

Effectiveness of Multilingual Teaching of Mathematics in a Tertiary Level State University in Bicol Region, Philippines

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Abstract - *Multilingual instruction is essential in alleviating students' performance. Hence, this study recognizes its importance in the teaching-learning process in Mathematics especially in plane and solid Geometry among college students. Its focus is on the use of English, Filipino, Bikol and other local dialects within the Bicol region as media of instruction. Quasi-experimental method was employed using the two-group post designs. The teacher-made pre-and-post-tests were utilized to assess the students' performance in the two mathematics classes which are handled by the researcher and became the subject of the study. One class was the control group using English alone as medium of instruction, while in the experimental class it employs multi-lingual instruction. Said classes were comparable because of an almost equal mean scores obtained in the pre-test. Convenient non-random sampling technique was used to determine the sample classes and simple average to determine the scores of both pre- and post-tests. T-test analysis was used to determine the significant difference between students' performance in the two classes. Result of the study revealed significant difference in the students' performance between the two groups. A homogeneous students' performance in the experimental group was observed as evidenced by a practically the same high scores obtained by the students in the post test. It therefore implies that the use of multilingual instruction in mathematics significantly contributed to the performance of the students.*

Keywords: Multilingual instruction, language, dialects, quasi-experimental method, students' performance

INTRODUCTION

The Philippines is an archipelago composed of more than 7,000 islands. It is a typical example of a multilingual state because of its diverse languages and

local dialects such as Bikol, Ilokano, Cebuano, etc. There are more than 170 languages around the country [1]. In the Bicol region there are four groups of Bikol dialects spoken, namely: Bicol Naga, Bicol Rinconada, Bicol Albay and Bicol Catanduanon. Although, Bikol Naga dialect is spoken all over the region, there are still other dialects used in addition to Filipino and English. While it is a mandate to use vernacular in the lower levels of the K to 12 programs, it is inaudible in the higher education level because English is the medium of instruction adopted. The use of bilingual or even multilingual instructions is true elsewhere.

Multilingual instruction has been considered a reality for decades. It conveys the ability of societies, institutions, groups, and individuals to have regular use of more than one language in their everyday lives over space and time, while language is impartially understood as a variety that a group admits to using as a habitual communication code [2].

In effect, from multilingual instruction in classroom to multilingual communication in institutions or organizations, allows opportunities for the employee-employer team work in the pursuit of their individual-organizational goals. Both will be equipped with appropriate adjustments. According to one researcher, the organization's perspective concerns the question of how the presence of or demand for multiple languages in the company is managed. And also how companies are guided by national and other policies in regard to the use of multiple languages and at the same time, how they create their own internal policies while the individual perspective examines the ways in which the presence of multiple languages is managed by the employees [3].

In Mathematics, medium of instruction plays a significant role in the teaching-learning process. In the Philippines, mathematics is being taught in English

for years. In other countries, like Europe, universities use their native languages with English as additional language. They are exhorted to cultivate and develop multilingualism. But, English language reigns supreme and has become the main foreign language used as a means of instruction [4]. However, as in other areas of knowledge, shifts in emphasis and other changes has long been espoused for continual growth of teachers. In addition, changes in media, materials, and technology paved way to the conceptualization of teachers' roles. The use of ethno methodology and conversation analysis has been tried and tested to demonstrate the notion of 'medium of classroom interaction' which is a more appropriate 'scheme' for the interpretation of the bilingual practices [5].

Despite the ascendancy of the Tagalog-based Filipino as the *lingua franca*, print media in the Philippines are still dominated by English. It is the medium of instruction in schools over time [6]. The dynamics of English language instruction in the Philippine basic education had been the subject in analysing the framework of systems thinking [7], while this study analysed the dynamics of multilingual instruction particularly in mathematics in tertiary education. However, prior to the country's bilingual education policy English and Filipino have been widely used as media of instruction.

Teaching mathematics requires a great deal of challenge to teachers in all levels of education. Abstract ideas in Mathematics expressed in English as another abstract language, are hard to push in the minds of students. All learners need skilful and sympathetic teachers. Many unhappy children are being taught by unhappy teachers [8]. This implies that the teaching of mathematics can be and should be made simple and appealing to students. Hence, this study attempted to verify and explore that multilingual instruction can catch the interest of students and improve their performance. The use of Filipino language as a medium in teaching Mathematics [9] has significantly improved students' performance. Further, the study investigated the benefits of introducing such intervention to students in a broader perspective. Thus, the adoption of multilingual instruction in mathematics is then believed to be essential in alleviating students' performance.

OBJECTIVES

The study determined the effectiveness of multilingual teaching of Mathematics in the tertiary level in Central Bicol State University of Agriculture (CBSUA). Specifically it aimed to: (1) assess the

performance level of the students; (2) determine significant difference in the students' performance in adopting multilingual teaching in Mathematics; and (3) recommend policy on multilingual instruction in mathematics.

Logical Framework of the Study

The study adopted the input-throughput-output process model. It was anchored on the premise that knowledge can be best acquired, retained and sustained through the individuals' dialect or language or his mother tongue. The students were given pre-and-post-tests to determine their level of performance in mathematics. The inputs of the study include classification of students according to gender profile and teacher's attributes.

Topics in the course syllabus have been organized and multilingual approach is being adopted by the faculty-researcher in teaching mathematics. The approach was employed as a tool, pedagogy or an art in teaching Mathematics. This served as the throughput or process of the study. The students' performance during the post-test vis-a-vis the pre-test was analysed with the assumption of better results achieved. As an output of the study, a protocol on multilingual instruction was developed.

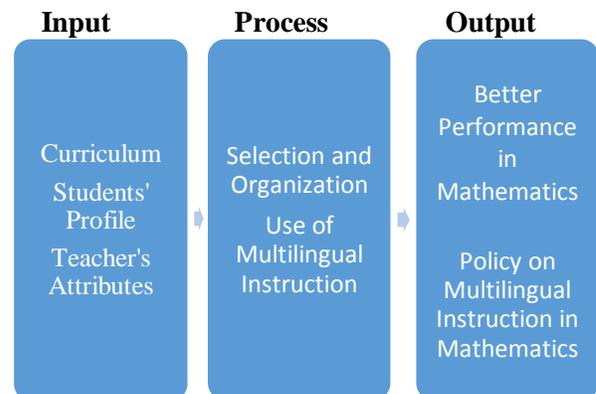


Fig. 1. Framework of the Study

The socio-cultural theory of development by Vygotsky (1896) as cited by Corpuz, Lucas, Borabo, and Lucido [10] was considered in the study. It stresses the role of language in the cognitive development learning is influenced by the desire of children to communicate with others as emphasized in language development interactionism theory [11].

The researcher's theory also strengthened the findings obtained in the study. It is believed that the use of one's native language significantly contribute

to a learner's greatest achievement. It is in this concept that this study is connected but is focused only in mathematical pedagogy as the researchers' field of endeavour.

METHODS

The study used the quasi-experimental method using the two-group post design. This method was found appropriate and useful where subjects happened to be randomly assigned to the researcher with conditions where independent variables had been considered. This is one of the designs treated by Campbell and Stanley and believes to have advantage over other designs in this endeavour. This method uses two classes, one for the control and another for the experimental group.

The researcher handled Mathematics 4 (Plane and Solid Geometry) for Bachelor of Elementary Education (BEE). Since these are the only classes being handled during the semester, convenience non-probability sampling techniques had been considered. The teacher-made test was used to measure the student's performance. The test was subjected to face validity among the researcher's colleagues of the Department of Natural and Applied Sciences (DNAS) to determine its appropriateness, fitness and mechanics. DNAS is a department under the College of Arts and Sciences (CAS) in CBSUA, where the researcher is an organic faculty member. Likewise, the examination was subjected to reliability test using the Kuder-Richardson formula 21. This reliability test was considered believing that all items are of equal difficulty. Table 1 shows the summary of the reliability test made on the post-test result itself.

Table 1. Reliability result of the teacher-made test for the pre-test and post-test for the two classes.

Reliability		
Group	Test	Index ≥ 0.5
Control		
	Pre-test	0.93
	Post-test	0.92
Experimental		
	Pre-test	0.93
	Post-test	0.76

Accordingly, a teacher-made test has an acceptable reliability index from 0.5 and above. Therefore, since both the control and experimental group obtained values from 0.76 to 0.93, the test used was reliable. Interview method was likewise employed in validating some of the data gathered.

In the course of the pedagogy using multilingual as media for instruction, some terminologies which cannot be translated in the dialect or vernacular, the English term is being adopted, as it is. Examples of which are: exponent, square root, Pythagorean Theorem, Cartesian coordinate plane, and many more.

Descriptive analysis was employed for the profile of the students. The significant difference between students' achievements was determined through t-test analysis.

Table 2. Profile of the respondents in terms of Gender

Group	Male	Female	Total
Control	4	34	38
Experimental	8	31	39
Total	12	65	77

The 77 respondents of the study were the two sections handled by the researcher in Mathematics 4. One was the control group. It has four males and 34 females with a total of 38 students. There was no intervention made, such as the use of other dialects or Filipino. The language used was only English.

The other group was the experimental class. Out of 39 students, eight are males and 31 are females. The researcher used varied languages in addition to English and Filipino and to some extent the vernacular used by the student, and the Bicol dialect.

Now, with the recent implementation of the K to 12 program, specifying the use of mother tongue in the lower levels, it manifested the importance of regional dialects in manpower development. With the above premises, the researcher believes that multilingual instruction will enhance the competence development required in the learning of Mathematics among tertiary students. It is possible for Filipinos to be literate in their mother tongue and still be fluent in Filipino, as the national and official language of the country, with English continuing its role as the international language. Basically, it is the essence of the study. Graduates will still be both locally and globally competitive. This means creating a borderless learning in mathematics.

RESULTS AND DISCUSSION

The study showed better performance of the students in the Bachelor of Elementary Education in Mathematics 4. This is presented in Table 3 and 4.

Table 3. Performance of students in Math 4 without intervention

Statistics	Pre-Test	Post Test
Mean	27.92	35.95
Mean Difference	8.03 or 28.76%	
Standard Deviation	15.84	14.87
Coefficient of Variation	56.73%	41.36%

It can be gleaned from the Tables 3 and 4 that the mean performances of students in the pre-test for both classes were almost the same which is 27.92 for non-intervention and 27.00 for those with intervention. This means that before the introduction of the intervention students have approximately of the same categories. This can be called homogeneity of the two classes or groups. It showed further that the mean performance for post-tests for classes with intervention were high which 50.82 against 35.95 for classes without the intervention.

Table 4. Performance of students in Math 4 with intervention

Statistics	Pre-Test	Post Test
Mean	27.00	50.82
Mean Difference	23.82 or 88.22%	
Standard Deviation	15.43	8.70
Coefficient of Variation	57.14%	17.11%

The table above showed that post-tests for both classes resulted in higher performances. However, the class with intervention posted even higher results. This implies that from having almost equal or the same performances in the pre-test, after the intervention there was an average increase of 23.82 or 88.22% which is very high. While the two post-tests has an average difference of 14.87 or 41.36% which is also high as shown Table 3. It can also be gleaned from the same table the homogeneity or heterogeneity of the group as reflected in the value of its standard deviation and the coefficient of variation. The pre-test and post-test for group with no intervention have higher standard deviation, likewise the pre-test of the class with intervention while the post-test have lower standard deviations. This means that homogeneity was visible only in the performance for the post-test with intervention as it was also seen and affirmed by the coefficient of variation which is 17.11% which is the lowest among rest. This meant further that the

performances of the group with intervention tended to consistency rather than variability.

Table 5. Test of difference between the classes with and without intervention and between pre-tests and between post-tests.

Group	t- test	Critical $\alpha_{.01} = 2.390$ Values $\alpha_{.05} = 1.671$
Control	2.150	Not significant
Experimental	8.507	Highly Significant

Table 5 reflected the results in the test of significant difference between the two groups: the experimental or the group with interventions and the control group or the no intervention group. It can be observed that the computed t-value for the group with intervention is very much higher which 8.507 than the critical values for 5% and 1% level of significance which are 1.671 and 2.390, respectively. This means highly significant difference between the pre-test and the post-test. It also implies that after the intervention was made, there was a higher performance achieved. Likewise, in Table 4b, a highly significant difference between post-test for both groups was observed. The association can be attributed to the use of the multilingual instruction which is the intervention per se. The result is an affirmation that language plays a vital role in cognitive development of the students according to Corpuz, Lucas, Borabo, and Lucido [10]. It further implies that language opens its doors for learners to acquire knowledge that others already have. Learners can use convenient language to know the world and solve problems.

Table 6. Test of difference between pre-tests and between post-tests.

Group	t test	Critical $\alpha_{.01} = 2.390$ Values $\alpha_{.05} = 1.671$
Pre-tests	0.270	Not significant
Post-tests	5.451	Highly significant

This had been manifested also in the study on bilingualism in France which demonstrated the notion of 'medium of classroom interaction', which is a more appropriate 'scheme' for the interpretation of the bilingual practices [5].

According to Isidro [13], because of the multiplicity of language in any part of the country, the use of English as a medium of instruction in school and international relation and the impress of national language in the academe, pedagogical concerns are being addressed. We can be both locally and globally

competitive. The study on multilingualism in companies manifested importance of the former not only in instruction. This is another index as regard usability of multilingualism.

The organizational perspective, concerns the question of how the presence of or demand for multiple languages in the company is managed – how companies are guided by national and other policies in regard to the use of multiple languages and at the same time, how they create their own internal policies. The individual perspective examines the ways in which the presence of multiple languages in the workplace is managed by employees [11].

The table also showed non-significant difference between results of both pre-test and post-test administered to the group with no intervention and the pre-tests for both. This means that the post-test result for the group with English as the only medium used for instruction was almost similar to the pre-test results for the two groups. This simply means that the pre-tests are alike while post-tests results are different.

CONCLUSION AND RECOMMENDATION

It is concluded that the performance of the students in the post-test of the group with intervention resulted to a higher mean rating than that of the post-test in group without intervention wherein said performances have led to consistency rather than variability.

Multilingual instruction as an intervention benefited significantly the post-test performance of the students in the teaching of mathematics. Multilingual instruction in mathematics can be a pedagogical option. The effort to alleviate and improve students' performance in school through multilingual instruction or medium of instruction has always been an interestingly debatable issue [12] (Fung, 2011). Said concluding statements are just the outcomes based from the identified problems. Although, great efforts are made to really prove this quest, these results and findings are still deemed inconclusive.

Multilingual instruction can be adopted in tertiary education. Expand the use of multilingual instruction through the conduct of the same in other field of study. A bigger scope of study can be conducted to cover other areas of Sciences and more instructional materials in Mathematics be developed using the national language. This will, in turn, contribute to the formulation of a sound and relevant policy recommendation on multilingual instruction.

As a matter of policy recommendation, the development of instructional materials in other areas of mathematics and other fields of physical and social sciences is being proposed and recommended by the researcher, using the national language so that everyone interested to use such materials needs no interpreter. According to Isidro [13], there are several concerns in the Philippine Education since 1940's. First, limitations in the teaching of the national language must be observed. It is considered more difficult to learn the national language than English. Many claim that the teaching of the national language weakens instruction in English. Second, in the early times, teachers are generally not prepared. Because of the dearth of qualified teachers, anyone who has the smattering of Tagalog is allowed to teach. These are in conflict with the statement of Lemetyinen [14] which says: "Language is a cognition that truly makes us human". Lastly, one of the greatest drawbacks is the lack or inadequate instructional materials in the language.

These phenomena still hold true today. In this study, the researcher made use of some sample materials in the national language for facility, and a prelude trial of such as an added interpolation in the class with intervention.

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