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Use of Filipino Language as Medium of Instruction in Teaching Advanced Algebra Class

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Abstract

This study aimed at testing the effectiveness of using Filipino language in teaching Advanced Algebra compared to the use of English Language. It described the performance of two groups of students in solving problems in Advanced Algebra before and after a series of instruction using pre-test and post-test design and testing whether there is a significant difference between the post-test scores of the two groups of subjects. This study was conducted in Nueva Ecija University of Science and Technology – Sumacab Campus and selected 3rd year bachelor students of secondary major in Mathematics (14) as subjects. The subjects were statistically divided into the control group and the experimental group based on their problem-solving skills in Advanced Algebra. The study used the experimental design of research. T-test was used for dependent and independent samples to test whether there is a significant difference between the pre-test and post-test scores of the groups and between the post-tests of the two groups. Results revealed that there is enough statistical evidence to accept the null hypothesis that there is no significant difference in the problem-solving skills of subjects under the control group in the pre-test and post-test. Also, after applying statistical treatments, it made enough statistical evidence to reject the null hypothesis that there is no significant difference in the problem-solving skills of subjects under the experimental group in the pre-test and post-test. Also, it reveals the rejection of the hypothesis that there is a significant difference in the problem-solving skills of the students between the two groups after instruction.

Keywords: Mathematical Proficiency, Advanced Algebra, Language, Problem Solving Skills, Instruction

Introduction

Algebra plays a vital role in mathematics. It involves finding the value of the unknown variable, factoring a given equation, simplifying functions. Algebra supports logic skills and introduces abstract thinking. According to California's Mathematics Framework, Algebra helps learners to reason symbolically and mathematically, as an outcome of this, their solving skills will increase dramatically and they will be able to solve complex types of equations and word problems. This problem—solving and critical thinking skills can help students succeed in their lives and jobs even if they do not continue their education beyond high school (Star et al., 2015).

In many studies with regards to mathematics, some students experience difficulties. It is perceived as difficult, monotonous and has limited meaning and little relevance to life. Habitual disinterest and absence of motives in mathematics lead to math avoidance as well as low learning efficiency thus making math learning a persistent nightmare for some learners. Many researchers have tried to change this wrong perception and enhance mathematics teaching and learning process through series of studies and practices (Mac Gregor as cited by Mazana et al., 2019).

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It was proved that one known factor that affects problem solving skills of students especially in the field of Mathematics is language. Language refers to the systematic means of communicating ideas or feelings by the use of conventionalized signs, sounds, gestures or marks having understood meaning (Chinyoka & Naidu, 2013, as cited by Guzman, 2018).

Many schools in the Philippines use Filipino as the medium of instruction in teaching different subjects. However, in the assessment, the examinations constructed were in the English language. Thus, conflict of the medium of instruction and assessment arises. One government program to cater this conflict is the implementation of Multilingualism in the current curriculum of the Philippines (Demavibas, 2012, as cited by Launio, 2015).

According to Launio (2015), multilingualism should support the preserving, development and enhancing of the national language and culture. In the country, the English language is currently used in giving instruction in mathematics, which is a general problem to some classroom teachers. Complaints from classroom mathematics teachers say that learners could hardly understand simple English as a medium of instruction in mathematics lessons thus making mathematics more difficult to understand. To cater these complaints, Mathematics teachers nowadays use Filipino as a supplement in the instruction. However, regardless of this kind of supplementation with the Filipino language, the assessment of topics in mathematics taught in Filipino were still in the English language thus violating the rule of assessment that the medium of language used in instruction must be aligned or similar with that of the assessment. Thus, this may be one of the different reasons for the poor problem solving skills of students in their mathematics subjects.

Mathematical word problems occupied a lot of the attention of multilingual pupils, particularly when they were translated from English to mathematical symbols. The majority of these studies identified vocabulary acquisition or difficulties with math register as the main difficulties that bilingual pupils encountered. This focus is reflected in recommendations for education for English language learners that prioritize vocabulary and reading comprehension abilities. On the other hand, recent research on the acquisition of mathematics has focused on the ways in which students create various meanings, negotiate meanings through interactions with peers and teachers, and engage in mathematical communication. Few studies have focused on mathematical communication in bilingual classes, despite the fact that research has examined it as a key component of learning mathematics in monolingual classrooms (Moschkovich, 2010, as cited by Sharma & Jourdain, 2016).

The need to connect with students is necessary to successfully transfer learning. Thus, the medium of instruction plays a role. Success in mathematics is also influenced by the medium of instruction used inside the class (Launio, 2015).

It clearly shows that language plays a vital factor in the Problem solving skills in the field of Mathematics. Bearing this in mind, many researchers sought to study the roles of language in learning Mathematics (Chinyoka & Naidu, 2013, as cited by Guzman, 2018). With these facts, it implies that a study regarding the consistency of the language used in teaching and assessing problem solving skills may be conducted. Furthermore, the researchers of this study aimed to determine the effect of the use of Filipino language supplemented with English as the medium of instruction and assessment in the learning mathematics specifically Advanced Algebra.

Statement of the Problem

This study aimed to investigate the effect of the use of Filipino language as a medium of instruction in Advanced Algebra class.

Specifically, the study sought to answer the following:

1. How may the problem solving skills of the students be described before the instruction in the

1.1 Control group; and
1.2 Experimental group?

2. How may the problem solving skills of the students be described after the instruction in the
2.1 Control group; and
2.2 Experimental group?

3. Are there significant differences in the problem solving skills of students under the
3.1 Control group; and
3.2 Experimental group;
before and after the instruction?

4. Is there a significant difference in the problem solving skills between the two groups of students after the instruction?

Research Method

Research Design

This study utilized true experimental research. Experimental research describes "what will be" when certain variables are carefully controlled and manipulated. It is the only method that can truly test hypothesis concerning cause and effect relationships (Cortez, 2015, as cited by Alvarez, 2021).

The researchers divided the subjects into two groups; experimental and control group. The effect of difference in medium of instruction was exposed by means of the problem solving skills of the subjects. Their problem solving skills were described by the result of assessment tool were determined and compare thus, the use of this method of research is the most appropriate.

This study used both qualitative and quantitative methods of research comprising in two phases. Phase 1 was determining the significant difference between the scores of the two groups. Qualitative method of research may utilize to describe the difference in the learners' way of presenting their solutions.

Subjects of the Study

This study was implemented to 3rd year BSE – Mathematics Major Students from Nueva Ecija University of Science and Technology, Sumacab Campus with a total population of 14 students. Participants consist of four (4) male and 10 female students who have taken Advanced Algebra (SEM 5) during the period when the study was conducted. The participants were divided into two groups; the control group was exposed to Mathematics instruction in English only and the experimental group was exposed to Mathematics instruction in Filipino supplemented with English. The basis of dividing the participants to each group is the result of the Mathematical Proficiency Test administered before the experiment.

Results of Mathematical Proficiency Test

Table 1: Results of the Mathematical Proficiency Test

Student	Student Number in Groups	Score	Verbal Interpretation	Group
A	1	40	Very High	Control
B	1	40		Experimental
C	2	39	Very High	Control
D	2	39		Experimental
E	3	38	Very High	Control

F	3	38		Experimental
G	4	37	Very High	Control
H	4	37		Experimental
I	5	36	Very High	Control
J	5	36		Experimental
K	6	35	Above Average	Control
L	6	35		Experimental
M	7	31	Above Average	Control
N	7	31		Experimental

Table 1 shows the results of the mathematical proficiency test conducted among the subjects to serve as the reference for the division among two groups. Table 1 shows that the score was equally distributed. The subjects were coded in a numerical code to show that each group has 7 subjects. Prior observation of the subjects was done to seek for the consistency and validity of the division of the subjects. The subjects' final grades in Advanced Algebra were also taken in consideration but treated with confidentiality.

Table 2: Mean Score and Standard Deviation of the two Groups

	Experimental Group	**Control Group**
Mean Score	36.57	36.57
Standard Deviation	2.7701	2.7701

According to Table 2, it was clearly shown that the mean scores of the two groups were equal. Also, the standard deviations of the two groups were also equal. This implies that the scores in the two groups were statistically distributed and has a common variability.

According to Table 2, it was clearly shown that the subjects were equally distributed among the two groups considering the results obtained for the mathematical proficiency test.

Instruments

This study made use of instruments that was of help to obtain the data and for the success of the study. This study used i.) Mathematical Proficiency Test in Advanced Algebra, ii.) Learning Plans in English and Filipino and iii.) Teacher Made Test, the Problem Solving Test in Advanced Algebra.

i.) Mathematical Proficiency Test in Advanced Algebra

Description. Mathematical Proficiency Test in Advanced Algebra is a teacher-made test which contains items in selected topics in Advanced Algebra. It is multiple choice type of test that contains 45 items with four (4) choices each. This was the basis for dividing the subjects into their respective groups. A Table of Specification of Teacher-made Test Questionnaire was prepared for this purpose.

Validation. The draft form of proficiency test was checked by an expert in the field of Mathematics and was pilot-tested to college students who were not members of the sample and have taken Advanced Algebra. After the pilot-testing and analyzing the internal consistency, the 50 item test later became 45 with an alpha index of 0.710.

ii.)Learning Plans

Description. Learning plans are a teacher made learning plans that served as the guide in giving the instruction. Each learning plan comes in two languages, one in English and the other one translated in Filipino. The topics in the learning plans were based on the syllabus of instruction for advanced algebra.

Validation. The learning plans were validated by experts in the field of mathematics and in the field of language. Some recommendations were given for better use in the instruction. Revisions were made incorporating the recommendations.

iii.) Problem Solving Test in Advanced Algebra

Description. Problem Solving Test in Advanced Algebra (PSTAA) is a teacher-made test which contains items in advanced algebra content of 2nd Year BSE - Mathematics. It is multiple choice type of test that contains 55 items with four (4) choices each. A Table of Specification of PSTAA was prepared for this purpose.

Validation. The draft form of PSTAA was checked by an expert in the field of Mathematics and was pilot-tested to a group of college students who have taken Advanced Algebra and were not members of the sample. After the pilot-testing and analyzing the internal consistency, the 60 item test later became 55 with an alpha index of 0.718 for the assessment tool in English and 0.759 for the assessment tool translated in Filipino.

Data Analysis

In this study, the data that were obtained was analyzed using the following statistical treatment. To describe students' performance in problem solving skills in advanced algebra before and after a series of instruction in the two groups, scores and mean score in each group was used and interpreted using the following interval.

Interval	*Verbal Interpretation*
44.2 – 55.0	Excellent
33.4 – 44.19	Very satisfactory
22.6 – 33.39	Satisfactory
11.80 – 22.59	Fair
1.0 – 11.79	Needs improvement

Mean and standard deviation were utilized to compare the problem-solving abilities of each group before and after the instruction. Additionally, Cummin's Theory and Polya's Problem Solving Techniques were utilized as the foundation for discussing how the individuals' problem-solving abilities improved.

To determine if there is a significant difference between the pre-test and post-test in each group, t – test for dependent samples was used.

To determine if there is a significant difference in the problem solving skills of the students between the two groups after instruction, t – test for independent samples was used.

Research Findings and Discussion

Problem Solving Skills of Two Groups of Students before the Instruction

Problem solving skills of students under control group before the instruction

Table 3: Problem solving skills of the Students Controlled group in Advanced Algebra before the Series of Instruction

Student	Control Group	Verbal Interpretation
1	40	Very Satisfactory
2	40	Very Satisfactory
3	40	Very Satisfactory
4	20	Fair
5	41	Very Satisfactory
6	31	Satisfactory
7	29	Satisfactory
Overall Mean Score	34.43	Very Satisfactory
Standard Deviation	7.42	

Table 3 shows the problem solving skills students under the control before the instruction. This table shows the results of the pre-test conducted in the control group.

Based on the table above, it shows that students 1, 2, 3 obtained a score of 40 out of 55 items, this was rated very satisfactory, student 4 obtained a score of 20 rated as fair, student 5 obtained 41 rated very satisfactory, student 6 scored 31 and student 7 obtained 29 both rated as satisfactory. The mean score of the control group in the pre-test was 34.43 with the verbal interpretation of very satisfactory.

Based on the result of the problem solving test in Advanced Algebra, it clearly shows that out of seven (7) students in the control group, 4 subjects obtained a verbal interpretation of very satisfactory, 2 obtained a verbal interpretation of satisfactory and one subject obtained a verbal interpretation of fair. Overall, with a mean of 34.43, the students in the control group performed very satisfactorily in the pre-test.

During the conduct of the pre-test in the control group, it was observed that the subjects have a difficulty in answering the test and some even frown answering each item. Some subjects were asking the facilitator regarding the terminologies and the mathematical concept to be used.

When asked on what are the difficulties that they have experienced in answering the questions, the students said that they have difficulty in understanding some problems because they were not that fluent in English. This implies that their competency in English affects their problem solving skills.

Based on the results obtained and observations, it can be deduced that majority of the subjects under the control group performed very satisfactorily in the pre-test, however there is a need for improvement since some of the students were not able to perform very satisfactory and thus there is a need for further instruction.

Problem solving skills of students under experimental group before the instruction

Table 4: Problem solving skills of the Students Experimental group in Advanced Algebra before the Series of Instruction

Student	Experimental Group	Verbal Interpretation
1	36	Very Satisfactory
2	30	Satisfactory
3	36	Very Satisfactory
4	31	Satisfactory
5	30	Satisfactory
6	28	Satisfactory
7	27	Satisfactory
Overall Mean Score	31.14	Satisfactory
Standard Deviation	3.31	

Table 4 shows the problem solving skills students under the experimental group before the instruction. This table shows the results of the pre-test conducted in the experimental group.

Based on the table above, it shows that students 1 and 3 of the experimental group obtained a score of 36 in a 55 items test and were rated as very satisfactory. Meanwhile, students 2 and 5 scored 30, student 4 scored 31, student 6 scored 28 and student 7 obtained a score of 27, all rated as satisfactory. The group performed satisfactory with a mean score of 31.14.

Based on the result of the problem solving test in advanced algebra, it clearly shows that out of seven (7) students in the experimental group, two (2) subjects obtained a verbal interpretation of very satisfactory and five (5) obtained a verbal interpretation of satisfactory.

Overall, with a mean of 31.14, the students in the experimental group performed satisfactorily in the pre-test.

During the conduct of pre-test in the experimental group, it was observed that when they have seen the items, they laughed and asked the facilitators if they really need to answer the items. They tried to answer each item but each item confused them and found it very difficult to answer every item.

Based on the results of the test and observations made, it can be deduced that the problem solving skills of the subjects under the experimental group needs to be improved and also the subjects needs to learn how to analyze mathematical problems presented in Filipino language.

When asked on what are the challenges and difficulties that they have experienced while answering the questions, the subjects said that they were stunned and surprised when they see each items. The subjects had a difficulty in understanding the problems since it is their first time to encounter those types of questions translated in Filipino.

The findings of the pre-test conducted in the two groups were relevantly demonstrated in Tables 3 and 4, showing that subjects in the control group scored higher than those in the experimental group. However, because the standard deviation of the control group is higher than that of the experimental group, the scores in the control group are much more dispersed than the scores in the experimental group. During the conduct of the pre-test, it was very eminent to observe that some students found it difficult to express their solutions to their answers as reflected by the way they frown during the examination period. Some were also observed to be unease while answering the same. Some even make some unnecessary movements to show discomfort.

It can be deduced from the above mentioned results that there was a room for further improvement of the students' problem solving skills in Advanced Algebra.

Problem solving skills of two groups of students after the instruction

Problem solving skills of students under control group after the instruction

Table 5: Problem solving skills of the Students under Controlled Group in Advanced Algebra after the Series of Instruction

Student	Control Group	Verbal Interpretation
1	41	Very Satisfactory
2	40	Very Satisfactory
3	42	Very Satisfactory
4	23	Satisfactory
5	39	Very Satisfactory
6	31	Satisfactory
7	30	Satisfactory
Overall Mean Score	35.14	Very Satisfactory
Standard Deviation	7.77	

Table 5 shows the problem solving skills of the students under the control group after the instruction. This table shows the problems solving skills of the subjects under the controlled group as reflected in the result of the post – test given after a series of instruction.

Based in the table above, it shows that in a 55 item test, student 1 scored 41, student 2 obtained 40, student 3 scored 43 and student 5 scored 39, all rated as very satisfactory. Meanwhile, student 4 obtained a score of 23, student 6 scored 31 and student 7 scored 30 and were all rated as satisfactory. The group performed very satisfactory with a mean score of 35.14.

The table reveals that subjects in the controlled group performed very satisfactorily in solving problems in Advanced Algebra after the series of instruction. It shows that out of the seven (7) students, four (4) got the verbal interpretation of very satisfactory and three (3) got satisfactory. When compared to the result of the problem solving skills of the subjects before the instruction, it is eminent that 5 out of 7 subjects have an increase in the score after the series of instruction. It shows that the subjects in general got an overall mean score of 35.14 with a verbal interpretation of very satisfactory.

During the post-test conducted in the controlled group, it was observed that the subjects were all focused and silently answering the items. Some took time understanding some items but with a shorter period of time compared to their performance during the pre-test.

Based on the results of the table and observations, it shows that there is an improvement in the problem solving skills of the subjects under the controlled group.

Problem solving skills of students under experimental group after the instruction

Table 6: Problem solving skills of the Students under the experimental group in Advanced Algebra after the series of Instruction

Student	Experimental Group	Verbal Interpretation
1	41	Very Satisfactory
2	39	Very Satisfactory
3	39	Very Satisfactory
4	35	Very Satisfactory
5	32	Satisfactory
6	36	Very Satisfactory
7	33	Satisfactory
Overall Mean Score	36.43	Very Satisfactory
Standard Deviation	6.13	

Table 6 shows the problem solving skills of the students under the experimental group after the instruction. This shows the result of the post – test conducted among the subjects in the experimental group after a series of instruction.

Based on the table above, it shows that in a 55 item test given after a series of instruction, student 1 scored 41, students 2 and 3 obtained a score of 39, student 4 scored 35, student 6 obtained a score of 36 and were all rated as very satisfactory. On the other hand, student 5 scored 32 and student 7 scored 33, both rated as satisfactory. The experimental group obtained a mean score of 36.43 and were interpreted to perform very satisfactory.

The table reveals that subjects in the experimental group performed very satisfactorily in solving problems in Advanced Algebra after the series of instruction. It shows that out of the seven (7) students, five (5) got the verbal interpretation of very satisfactory and two (2) got satisfactory. When compared to the result of the problem solving skills of the subjects before the instruction, it is eminent that all the subjects have consistently improved their scores after the series of instruction. It shows that the subjects in general got an overall mean score of 36.43 with a verbal interpretation of very satisfactory.

During the post - test, it was observed that all of the subjects under the experimental group was focused and silently answered the examination. None of them frowned while answering or even bothered asking their facilitator about some points in the test.

Based on the result of the table and observations, it can be deduced that the subjects under the experimental group have obtained an improvement in terms of their problem solving skills in Advanced Algebra and were able to analyzed problems presented in the Filipino language.

Comparison between the mean scores of the two groups before and after a Series of Instruction

Table 7: Comparison between the mean scores of the two groups before and after a Series of Instruction

	Before	After	Difference
Experimental	31.14	36.43	**5.29**
Controlled	34.43	35.14	**0.71**
Difference	**-3.29**	**1.29**	

The table above shows comparison between the mean scores of the two groups before and after a series of instruction. With a mean score of 34.43 in the pre-test, the mean score of the controlled group increases to 35.14 making a difference of 0.71. On the other hand, the experimental group has the greater increase from a mean score of 31.14 to 36.43 making a difference of 5.29.

The controlled group had a mean score of 34.43, which was higher than the mean score of the experimental group by 3.29 when the mean scores of the two groups were compared prior to the series of instruction. After the series of instructions, it is evident that the experimental group's mean score is higher than the control group's mean score. The experimental group's mean score increases from 31.14 to 36.43, a difference of 1.29 points more than the controlling group.

Overall, the experimental group with an increase of 5.29 in the mean score exceeded the increase in the mean score of the control group by 4.57 concluding that the experimental group have perform better that the controlled group after the series of instruction.

It can therefore be deduced from the findings of the study that the students were able to grasp the skills necessary for them to solve the problems. Such skills can be described as critical for they knew then how to see every detail in the question and used the same in formulation their solutions and explanations.

Significant Differences in the Problem Solving Skills in Advanced Algebra based on the Pre-test and Post-test of the Two Groups before and after the Series of Instruction

Controlled Group

Table 8: t-test Results of the Significant Difference in the Problem Solving Skills of Students under the controlled group in Solving Problems in Algebra before and after the series of Instruction

	Pre-test	Post-test
Mean	34.43	35.14
Sd	7.4231	7.7723
Df	7	7
Level of confidence	1%, two-tailed	
t-crit	3.707	
t-comp	-1.179	
Decision	Accept Ho	
Interpretation	Not Significant	

The t-test result of the significant difference between the participants in the controlled group's pre-test and post-test scores is shown in Table 8 for those subjects. The calculated t-value of -1.179 is less than the t-critical value of 3.707 in absolute terms. Therefore, there is

sufficient statistical evidence to accept the null hypothesis and draw the conclusion that, at the 1% level of significance, there is no significant difference between the test scores of the students in the controlled group on the pretest and post-test.

Based on the above table, it shows that the use of English language has no significant effect to the problem solving skill in Advanced Algebra. As cited by Robertson (2012), mathematical reasoning and problem solving are closely linked to language and rely upon a firm understanding of basic math vocabulary (Dale & Cuevas, 1992; Jarret, 1999). As cited by Siy (2015), multilingual students learning mathematics focused on word problems, especially translating word problems from English to mathematical symbols. Most of these studies characterized the challenges that bilingual students faced as acquiring vocabulary or struggling with the mathematics register. Recommendations for instruction for English learners that emphasize vocabulary and reading comprehension skills reflect this focus. In contrast, current research on mathematics learning emphasizes how students construct multiple meanings, negotiate meanings through interactions with peers and teachers, and participate in mathematical communication. Although research has explored mathematical communication as a central aspect of learning mathematics in monolingual classrooms, few studies have addressed mathematical communication in bilingual classrooms.

Considering the scores obtained by the subjects under the controlled group, Figure 1 shows the subjects' ways of presenting their solutions and the students' application of their problem solving skills in solving problems in Advanced Algebra before and after the instruction described according to Polya's Problem Solving Techniques and different theories on the importance of language in the problem solving skills of the learners.

Figure 1 shows the answers of Student 1 in Question 54 in pre-test and post-test, respectively.

Question 54

Find two real numbers whose sum is 8 and whose product is 16.

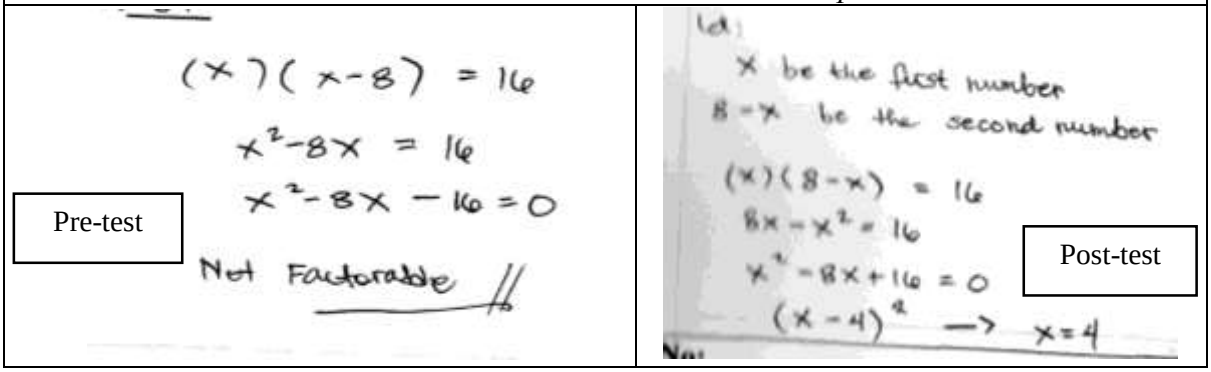


Figure 1: Answers of Student 1 in Question 54

Notice that Student 1 incorrectly got the answer in pre-test and correctly got it in the post-test.

During the pre-test, Student 1 incorrectly got the answer because of wrong representation of variable as shown by his response ***"x – 8"*** which should not be the case. This is inconsonance to ***Polya's Second Principle***, which is ***Devising a Plan***, which is to ***solve an equation***. However, if we are to analyze it fully, the first principle was not followed also for such non-use of strategy came from poor ***understanding of the problem***.

During the post-test, notice that student 1 was able to answer the problem correctly by ***representing the correct variables.*** Such merits their ***better understanding of the problem, carrying out the planned solution and checking*** the response.

When asked on what are the problems experienced by her in this part, she said that she had difficulty in understanding and analyzing the problem. This is inconsonance to the theory of Cummin that it was essential for bilingual students to be competent in their first language *(lingua franca)* as well as in their second language to learn mathematics better.

Experimental Group

Table 9: t-test Results of the Significant Difference in the Problem Solving Skills of Students under the experimental group in Solving Problems in Algebra before and after the series of Instruction

	Pre-test	**Post-test**
Mean	31.14	36.43
Sd	3.3135	6.1329
Df	7	7
Level of confidence	1%, two-tailed	
t-crit	3.707	
t-comp	-5.455	
Decision	Reject Ho	
Interpretation	Significant	

The results of the t-test for the subjects in the experimental group who had a significant difference between their pre-test and post-test scores are displayed in Table 9. The calculated t-value of -5.455 is bigger in absolute terms than the t-critical value of 3.707. Therefore, there is sufficient statistical evidence to reject the null hypothesis and draw the conclusion that, at the 1% level of significance, there is a significant difference between the test scores of the students in the experimental group on the pre-test and post-test.

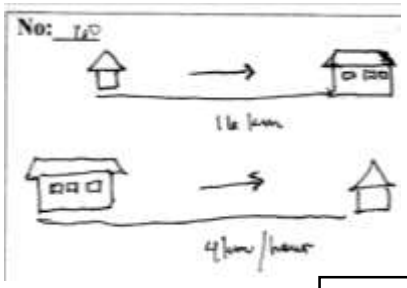
Based on the table above, it clearly shows that there is a significant difference between the test scores of the students under experimental group in the pre-test and post-test. According to Cummins (1981) as cited by Nillas (2002), it was essential for bilingual students to be competent in their first language *(lingua franca)* as well as in their second language to learn mathematics better. It also explains that, by using the first language of the learners as the medium of instruction, these learners can easily learn and acquire academic skills. According Launio (2015), this theory also emphasizes the importance of the language proficiency in bilingual education which is the placement of the learners to classes taught by means of language which will promote better learning.

Considering the scores obtained by the subjects under the experimental group, the figure 2 shows the subjects' ways of presenting their solutions and the students' application of their problem solving skills in solving problems in Advanced Algebra before and after the instruction described according to Polya's Problem Solving Techniques and different theories on the importance of language in the problem solving skills of the learners.

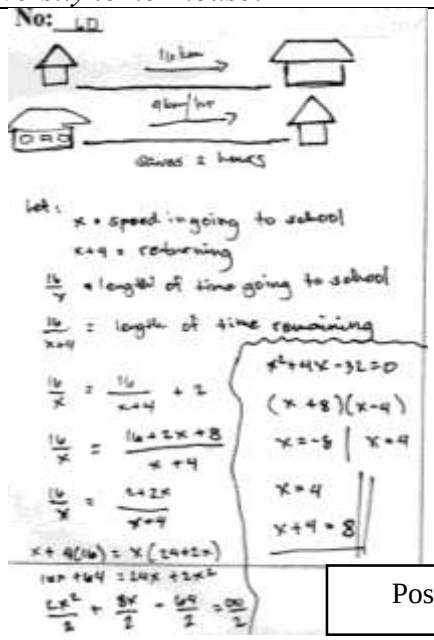
Figure 2 shows the answers of Student 1 in Question 60 in pre-test and post-test, respectively.

Question 60

Ms. Romellen T. Gonzalvo is driving 16 kilometers from her house to the University where she is working. On her way home, she increased her speed by 4 kilometers and her travel time was deduced by 2 hours. What is her speed from her house to the University and from University to her house?



Pre-test



Post-test

Figure 2: Answers of Student 1 in Question 60

Notice that Student 1 has no answer in pre-test and correctly got it in the post-test.

During the pre-test, Student 1 did not continue solving the problem thus; he has no answer but he is able to illustrate the problem. This is inconsonance to ***Polya's Third Principle***, which is ***carrying out the plan***, which is to perform all the necessary steps in solving the problem.

During the post-test, Student 6 was also able to illustrate the problem and solve it by means of representing the unknown by variable x. Further, the problem was solved with clear presentation of solution and Student 1 really understands the problem.

When interviewed about the problem, he said that at the pre-test, he had difficulty in understanding the problem but when given prior instruction, he was able to solve the given problem and was able to draw a diagram from the given scenario. He said that it is a great help that the problem was translated to Filipino because it helped him to understand the problem more clearly. This is inconsonance to the theory of Cummin that states that it was essential for bilingual students to be competent in their first language *(lingua franca)* as well as in their second language to learn mathematics better.

Significant Difference between the Score of the Experimental and Control Group after a Series of Instructions

Table 10: Significant Difference between the scores of the Experimental and Controlled Group after a Series of Instructions

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores	Equal variances assumed	7.557	.018	.428	12	.676	1.28571	3.00227	-7.88483	10.4562
	Equal variances not assumed			.428	8.496	.679	1.28571	3.00227	-8.61962	11.1910

Table 10 shows the t test result and the significant difference in the scores of the experimental and control group after a series of instructions. The computed sig of 0.018 is less than the sig critical value of 0.05. Hence, there is enough statistical evidence to reject the null hypothesis that *there is no significant difference between the test scores of the students under the two groups after the instruction at 1% level of significance*. It is therefore concluded that there is a significant difference between the test scores of the students under the two groups after the instruction.

Based on the result of the t test and significant differences, it shows since there is a significant difference in the post test scores of the two groups, it can be deduced based on the findings that the experimental group, the subjects taught with Filipino language as a medium of instruction in teaching Advanced Algebra performed better when compared to the control group. This is with accordance to the findings of Launio (2015) that students under the first language instruction performed better compared to the students taught under the English language as medium of instruction.

Based on the result from the table above, it can be deduced that the students who used their first language in learning mathematics have a better improvement of problem solving skills compared to the students who have taught in English language. This can be supported with the result release from Trends in International Mathematics and Science Study (2015), it shows that Singapore, Hong Kong SAR, Korea, Chinese Taipei, and Japan continue outperforming all participating countries in mathematics at the fourth and eighth grades, maintaining a 20 year edge according to results released from TIMSS, the longest running, large scale international assessment of mathematics and science education in the world. These countries use their lingua franca or first language in teaching Mathematics and Science. It was concluded that using the first language in teaching these subjects were effective and have obtained a better result and outcome.

Conclusion

Based on the findings of this study, the following conclusions were drawn.

1. The students under the experimental group performed satisfactorily in solving problems in Advanced Algebra before a series of instruction in Filipino Language and very satisfactorily after a series of instruction in Filipino Language. On the other hand, the students under the controlled group performed very satisfactorily before and after the series of instruction with English as a medium of instruction. There was an increased in the mean score of this group but very minimal compared to the experimental group.
2. There is a no significant difference in the performance in solving problems in advanced algebra before and after a series of instruction with English as a medium of instruction.
3. There is a significant difference in the performance in solving problems in advanced algebra before and after a series of instruction with Filipino as the medium of instruction. The mean scores of the pre-test of the two groups increase after the series of instruction.
4. There is a significant difference in the problem-solving skills of the students between the two groups after instruction.
5. In this study, using of Filipino language as a medium of instruction in teaching advanced algebra class is effective.

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