their preferred medium of instruction in the course. The questionnaire has two parts; the demographic profile, such as the name, gender, and the Grade Point Average (GPA) on the prerequisite subject of the participants, and the second part includes information on the participants' perception of the language effectiveness and appropriateness for the course. This Survey Questionnaire, validated by the panel of evaluators, tested for reliability with Cronbach's Alpha coefficient of 0.735.

After the pre-testing, as a part of the syllabus of Industrial Electronics, the program was implemented. And the participants were not informed of the program implemented in their classes. The Controlled Group used English as a medium of instruction. Participants took the pretest, and after that, the professor delivered the lesson also in the English language. After the discussions, problem-solving activities, and laboratory experiments, the participants took the post-test. The post-test result was also a part of the participants' grades in the course/subject. The same program of activities was done by the Experimental Group using the Filipino language.

Following the post-testing, the students answered the survey questionnaire to determine their perception of the medium of instruction.

The results of the pre-test, post-test, and survey questionnaires were treated statistically. Data analysis includes Percentages to determine the gender of the participants, their Grade Point Average in the prerequisite subject, and in determining the participants' perception towards the medium of instruction. A T-test was used in finding the difference in the performance of the two languages before and after the intervention. And Pearson r to see the relationship between the participants' profile and their performance after the test.

Results

The research has three primary goals: 1. determine the perception of students towards the medium of instruction used in the teaching of Engineering courses at the tertiary level; 2. compare the performance of two languages before and after the intervention, and 3. identify the relationship between the respondents' profile and their performance after the test.

Table 1 shows the perception of the participants towards the medium of instruction for Engineering education. They chose between English and Filipino language as their preference to be the language of instruction, and they believe as valuable and effective tools in teaching and learning engineering.

Table 1. General Perception towards the Medium of Instruction

Statements	Filipino	%	English	%	Total	%
I prefer the course to be taught in _____.	39	28.9	96	71.1	135	100
I find _____ as medium of instruction useful.	44	32.6	91	67.4	135	100
I find it appropriate that Engineering courses should be studied in _____ language.	20	14.8	115	85.2	135	100
I understand the explanation of my teacher using _____ instruction.	70	51.9	65	48.1	135	100
I asked questions whenever necessary for clarifications in _____ language.	111	82.2	24	17.8	135	100
Teaching the course in _____ is desirable to me.	38	28.1	97	71.9	135	100
If teachers that teach engineering subjects have perfect competence in _____, student's learning of the subject matter will be facilitated.	32	23.7	103	76.3	135	100
If the students have a firmer background in _____, their success in engineering courses will be increased.	16	11.9	119	88.1	135	100
If the teacher asked a question in _____, we have to try our best to answer it.	34	25.2	101	74.8	135	100
_____ as a medium of instruction has a positive effect on the productivity of engineering instruction.	40	29.6	95	70.4	135	100
_____ as a medium of instruction helps to arouse my interest in the subject.	53	39.3	82	60.7	135	100

As far as the majority of the participants were concerned, English as their chosen language of instruction. They believe that English is helpful and appropriate for Engineering. English is used as a standard medium of communication in engineering education worldwide, whether it is for gaining information through books, writing scientific studies, making oral presentations, or delivering papers at seminars and conferences. (Shrestha et al., 2015)

Teachers must be proficient in oral and written communication to serve the educational needs of their students, but, in any language, competence is vital to providing instruction. Participants believed that the teachers' English competence would facilitate students' learning of the subject matter. It also arouses their interest in the subject because they tried their best to answer the questions of the teacher using the English language. This practice develops their knowledge of the subject matter and their competency in the English language. Wu & Lee (2017) noted that the students' attitudes to English have a beneficial impact on their drive to learn English, and their actions reflect this encouragement. Therefore, if the students have a firmer background in English, it increases their success in engineering courses. Shrestha et al. (2016) state that the careers of Engineers rely heavily on their ability to communicate in English. They will need English from the time they begin as students to the time they retire as engineers.

Whereas participants still need the Filipino language when asking for clarifications from their teachers. Their values and beliefs linked to their attitudes promote or discourage their linguistic preferences in scholarly or casual contexts in their everyday practices (Nodoba, 2010). They believe that their native tongue, Tagalog and/or the vernacular, are used more frequently in informal settings, while English is commonly used in formal settings. (Borlongan, 2009). Hence, English and Filipino languages play an essential role in the educational process. English is perceived as the language for teaching, and Filipino will act only as a support in the educational process.

Table 2. Mean Scores of Both Groups

Group	Pre-test		Post-test		Mean Gain
	Mean	Standard Deviation	Mean	Standard Deviation	
Experimental	7.1	2.479	14.28	2.879	7.18
Controlled	7.64	2.693	13.92	2.698	6.3

Table 2 shows the pre-test and post-test results of the Experimental and Controlled Group. Pre-test and post-test were used to compare the performance of two languages before and after the intervention. The pre-test was given before implementing the program and the post-testing after the program's implementation. Participants in the Controlled Group took the tests in the English language and the Experimental Group in the Filipino language.

It also revealed that the pre-test mean score of the experimental group was 7.1 while that of the controlled group was 7.64. The post-test mean scores for both experimental and controlled groups were recorded as 14.28 and 13.92, respectively. Furthermore, the mean gain based on the differences between the pre-test and post-test scores of each group indicated 7.18 for the experimental group and 6.3 for the controlled group. It only shows that students' performance in engineering courses was better when taught using the Filipino language. Engineering courses are similar to Mathematics which consist of computations and problem-solving activities. In the case of Mathematics, the results corroborated Espada's (2012) findings that students who studied Math in a native language gained superior Mathematics comprehension more quickly than anyone who learned Math in a foreign language. Without competence in the instructional language, even students with strong potential in Mathematics were likely to struggle, as the language barrier caused a significant distance between them and the concepts/skills to study. The most important thing in dealing with students' achievement is the assurance that the students truly understand the concepts of the study. And the understanding of concepts depends on the ability of the students to comprehend using the language used in the teaching and learning process.

Table 3. t-test Results for the Difference in the Performance of two languages before and after the intervention

Compared Groups	d.f.	Mean	s.d.	Computed Value of t	Critical Value	Interpretation
Pretest Experimental Controlled	133	7.1 7.64	2.479 2.693	-1.218	1.96	No Significant Difference
Posttest Experimental Controlled	133	14.28 13.92	2.879 2.698	0.747	1.96	No Significant Difference

The t-test computations reveal no significant difference in the performance of the two languages before and after the intervention. There is no difference between the controlled and the experimental group, which means that students taught in English and Filipino have the same performance level after the treatment.

This is similar to Khashi'ie et al. (2017), which revealed no significant difference for each trigonometric question, even though the percentage of the post-result was higher. Students were found to have misunderstood the questions and had little practical application for the concepts taught. Moreover, in the teaching of Secondary Physics, it was found that the non-significant difference in the effect of Computer-Assisted Instruction (CAI) and conventional methods may be attributed to the mode of delivery. (Rosali, 2020)

Therefore, all possibilities remain to affect the performance of the groups in this present study. And possibly, there are not enough people in the two groups to establish a significant difference.

Table 4. Correlation Matrix between the Participants' Profile and Performance in the Posttest

Profile		Posttest
Gender	Pearson Correlation	-0.027
	Sig. (2-tailed)	0.757
	N	135
GPA	Pearson Correlation	-0.177
	Sig. (2-tailed)	0.040
	N	135

Table 4 shows the relationship between the participants' profile and their performance after the test.

The gender of the participants has a moderately small negative correlation to their performance after the test (-0.27), which shows that when the performance of the male increases, the female decreases, and vice versa. In particular, all of the participants have the motivation and the ability to achieve their desired goals through their performance in the class. Scales (2000) found a slight relationship between gender and project grades; however, it did not seem to exist between gender and post-test grades. Similar to the study of Ajai & Imoko (2015), the gender factor is not significant in the male and female students' performance mean grades in algebra when taught using the PBL technique. In the classroom, both genders are capable of winning and cooperating. Gender disparities in school achievement, as stated by Duckworth & Seligman (2006) reported, have been said to stem from a young child's innate ability to regulate their behavior (as cited in Weis et al., 2013). On the other hand, Amedu (2015) found that when boys were taught Biology using the Jigsaw technique, they performed slightly better than females. More testing is needed to vary the system so that both boys and girls achieve the best advantage that the method has to provide. There will be a need to conduct additional research into other variables such as grouping strategies, group dynamics, and other data collection techniques, especially from girls, to determine how they performed during the lessons.

Moreover, the Grade Point Average (GPA) on the pre-requisite subject has a very small negative correlation to their performance after the test (-.177). Even though the GPA in the pre-requisite subject is an essential requirement, it is only a gauge of the student's preparedness to take the next course/subject. In the present study, all of the participants passed the pre-requisite subject that only

shows readiness and has the proper background for the study. However, Sulphey et al. (2018) claimed that the scores in the standardized eligibility test are a definite predictor of success in university GPA. A standardized eligibility test is like a pre-requisite subject that needs to pass to pursue or enter the university. It only means that the GPA in the pre-requisite subject is considered a predictor of success in the present subject/course.

Conclusion

The primary purpose of the study is to determine which language is more effective in teaching engineering courses at the tertiary level in selected universities. Most of the studies conducted similar to this study compare the effectiveness of two languages in teaching Mathematics and Science subjects at primary and secondary levels. That is why the author investigates which language is more effective as a medium of instruction in teaching Engineering courses at the tertiary level.

There was a strong preference for using English as a medium of instruction in the general perception of the medium of instruction. The Filipino language is still used as strategic competence, especially when asking questions for clarifications. Language barrier becomes the focal problem in terms of concepts taught in English. And Filipino language becomes the resort when the topic needs direct instruction and immediate explanation.

The result of the tests signifies that both groups considerably improved from the pretest to the posttest. Considering that the t-test revealed no notable difference in results of the languages before and after the intervention, all processes that affect the teaching and learning might help or distract the students' understanding. Engineering faculty members should explore possibilities and other strategies to ensure the achievement of the students.

All of the participants have a background in the course as shown on their Grade Point Average (GPA) on the pre-requisite subject, and there is a possibility that it has a minimal impact on their performance on the present course/subject. However, still, their academic performance does not depend on their background knowledge. As revealed in the test of correlation, there is a very small negative correlation between the GPA of the pre-requisite subject and the participants' performance after the test. Pre-requisites are essential requirements but do not guarantee competence and achievement. Also, the gender of the participants does not have a direct effect on their performance in the class. As revealed in this study, there is a moderately small negative correlation between gender and performance after the test. Both males and females enjoy similar learning experiences in engineering courses.

This research is constrained in that it was conducted with a small number of participants focusing solely on one subject. Similar studies can be performed on a wider group of subjects and at various educational stages so that the results can be accurately represented. A more detailed and multifaceted study of academic achievement can also be carried out with the use of various data collection instruments in addition to the pre-test, post-test, and surveys. Revisiting the curriculum for evaluation and the inclusion of language enrichment and an intensive language program for the students and faculty members is also recommended. The research, however, was limited to engineering education, with implications for other disciplines.

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