

Effects of Using Mother Tongue as a Medium of Instruction for Physics Class

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Abstract

This study explored the impact of employing Mother tongue as an instructional medium in one of the Education Department's programs at the university level. More specifically, it sought to find out the academic performance of General Physics students in mother tongue-based instruction in Visayas State University, Baybay City, Leyte. It specifically aimed to determine the gender and native language of the students, differentiate the academic performance of students in Physics in the mother tongue class and English class. More so, it adopted a quasi-experimental approach in which pre- and post-tests were administered to General Physics students enrolled in School Year 2017-2018. In the experimental group, Mother language was employed as the medium of teaching, whereas English was used in the control group. The lesson plans for both groups were identical, but the instructional medium was varied. Data were statistically treated using frequency, percentage, descriptive statistics, matching T-test, Z-test, and F-test. Findings revealed that the post-test academic performance of both groups in Physics was found to be superior than that of the pre-test. There is no significant difference in their academic achievement when grouped according to gender. The medium of teaching in Physics class has no impact on the academic achievement of pupils. Still, Physics was recommended to be taught with activities and instructional methodologies regardless of the language of education.

Keywords: mother-tongue based multilingual education (MTBMLE)

Introduction

Over the years, Physics has been viewed as one of the most challenging topics by students. The academic performance of pupils in this field is unsatisfactory, and this situation requires rapid attention. Consider the medium of education utilized in Physics class as a consideration.

As eloquently stated by Quizmundo (2016) in the Philippine Daily Inquirer that few students have the courage to enroll in courses that the government deems essential for the country's growth. These courses include Physics-related courses. It is undoubtedly a difficulty for instructors to make the topic enjoyable and engaging. Teaching methods and tactics are developing to fit the demands of the students. The medium of instruction is a factor to consider while choosing a certain technique of education. The Department of Education Order No. 16 s. 2012 stipulates that beginning with the 2012-2013 School Year, Mother Tongue-based Multilingual education will be implemented in all public schools, particularly in Grade I, as part of the K-12 Curriculum.

Implementing mother language as a medium of teaching is not necessary in colleges and universities. To increase the academic performance of students and to enhance classroom education, however, it is vital for instructors to test and experiment with a variety of teaching approaches. According to CHED Chair Patricia Licuanan (2015), "With science and technology courses being severely under-enrolled, the necessary human resources for research and development would be unavailable. This will negatively affect national growth and international competitiveness." To do this, it is necessary to generate highly qualified individuals, including researchers and scientists who can invent intellectual items and businessmen and entrepreneurs who can translate discoveries into economically viable

products. She stated: In postsecondary education, the language of teaching for science and mathematics courses is English.

The English proficiency of Filipinos is seen as a competitive advantage in the global employment market. Foreign competition and a decline in English proficiency among Filipino college graduates are replacing it. IDP Education Pty. Ltd. Philippines, a certified organization that administers the International English Language Testing System (IELTS) to Filipinos seeking employment and migration abroad, has recently released language test results indicating that the Philippines is no longer Asia's foremost English-speaking nation. The Aquino administration reformed the education system in the Philippines. In June 2012, the 10-year basic education was changed into a K-12 education. In the current system, pupils cannot join first grade unless they have completed kindergarten, and the primary school years remain unchanged. Junior high is a four-year program, whereas senior high is a two-year program. In tandem with these modifications, the Mother tongue-based Multilingual Education strategy was implemented (MTB-MLE). The Department of Education (DepEd) stated in a press release in March 2012 that MTB-MLE under the K+12 system comprises teaching a child's mother tongue from kindergarten through third grade (Mondez, 2013). DepEd has designated just twelve main regional languages as "mother tongue" intended for the first four years of elementary school – Kapampangan, Tagalog, Iloko, Pangasinense, Maranao, Chabacano, Hiligaynon, Waray, Bikol, Cebuano, Tausug, Maguindanaoan, (Mondez, 2013).

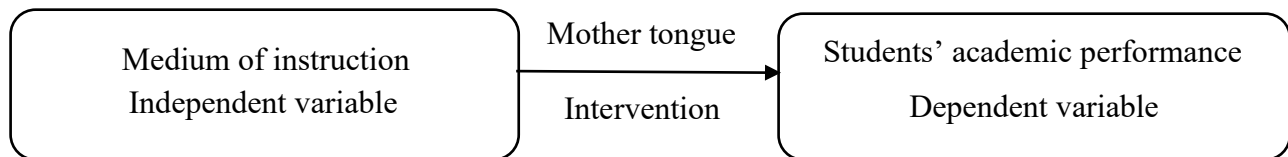
In addition, many wealthy nations struggle to recruit outstanding young learners into physics teaching schools (Smithers & Robinson, 2005). Even the United States and Canada seek scientific professors in the Philippines, which has a chronic scarcity of experienced and qualified physics teachers (Locay-locay & Gallos, 2002). There is a dearth of Physics instructors, and enrollment in Physics-related courses is declining. Unsurprisingly, the quality of Physics education in the United States has dropped.

This study will assess the efficiency of employing mother tongue as the medium of teaching in a college-level physics course. Instructional medium affects students' perspectives about Physics. In most underdeveloped countries, mother-tongue education increases learning. Reinforcements reduce repetition, failure, and dropouts and boosts self-esteem, confidence, and academic aspirations (UNESCO, 2006). L1 classes let students express themselves, participate in arguments, and strengthen their intellects. In submersion classrooms, pupils are forced to cooperate, sit silently, or repeat routines, causing annoyance, failure, and dropout (Benson, 2004). Most of the heads and principals, teachers, and children's parents in the program discovered that students who begin learning in their home language ask more questions, are more self-confident as learners, learn to read and comprehend more easily, take an active part in classroom discussions, learn to read and write more easily and articulate themselves effectively in writing, and understand language both orally and written efficiently and with enhanced comprehension. (Benson, 2004).

This research is strongly connected to and grounded in Ricablanca's work (2014). His work is titled *The Impact of Mother-Tongue-Based Instruction on Pupils' Mathematics Achievement*. According to (Ricablanca, 2014), when students are taught using their mother language as the medium of instruction, their level of accomplishment on the pre-test, post-test, and retention test increased more than the achievement of students who were instructed in English. Although the results acquired by students in mother-tongue-based education are not very high, they surpass the scores earned by students in English-based instruction. There is a considerable gap in the mathematics performance of students who are taught in their home language and those who are taught in English. The performance of the students in their native language is much greater than that of those in classes where English is the medium of teaching. When students are categorized by gender in either of the two groups, there is no discernible difference in mathematics performance. In addition, there is no substantial difference between ethnicity and success in mother tongue teaching. However, in English education, there is a considerable disparity in success between learners of Cebuano and those of other ethnicities.

A comparable research (Nekatibeb, 2012) found that pupils who studied Grade 8 Math, Physics, Chemistry, and Biology in their mother language had much better average results than those who studied these subjects in their non-mother tongue. The foundation of this work is James Cummins' interdependence theory of language. Cummins felt that once a person has mastered their original language, they are ready to acquire a second language. According to him, it is of the utmost importance to encourage students to continue developing their native language proficiency. Even more, he urged that parents assist their children in acquiring their original language by discussing their academic performance in their home tongue. To properly study a second language, one must not abandon his native tongue, but rather continue to master it. In light of the fact that Filipino college graduates' command of the English language is deteriorating, the main goal of this study is to evaluate the efficacy of employing the native language or mother tongue as medium of instruction.

In this study, the independent variable is the medium of instruction while the dependent variable is the students' academic performance indicated by their scores. By the use of mother tongue as a medium of instruction will improve students' academic performance.



Objectives of the Study

This research meant to find out the academic performance of the Physics 11 (General Physics) students in mother tongue-based instruction in Visayas State University. Specifically, it sought to fulfill the following specific objectives:

1. Determine profile of the students in terms of gender and mother-tongue.
2. Evaluate if there is a significant difference between the mean scores of students' academic performance in Physics in the experimental group and control group when they are grouped based on gender.
3. Assess if there is a significant difference of students' Physics academic performance on Pre-test and Post-test in both groups.
4. Determine the significant difference of students' Physics academic performance between the experimental group and control group.

Methodology

Quasi – experimental design was employed in this study. There is a control group and experimental group. When it comes to teaching Physics, the group that was subjected to the experiment had their native language serve as the medium of instruction in the classroom, while the group that served as the control had English serve in that capacity. The comparison of students' results on the pre- and post-tests is used to identify any substantial changes in the students' academic performance in Physics. The researcher served as the instructor for both sessions throughout their allotted class time.

The enrolled Physics 11 (General Physics) students of Visayas State University on the First Semester of School Year 2017 – 2018 served as the respondents of this study in the experimental group. The class of another faculty was used as the control group. The researcher herself made the lesson plan about Heat Transfer. Content expert is consulted to validate the material. The two lesson plans were parallel and identical but the medium of language used was varied. For the control group, the English lesson was used, and for the experimental group, Mother tongue lesson plan was used. The lesson plan in the experimental group was written in Cebuano instruction which is translated by

the researcher from the English lesson plan. However, if it so happen that some of the terminologies cannot be translated to mother tongue, the researcher will use the quotation mark symbol (“ ”) to quote the term.

For the test questionnaires used in pretest and posttest, the researcher used a prepared questionnaire about Heat Transfer and a content expert was still consulted to validate the material. Pilot testing was conducted to students who have undergone Physics last semester. The test questionnaire for the experimental group is in Cebuano while the test questionnaire for the control group was in English.

The main source of data was the students' response to the questions in a form of quiz. The researcher herself handles the two classes to minimize the effect of diverging teachers. The study was conducted on the first week of November 2017. Before conducting the study, a pretest is given to both groups. This was to determine whether the two groups are indeed comparable in the first place. The two groups were taught with the same lesson but with different medium of instruction. After the discussion of the two groups, same test was given to both as their posttest.

Various statistical tools were used to analyze the data. Frequency and percentage is used to describe the profile of the Physics 11 students in terms of gender and mother tongue used. Descriptive statistics was used to determine the comparability of both classes' pre-test scores. Frequency and percentage is used to show the distribution of scores in both classes. Matched T-Test was used to test of significance in the difference between posttest and pretest mean scores in both classes. T-test was used to test the significance in the difference between the mean scores of posttests and pretest when grouped according to gender in the both classes. F-test was used to test the significance in the difference between the variability of scores in posttest and pretest when grouped according to gender and Z-test was used to test the significance in the difference between the mean scores in posttest and pretest when grouped according to gender.

Results and Discussions

1. Profile of Students in terms of Mother Tongue and English Class

Below shows the profile of students in the experimental group and control group.

1.1. In terms of Mother tongue class

Table 1
Profile of Students in the Mother tongue Class

Profile	Frequency	Percentage
Gender:		
Male	21	36
Female	37	64
Total	58	100
Mother Tongue:		
Cebuano	50	86
Others:		
Waray	6	10
Tagalog	2	4
Total	58	100

The total number of students in the Mother tongue class is 58. As exhibited in Table 1, there are 37 female students (64%) and 21 male students (36%). Fifty of them (86%) consider Cebuano as their mother tongue while 8 of them (14%) are Waray-waray and Tagalog. In the English class, the total number of students is 29. From this table, it highlights that most students in the experimental group consider Cebuano as their mother tongue and only a few do not.

1.2. In terms of English class

Table 2
Profile of Students in the English Class

Profile		Frequency	Percentage
Gender	Male	14	48
	Female	15	52
	Total	29	100
Mother Tongue			
	Cebuano	27	93
Others:	Tagalog	2	7
	Total	29	100

As shown in Table 2, 14 among all students in English class (48%) are males while 15 of them (52%) are females. Majority (93%) of them considers Cebuano as their native language while only two of them (7%) are Tagalog. Similar with the experimental group, majority of the students in the control group have Cebuano as mother tongue.

2. Descriptive Statistics of Students' Mean Scores in Pretest and Posttest for Both Experimental and Control Group

Table 3
Pre-test Mean Scores of the Mother tongue Class and English Class

	N	Mean	Std. Deviation
	Statistic	Statistic	Std. Error
Experimental Group	58	2.5690	.19228
Control Group	29	2.1379	.23132
Valid N (listwise)	29		

The results of the pre-test, including both groups' mean scores, are displayed in Table 3. It is evidence that the two classes are, in fact, comparable from the beginning. The experimental group had a mean score of 2.57, whereas the control group received a score of 2.14. The gap between the two classes' average scores is not very significant but rather significantly smaller. From this, the comparison between the two classes could proceed.

Table 4
Frequency Table of Post-test Scores in the Mother tongue Class

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	1.7	1.7
	3.00	7	12.1	13.8
	4.00	14	24.1	37.9
	5.00	18	31.0	69.0
	6.00	13	22.4	91.4
	7.00	2	3.4	94.8
	8.00	1	1.7	96.6
	9.00	2	3.4	100.0
Total	58	100.0	100.0	

Table 4 flashes the frequency and descriptive statistics of the experimental group's scores in the post-test. The class's average score is 4.09 while the mode indicates that most students (31%) got a score of 5. 14 students (24.1%) got a score of 4, 13 students (22.4%) got a score of 6, 7 of them (12.1%) got a score of 3, 2 of them (3.4%) got a score of 9, 2 also of them (3.4%) got a score of 7, 1 student (1.7%) got a score of 8 and another student (1.7%) got a score of 2. The scores of the students in the experimental group are relatively low since most students got a score of 5 out of 10. The passing score is 60% and so, only 13 students passed the short quiz.

Table 5
Frequency Table of Post-test Scores in the English Class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	3	5.2	10.3	10.3
	3.00	5	8.6	17.2	27.6
	4.00	5	8.6	17.2	44.8
	5.00	7	12.1	24.1	69.0
	6.00	3	5.2	10.3	79.3
	7.00	5	8.6	17.2	96.6
	9.00	1	1.7	3.4	100.0
	Total	29	50.0	100.0	
Missing	System	29	50.0		
Total		58	100.0		

In the control group, as shown in Table 5, their average score is 4.76 which is a bit higher than the average score of the Mother tongue class but most of the students (24.1%) also got a score of 5, similar to the Mother tongue class. 5 of them (17.2%) got a score of 3, 5 of them (17.2%) got a score of 4, also 5 of them (17.2%) got a score of 7, 3 students (10.3%) got a score of 2, 3 students (10.3%) also got a score of 6, and another student (1.7%) got a score of 9. The majority of the students in the control group received a score of five out of ten, which results in relatively low scores for those learners. Because the passing mark was set at sixty percent, there were only seven students who were successful in passing the little quiz.

3. Test of Significance in the Difference between Posttest and Pretest Mean Scores of Male and Female Students in Both Groups

Table 6
Test of Significance in the Difference between Posttest and Pretest Mean Scores in the Experimental Group (using Matched T-Test)

Variable	Observations	Mean Difference	Standard Deviation of Difference	Test Statistic (T) Value	p-value
Overall	58	2.37931	1.715027	10.5656***	0.000
Female	37	2.162162	1.536835	8.5578***	0.000
Male	21	2.761905	1.972429	6.4168***	0.000

***-Significant at 0.01%

In Table 6, shown is the test of significance in the difference between posttest and pretest mean scores in the experimental group using matched T-test. Statistically speaking, both males and females in the mother tongue group show improvement in their academic performance as indicated by their scores in the post-test. With this result, the null hypothesis is rejected. There is a significant difference in the scores of students between the pre-test and post-test in the mother tongue group for both males and females.

Table 7

Test of Significance in the Difference between Posttest and Pretest Mean Scores in the Control Group (using Matched T-Test)

Variable	Observations	Mean Difference	Standard Deviation of Difference	Test Statistic (T) Value	p-value
Overall	29	2.62069	2.007376	7.0305***	0.000
Female	14	2.142857	1.875229	4.2757***	0.0005
Male	15	3.066667	2.086236	5.6931***	0.000

***-Significant at 0.01%

Table 7 illustrates the test of significance in the difference between post-test and pre-test mean scores in the control group using matched T-test. Both males and females in the control group displays an improvement in their academic performance in both pre-test and post-test. With this result, the null hypothesis is rejected. There is a significant difference in the scores of students in the English group for both males and females.

4. Test of Significance in the Difference between Posttest and Pretest Mean Scores of Students in Both Groups when Grouped According to Gender

Table 8

Test of Significance in the Difference between the Mean Scores of Posttests and Pretest When Grouped According to Gender in the Experimental Group

Variable	Observations	Mean	Standard Deviation	Test Statistic (T) Value	p-value
Pretest	58	2.568966	1.464337		
Female	37	2.567568	1.424791	-0.0096 ^{ns}	0.9924
Male	21	2.571429	1.567528		
Posttest	58	4.948276	1.40703		
Female	37	4.72973	1.21675	-1.5911 ^{ns}	0.1172
Male	21	5.333333	1.65328		

Equality of Means (using T-Test), ns-Not significant

The result of the T-test in Table 8 illustrates that the mean scores in both tests in the mother tongue group of both gender in pre-test and post-test are statistically equal. The null hypothesis is accepted. There is no significant difference in the mean score of students when grouped according to gender in both pre-test and post-test.

Table 9

Test of Significance in the Difference between the Mean Scores of Posttests and Pretest When Grouped According to Gender in the Control Group

Variable	Observations	Mean	Standard Deviation	Test Statistic (T) Value	p-value
Pretest	29	2.137931	1.245682		
Female	14	2.214286	1.121714	0.3137	0.7561
Male	15	2.066667	1.387015		
Posttest	29	4.758621	1.785961		
Female	14	4.357143	1.446861	-1.1776	0.2492
Male	15	5.133333	2.030717		

Equality of Means (using T-Test)

ns-Not significant

The result of the T-test in Table 9 demonstrates that the mean scores in the English group of both gender in pre-test and post-test are statistically equal. The null hypothesis is accepted. There is no significant difference in the mean score of students for both tests when grouped according to gender.

5. Test of Significance in the Difference between the Posttest Mean Scores of Students in Control Group and Experimental Group

Table 10

Test of Significance in the Difference between the Variabilities of Posttest Scores in the Experimental Group and Control Group Using F-test

Variable	Observations	Mean	Standard Deviation	Test Statistic (F) Value	p-value
Control	29	4.758621	1.785961	1.6112 ^{ns}	0.1277
Experimental	58	4.948276	1.40703		

Equality of Variances (using F-Test)

ns-Not significant

As displayed in Table 10, the variability of scores across the control and experimental group is equal. This indicates that there is no significant difference in the variabilities of scores of scores between the experimental group and control group.

Table 11

Test of Significance in the Difference between the Mean Scores of Posttests in the Experimental Group and Control Group Using Z-test

Variable	Observations	Mean	Standard Deviation	Test Statistic (Z) Value	p-value
Control	29	4.758621	1.785961	0.5407 ^{ns}	0.2943
Experimental	58	4.948276	1.40703		

Equality of Means (using Z-Test)

ns-Not significant

Table 11 shows that the mean scores of the two groups are statistically equal. This means that the null hypothesis is accepted. There is no significant difference in the Physics academic performance between the experimental group and the control group.

Conclusions

The mother tongue class has 58 students with 37 females and 21 males. Majority of them considers Cebuano as their native language while only 8 of them are Waray-waray and Tagalog. In the English class, there are 29 students with 15 females and 14 males. Most of them noted that their native language is Cebuano while only two (2) of them said that their native language is Tagalog and Ilonggo. The two groups have low scores in the pre-test but based on the result, there is a significant difference observed in their post-test. Both males and females of the two groups show an improvement in their Physics academic performance.

When grouped according to gender, both in pre-test and post-test revealed that there is no significant difference in the experimental and control group. Females' and males' academic performance in both groups are statistically equal. The academic performance of the experimental group and the control group is statistically equal too. Comparing the academic performance of the two groups, it was found that it has no significant difference. Gender does not contribute as a factor in achieving high academic performance in Physics class.

Recommendations

Based on the data gathered, it suggests that Physics must be taught with activities and teaching strategies without considering the medium of instruction used.

For future studies, the class size of the two groups must be equal or almost equal. According to (McKeachie, 1990), in large classes, the discussion time becomes uneven among students and instructors may rely on passive lecturing, assign less written homework or fewer problem sets, and may not require written papers.

Their courses must also be considered to identify whether their course is Math or Physics-related. A class with plenty of Math or Physics-inclined students will perhaps attain higher academic performance than the other class.

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