[Article]

A Study of Bilingual Education in the Philippines

—Difference in Pupils' Degree of Understanding Between Learning Mathematics in Cebuano and English—

Yumiko YANAGIHARA *

At present, bilingual education in the Philippines is provided using either English or Filipino as the language of instruction and a regional language as the auxiliary language of instruction depending on the subject. However, the scholastic achievement rates for the subjects of mathematics, science, and English taught in English are low, and the cause of this has been indicated as being a problem with the language of instruction.

In light of this, the current study, targeted at 480 public elementary school 3rd graders, 4th graders, and 6th graders (160 pupils in each grade), was conducted for the purpose of (1) verifying differences in degree of understanding between the use of Cebuano (regional language) and English as the language of instruction, (2) verifying the effects of introducing animated images (video) and providing words essential for learning in advance, and (3) examining the acquisition of unknown words by pupils during mathematics instruction.

Introduction

Following the implementation of a bilingual education policy in 1974, public education has been provided in the

*柳原由美子　やなぎはら・ゆみこ：敬愛大学国際学部准教授　教育工学

Associate Professor of English, Faculty of International Studies, Keiai University; educational technology.

Philippines from grade I of elementary school to the 4th year of high school (intermediate school) on the basis of using English as the language of instruction for science courses (such as mathematics and science, in addition to English) and using Filipino for liberal arts classes (such as Filipino, social studies, civics, and physical education). However, as is pointed out by the Master Plan for Basic Education (DECS: 1995, p. 5), the learning of mathematics and science is currently not proceeding smoothly due to a lack of ability in English, which is used for instruction in those courses, thus resulting in a need to re-examine bilingual education policy and improve the teaching of English. In addition, under the Estrada administration in 1999, the use of a lingua franca (here referring to the three languages of Tagalog, Cebuano, and Ilokano) as the language of instruction was proposed and actually implemented at several schools (Kim: 2004, p. 104). Thus, although there have been some steps taken to re-examine the language of instruction used in the Philippines, the direction to be taken has yet to be determined.

In light of the present state of bilingual education in the Philippines, this study was conducted for the purpose of (1) verifying differences in degree of understanding between the use of Cebuano (regional language) and English as the language of instruction, (2) verifying the effects of introducing animated images (video) and providing words essential for learning in advance as means for enhancing the level of understanding when English is used as the language of instruction, and (3) examining the acquisition of unknown words by pupils themselves during the course of learning, during mathematics instruction targeted at 480 public elementary school 3rd graders, 4th graders, and 6th graders (160 pupils in each grade).

An overview is first provided of elementary education in the Philippines, particularly some issues to be raised, as part of the background of this study. Discussions are then provided regarding the geographically and historically complex status of language usage in the Philippines along with problems

currently encountered in bilingual education in that country. This is followed by an experiment on the degree of understanding of mathematics learning according to differences in the language of instruction and a description of a questionnaire survey given to the 480 pupils. Finally, an attempt is made to verify the hypotheses, and a discussion is provided.

I. Background of the Study

1. Elementary Education in the Philippines

The Philippine educational system[1] consists of elementary education (six years, although it is provided for seven years at some private schools), intermediate education (four years) and higher education (university and graduate school). Both elementary and intermediate education are called basic education. Elementary education is defined as mandatory and free of charge according to Article 14, Paragraph 2 of the Philippine Constitution of 1987. Although intermediate education is free of charge, it is not mandatory.

Table 1 shows the basic indicators relating to public elementary education in 2003. According to these indicators, despite a gross enrollment rate of 98.25%, the completion rate of the final year of school is low at only 62.20%, and there are a large number of dropouts. The dropout rate of 8.90% is the mean rate, which includes metropolitan areas. However, in farming villages and other rural areas, cases of children no longer attending school in order to work on farms are certainly not rare. It is estimated that one of four children in farming villages drops out of school before reaching the 3rd grade (PCER: 2000, p. 117). According to a survey conducted by the Department of Education of the Philippines, there are 445 *barangays* (the smallest municipal unit in the Philippines) that do not even have an elementary school.[2] Since the adult literacy rate in the Philippines is reported to be 92.6%,[3] this indicates the considerable dis-

Table 1 Basic Indicators in Public Elementary Education in 2003

INDICATORS	ELEMENTARY
Gross Enrollment Rate	98.25%
Net Enrollment Rate	81.72%
Pupil/Student-Teacher Ratio	35.73
Pupil/Student-Room Ratio	37.68
Cohort Survival Rate	64.15%
Completion Rate	62.20%
Dropout Rate	8.90%
Transition Rate*	97.00%
Achievement Rate (MPS)**	
Mathematics	44.84% (Grade IV) (2002–2003)
Science	43.98% (Grade IV) (2002–2003)
English	41.80% (Grade IV) (2002–2003)
Filipino	Not applicable

Notes: * From Primary (Grade IV) to intermediate (Grade V).
** Source: National Education Testing and Research Center (NETRC).
Source: "Fact Sheet Basic Education Statistics" released by the Department of Education of the Philippines.

crepancies among individual regions of the country. In addition, another important matter that should be noted in Table 1 is that the scholastic achievement rates for the main courses of mathematics, science, and English are all below 50%.

The primary causes of the issues above are the disparity of educational opportunity for children in different areas, the language of instruction, a deficiency in the number and quality of mathematics/science teachers, and the lack of educational facilities, machinery, or materials (JICA: 1999, p. 98) (Bauer & Tamaki: 2000, p. 55). Among these problems, this study focused on the languages of instruction (bilingual education) in the Philippines. The following describes the geographical and historical complexity of the language situation and problems currently encountered in bilingual education in the Philippines.

2. Languages Used in the Philippines

The language situation in the Philippines, a country comprised of more than 7,000 islands, is both geographically and

historically complex. In terms of the number of languages, there are said to be 171 spoken in the Philippines.[4]

To begin with, from a geographical viewpoint, Tagalog is the most prominent language. It is used in an around metropolitan areas and is the basis of the Filipino language designated as the national language in the 1987 Constitution. Ilokano is spoken in the north, while Cebuano is spoken in the south, and both are used as common languages in their respective regions. Kawahara (2003, p. 67) lists eight major languages in the Philippines—Ilokano, Pampangan, Pangasinan, Tagalog, Bicol, Hiligaynon, Waray, and Cebuano—and states that after these eight major languages, there are other languages spoken by several hundred thousand speakers, and lying on the outermost edge of these languages, there are languages spoken by minority races referred to as cultural minorities. These indigenous languages are described as not being equally and uniformly distributed and as having social linguistic superiority or inferiority. They are most accurately perceived as being divided among multiple levels. The geographical condition of being an island country is primarily responsible for the formation of this linguistic situation.

Next, from a historical perspective, the languages of the Philippines can broadly be divided into four languages, namely, (1) regional languages (local languages such as Tagalog and Cebuano), (2) colonial languages (such as Spanish and English), (3) immigrant languages (such as Chinese and Cantonese), and (4) pidgin[5] and Creole[6] (Kawahara: 2003, p. 67).

The most commonly used languages at present consist of the regional languages and English. In Japan, Japanese is the national language, official language, and language of instruction. For many Japanese, the use of three languages consisting of a regional language routinely used in local communities, English, considered to be the official language essential for advancing to higher education and acquiring a professional occupation, and Filipino, designated as the offi-

cial national language by the Philippine government, is virtually unimaginable and effectively illustrates the complexity of the language situation in the Philippines.

3. Bilingual Education in the Philippines

Table 2 shows the changes in the usage of the language of instruction and auxiliary languages of instruction in public education from the 1st year of elementary school to the 4th year of high school (intermediate school) from the time of American colonization to the present. At present, in elementary education, the three subjects of mathematics, natural science, and English are taught in English, while the five subjects of ethics, civics, MSEP (music/arts/physical education), life science, and Filipino are taught in Filipino. However, as shown in Table 1, the scholastic achievement rates for the subjects of mathematics, science, and English taught in English are low at less than 50%, and the cause of this has been indicated as being a problem with the language of instruction.

Problems with the language of instruction become more serious in farming villages and other rural areas. The situation is not that serious where the native language of the pupil is a relatively frequently spoken language like Tagalog, since this only involves switching from Tagalog to English. Where the native language of the pupil is a language spoken by a cultural minority, however, it means that the pupil must be fluent in not only his or her native language but also other common regional languages, English, and Filipino in order to matriculate to higher education and secure a professional occupation. Thus, children of farming villages and other rural areas end up being confronted with a social structure that prevents them from matriculating to higher education and joining the upper echelons of society.

The following summarizes the findings described in "The Philippine National Assistance Research Report—Analysis of Current Conditions" (JICA: 1999, p. 98): "With regard to the effect of the language of instruction on pupils' or students'

Table 2 Legally Adopted Languages of Instruction and Auxiliary Languages of Instruction in the Philippines

	National language	English	Regional languages	Native language
1901–40	—	LI for all school years and all subjects	—	—
1940–57	—	LI for all school years and all subjects	ALI through 4th year of elementary school	—
1957–74	ALI starting in 5th year of elementary school	LI for all subjects starting in 3rd year of elementary school	ALI through 4th year of elementary school	LI for 1st and 2nd years of elementary school
1974–	LI for subjects other than mathematics, natural science, and English for all school years	LI for mathematics, natural science, and English for all school years	ALI through 2nd year of elementary school	—

Note: LI means language of instruction, and ALI means auxiliary language of instruction (translated by the author).
Source: Okada (2004, p. 156).

degree of understanding, it is said that the degree of understanding among pupils or students is low because, for example, science and mathematics are taught in English, and it is felt that (this problem) cannot be considered to be insignificant. . . . Although there are various opinions regarding the language of instruction, and the use of English is desirable for teaching and research in advanced fields, at the stage of basic learning, there are also those who feel that instruction in a regional language is effective for gaining a better understanding of concepts."

The experiment and questionnaire survey below were conducted considering the state of bilingual education in the Philippines. The following provides a detailed description of the findings obtained.

II. Experiment and Questionnaire Survey

1. Objective

The objective of this experiment was to clarify the following four hypotheses during mathematics instruction at an elementary school in Cebu:

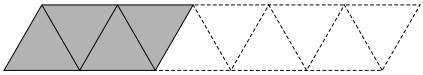
(1) Providing instruction in a regional language (Cebuano) is more effective than instructing in English in terms of the degree of understanding of mathematics.

(2) Even if the language of instruction is English, if pupils are familiar with the minimum essential words for a particular class in advance, the degree of understanding of mathematics is the same as when taught in a regional language (Cebuano).

(3) The presentation of animated images (video) is a significant aid to understanding in the case of learning mathematics. Thus, the degree of understanding of mathematics is low when taught only in English without presenting animated images.

(4) Even if pupils are unfamiliar with certain English

Figure 1 Arrangement of Equilateral Triangles



words before learning, they are able to acquire those words during the course of learning.

The learning of mathematics here refers to learning about "Triangles and Their Perimeters" (cf. chapter II, section 3. 3) "Experiment Materials" (1), (2). The learning objectives consisted of (1) being able to state the perimeter of 20 equilateral triangles arranged side by side (measuring 1 cm on a side) as shown in Figure 1, and (2) being able to state the relational expression between the number and perimeter of equilateral triangles arranged side by side as shown in Figure 1.

2. Experiment Hypotheses

The following hypotheses were established in line with the objective of the experiment. The VE, VC, E, and C groups indicate four experiment groups who learned mathematics in the form of "Triangles and Their Perimeters" using the methods indicated below:

(1) VE group: Instructed using an English video
(2) VC group: Instructed using a Cebuano video
(3) E group: Instructed using oral explanations in English (by an instructor) and shown only Figure 1 above
(4) C group: Instructed using oral explanations in Cebuano (by an instructor) and shown only Figure 1 above

Hypothesis 1:

The VC group has a higher degree of understanding of "Triangles and Their Perimeters" than the VE group. In addition, the C group has a higher degree of understanding than the E group.

Hypothesis 2:

The degree of understanding of pupils in the VE group

who were familiar with the words "triangle," "perimeter," and "twenty" (minimum essential words) prior to learning about "Triangles and Their Perimeters" is no different than the degree of understanding of pupils in the VC group. In addition, the degree of understanding of pupils in the E group who were familiar with these words prior to learning is no different from the degree of understanding of pupils in the C group.

Hypothesis 3:

The VE group has a higher degree of understanding of "Triangles and Their Perimeters" than the E group.

Hypothesis 4:

The word test scores of the VE and E groups when learning about "Triangles and Their Perimeters" are higher after learning than before learning.

3. Experiment Method

1) Subjects

The subjects consisted of 480 3rd, 4th, and 6th graders (40 students × 4 groups × 3 grades) of the Guadalupe Elementary School in Cebu. The reasons for selecting 3rd, 4th, and 6th graders as subjects are indicated below.

(1) Although mathematics is taught in English starting in the first year of elementary school in the Philippines, the use of a regional language (Cebuano in the case of Cebu) is permitted as an auxiliary language of instruction during grades I and II. However, mathematics is only taught in English starting in grade III (see Table 2). Third, 4th, and 6th graders were therefore selected while adding 3rd graders as representatives of the first year in which mathematics is taught in English.

(2) The reason for selecting subjects ranging from grade III to grade VI was to verify differences in the degree of understanding of mathematics (as related to "Triangles and Their Perimeters" in this study) by school year ranging from 3rd graders, who can be presumed to be relatively inexperienced in learning English, to 6th graders,

who are thought to have progressed considerably in their English ability.

(3) Fifth graders were not included in the study due to circumstances at the school on the day of the experiment.

The four experiment groups (VE, VC, E, and C) were assigned to classes already being held at the school. According to the instructors, the pupils in those classes were grouped in alphabetical order and not according to scholastic ability, and their overall scholastic ability was reported to be about the same. In this experiment, however, the pupils were given an English test and mathematics test to determine homogeneity among the four experiment groups. The details are described in section 4. 1) entitled "Test of Homogeneity of the Four Experiment Groups," and homogeneity among the groups was confirmed. In addition, when the instructors at this elementary school were asked about the native language of the pupils prior to the experiment, it was found that the regional language, Cebuano, was the native language for nearly all of the pupils.

2) Time of Experiment: September 2003

3) Experiment Materials

(1) Video entitled "Triangles and Their Perimeters" (English and Cebuano versions): This video is a mathematics learning video created by the author. It is comprised of 47 scenes of animation.[7] The English version was used to instruct the VE group, while the Cebuano version was used to instruct the VC group.

(2) Script for oral explanation of "Triangles and Their Perimeters" (English and Cebuano versions): This is completely identical to the narration script of the videos used in (1) above. The English version was used to instruct the E group, while the Cebuano version was used to instruct the C group.

(3) English Test: This test was used to verify homogeneity among the four experiment groups of each grade. (Tests

having a maximum score of 10 points were used for the 3rd and 4th graders, while that having a maximum score of 20 points was used for the 6th graders.)

(4) Word Test (English and Cebuano versions): These tests were used before and after learning (the same tests were given) to verify hypotheses 2 and 4. The Cebuano version was used for the VC and C groups, while the English version was used for the VE and E groups (maximum score: 40).

(5) Math Test (English and Cebuano versions): These tests were used before and after learning (the same tests were given). The tests given before learning were used to measure the mathematics ability of the pupils with respect to "Triangles and Their Perimeters," while the tests given after learning were used to measure the degree of understanding of the pupils after learning. In addition, the tests given before learning were also used to verify homogeneity among the four experiment groups of each grade. The Cebuano version was used for the VC and C groups, while the English version was used for the VE and E groups (maximum score: 40).

(6) Questionnaire: The pupils were asked about their use of English and Cebuano.

4) Experiment Procedure

The experiment was conducted by following the learning procedure (cf. Figure 2) for each of the experiment groups.

Figure 2 Learning Procedure

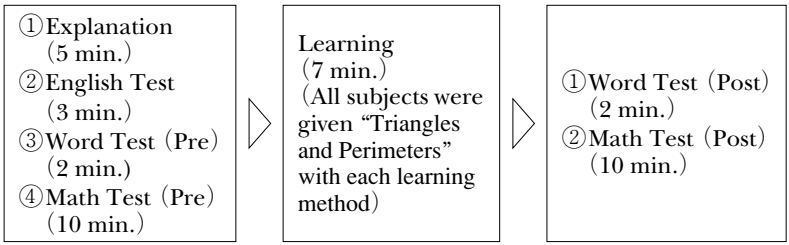


Table 3 Analysis of Variance on English Pre-Test Scores

Grade	Source of variation	Sum of squares	d.f.	Mean square	F calc.
III	Among groups	8.07	3	2.69	1.53
	Within groups	274.27	156	1.76	(NS)
	Total	282.34	159		
IV	Among groups	11.85	3	3.95	2.10
	Within groups	293.25	156	1.88	(NS)
	Total	305.10	159		
VI	Among groups	24.67	3	8.22	1.08
	Within groups	1,182.10	156	7.58	(NS)
	Total	1,206.77	159		

5) Analytical Methods

Analysis of variance, Tukey's multiple range test (Tukey HSD),[8] and the T-Test were used to analyze the results.

4. Experiment Results

1) Test of Homogeneity Among the Four Experiment Groups

As shown in Table 3, the result of analyzing the variance of the English pre-test scores indicated the absence of a significant difference among the four experiment groups in each grade at the 1% significant level. In addition, the result of analyzing the variance of math pre-test scores as shown in Table 4 again indicated the absence of a significant difference among each experiment group at the 1% significant level. Thus, the four experiment groups of each grade were able to be treated as being homogeneous.

2) Test of Differences in Learning Results due to Learning Method

As a result of analyzing the variance of math post-test scores as shown in Table 5, there were significant differences observed in learning results among the four experiment groups in each grade at the 1% significant level. Namely, dif-

Table 4 Analysis of Variance on Math Pre-Test Scores

Grade	Source of variation	Sum of squares	d.f.	Mean square	F calc.
III	Among groups	44.5	3	14.83	1.47
	Within groups	1,571.4	156	10.07	(NS)
	Total	1,615.9	159		
IV	Among groups	65.9	3	21.97	2.15
	Within groups	1,598.0	156	10.24	(NS)
	Total	1,663.9	159		
VI	Among groups	104.3	3	3.477	3.33
	Within groups	1,630.8	156	10.45	(NS)
	Total	1,735.1	159		

Table 5 Analysis of Variance on Math Post-Test Scores

Grade	Source of variation	Sum of squares	d.f.	Mean square	F calc.
III	Among groups	4,049.62	3	1,349.87	50.01
	Within groups	4,210.35	156	26.99	($\alpha = 0.01$)
	Total	8,259.97	159		
IV	Among groups	2,690.70	3	896.90	34.08
	Within groups	4,105.20	156	26.32	($\alpha = 0.01$)
	Total	6,795.90	159		
VI	Among groups	2,575.50	3	858.50	20.48
	Within groups	6,539.60	156	41.92	($\alpha = 0.01$)
	Total	9,115.10	159		

ferences were observed in learning results that were attributable to the learning method.

Moreover, a multiple range test using the Tukey method was performed to examine differences in learning results between each of the learning methods. The q value for α = 0.01, r = 4 (number of learning methods), and d.f. = 156 (degree of freedom) was 4.40 according to the "Table of Student-Transformed Ranges" (Yamauchi: 1990). The values for grade III consisted of HSD = 3.61 (α = 0.01)/HSD = 2.98 (α = 0.05), the values for grade IV consisted of HSD = 3.57

Table 6　Tukey's Multiple Range Test（Tukey HSD）

			E	C	VE	VC
Grade III	Means		6.75	8.48	16.05	18.78
	E	6.75	—	1.73	9.30*	12.30*
	C	8.48		—	7.57*	10.30*
	VE	16.05			—	2.73
	VC	18.78			—	—
Grade IV	Means		9.60	11.80	18.60	18.90
	E	9.60	—	2.20	9.00*	9.03*
	C	11.80		—	6.80*	7.10*
	VE	18.60			—	0.30
	VC	18.90				—
Grade VI	Means		13.65	19.35	21.75	24.55
	E	13.65	—	5.70*	8.10*	10.90*
	C	19.35		—	2.40	5.20*
	VE	21.75			—	2.80
	VC	24.55				—

（*$P<0.01$）

（$\alpha = 0.01$）/HSD = 2.94（$\alpha = 0.05$）, and the values for grade VI consisted of HSD = 4.50（$\alpha = 0.01$）/HSD = 3.72（$\alpha = 0.05$）. According to Table 6, significant differences were observed at the 1% significant level between the VE and E groups, VE and C groups, VC and E groups, and VC and C groups in grade III, between the VE and E groups, VE and C groups, VC and E groups, and VC and C groups in grade IV, and between the E and C groups, VC and C groups, VE and C groups, and VE and E groups in grade VI.

3）Other Results Relating to Test Scores（For Hypotheses 2 and 4）

Table 7 shows the means of all pupils in the VC and C groups and pupils in the VE and E groups who were familiar with the three minimum essential words（triangle, perimeter, and twenty）for understanding "Triangles and Their Perimeters" prior to learning.

In addition, Table 8 shows the word test score differences

Table 7 Means of Math Post-Test Scores of the Subjects Who Knew Minimum Essential Words Before Math Learning and All Subjects

		VE	VC	E	C
Grade III	Means of the subjects who knew the three words before learning	(15) 16.93	—	(23) 6.78	—
	Means of all subjects	—	(40) 18.78	—	(40) 8.48
Grade IV	Means of the subjects who knew the three words before learning	(28) 18.43	—	(29) 10.21	—
	Means of all subjects	—	(40) 18.90	—	(40) 11.80
Grade VI	Means of the subjects who knew the three words before learning	(38) 24.58	—	(32) 20.13	—
	Means of all subjects	—	(40) 21.75	—	(40) 13.65

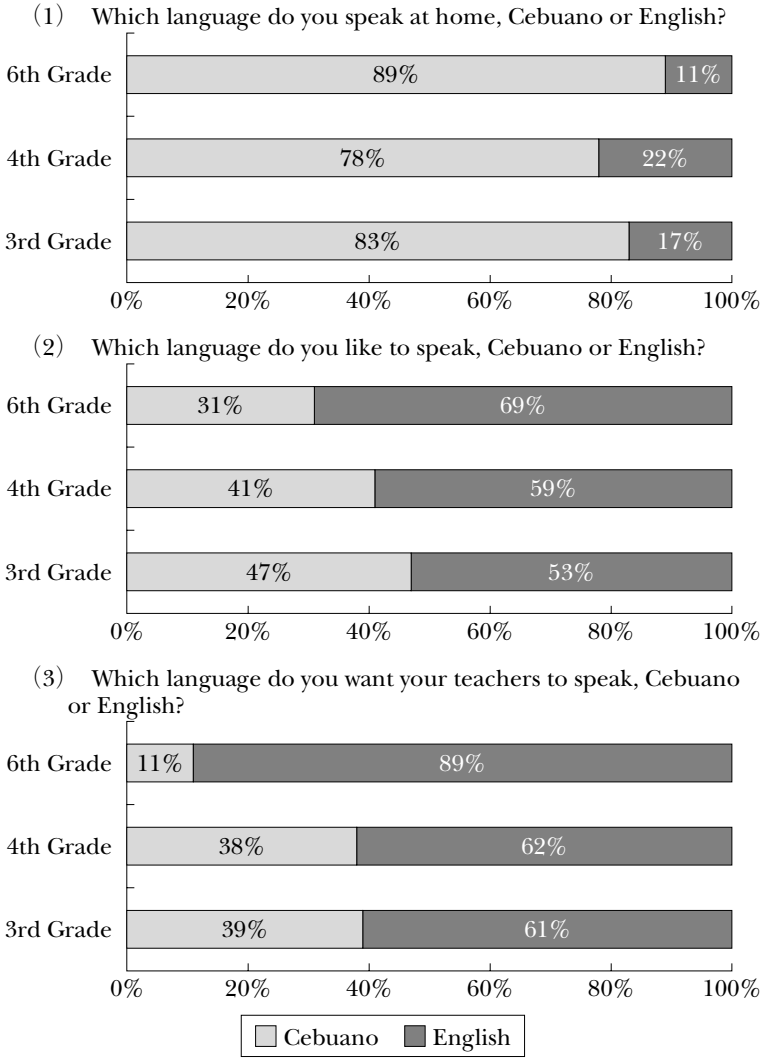
Note: Number inside each parenthesis is subjects.

Table 8 Word Test Score Differences Before and After Learning and Means of the Differences in Each Grade and in Each Group

		VE	VC	E	C	Means of the differences in each grade
Differences before and after learning	Grade III	+11.40	+6.20	+9.60	+11.20	9.60
	Grade IV	+5.20	+3.30	+11.10	+8.00	6.90
	Grade VI	+3.60	+7.40	+5.00	+6.30	5.58
Means of the differences in each group		6.73	5.63	8.57	8.50	

from the means before and after learning, along with the means of the differences in each grade and the means of the differences in each group.

Figure 3　Results of Questionnaire



4) Questionnaire Results

The results of a questionnaire given to the 480 pupils (160 subjects × 3 grades) are shown in Figure 3.

5. Verification of Hypotheses and Discussion

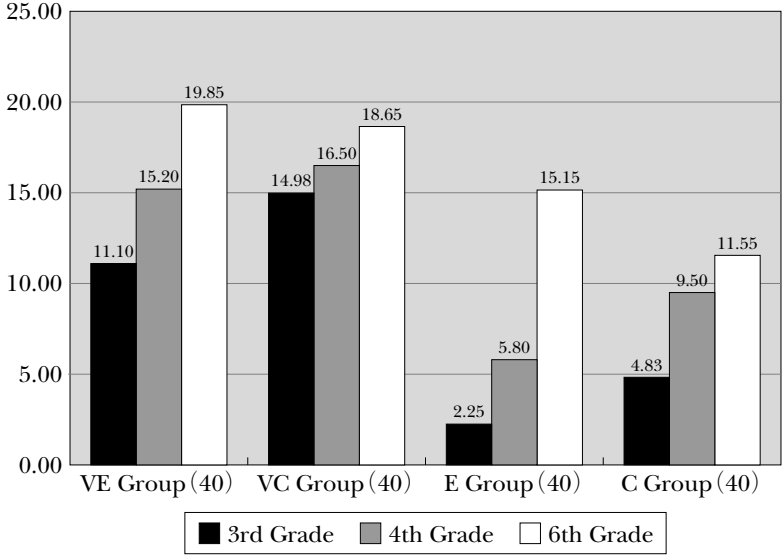
1) Hypothesis 1

Hypothesis 1 was not supported in this experiment. As shown in Table 6, there were no significant differences between the VE and VC groups or between the E and C groups observed in any of grades III, IV, or VI for supporting the hypothesis that using Cebuano instead of English for the language of instruction when learning mathematics results in a higher degree of understanding.

However, the difference of 2.73 between the VE and VC groups in grade III (cf. Table 6) approaches the value of HSD = 2.98 ($\alpha = 0.05$). In addition, the differences in means in the math tests (between before and after learning) for the E and C groups in grade III shown in Figure 4 indicate that, although both groups demonstrated a low level of understanding, use of Cebuano for the language of instruction resulted in a degree of understanding more than twice as high as that in the case of using English. This most likely suggests that learning about "Triangles and Their Perimeters" may be difficult for 3rd graders. In the case of having to understand based solely on words without being assisted by a video, as in the VE and VC groups, 3rd graders would be expected to encounter difficulty in learning using English alone, since only one year has passed since they were using a regional language as an auxiliary language of instruction. The use of auxiliary materials such as videos and illustrations to aid learning and understanding and the use of a regional language as an auxiliary language of instruction at the minimally required level are desirable when teaching mathematics to 3rd graders.

In addition, what is interesting about Table 6 is that in contrast to the math post-test means for grades III and IV being highest for the VC group followed by the VE group, C group, and E group in that order, in the case of grade VI, the means were highest for the VE group followed by the VC group, E group, and C group, with the rankings for English and Cebuano being inverted. Moreover, the relationship between the C and E

Figure 4　Differences of Means of Math Test Scores in Pre-Test and Post-Test



groups in grade VI was such that a hypothesis completely opposite from hypothesis 1 was supported at the 1% significant level, namely, that using English for the language of instruction instead of Cebuano results in a higher degree of understanding (cf. Table 6). On the basis of Figure 4 as well, although Cebuano was determined to be more easily understood than English in grades III and IV (VE < VC, E < C), English appears to be more easily understood than Cebuano in grade VI (VC < VE, C < E). This finding that mathematics is more easily understood when taught in English rather than in Cebuano among 6th graders can be said to demonstrate that English is more suitable than Cebuano for the language of instruction when learning mathematics for those pupils who have English ability.

2) Hypothesis 2

Hypothesis 2 was supported in this experiment. Namely, in the case of using English for the language of instruction when learning mathematics, being familiar with the minimum essen-

tial words for learning mathematics in advance was verified to be effective for understanding. According to Table 7, there were hardly any differences observed in the means of math post-test scores between the VE and VC groups and E and C groups in grade III, between the VE and VC groups and E and C groups in grade IV, and between the VE and VC groups in grade VI. Namely, there were no differences in the degree of understanding regardless of whether English or Cebuano was used for the language of instruction provided that the pupils already were familiar with the three minimum essential words ("triangle," "perimeter," and "twenty") for learning the mathematics used in this experiment.

However, there was a large difference of 6.48 between the means of the E and C groups in grade VI (Table 7). When these results were tested with the T-Test, a significant difference was observed between the means of both groups (both-sided test: $t(78)^9 = 3.38$, $P < 0.01$). This means that the pupils of group E who knew these three words before learning had a higher degree of understanding than the pupils of group C and does not mean that the pupils of group E had a lower degree of understanding than group C despite having been familiar with these three words. This indicates the opposite phenomenon, namely, as was previously described with respect to hypothesis 1, that the use of English for the language of instruction is better for learning mathematics for pupils who have a high English ability.

In the case of using English for the language of instruction for 3rd and 4th graders who do not yet have adequate English ability, it is important to learn English words thought to be important for a particular class prior to learning and to create a schema in their minds, so as to not to cause an obstruction to learning and understanding due to interruption of the thought process as a result of not understanding the words.

3) Hypothesis 3

Hypothesis 3 was supported by the experiment. Significant dif-

ferences were observed between the VE and E groups for grades III, IV, and VI at the 1% significant level (cf. Table 6). Namely, the presentation of a video was verified to be effective for enhancing the degree of understanding of pupils in the case of learning mathematics using English as the language of instruction. This finding is also prominently indicated by Figure 4. In the case of 3rd and 4th grade pupils in particular who still have inadequate English ability, the presence or absence of a video was found to be intimately related to degree of understanding. Although differences were still observed among 6th graders, they were not as pronounced.

In addition, although only groups VE and E were assessed to demonstrate hypothesis 3, there were also significant differences observed in the learning methods between groups VC and C and between groups VE and C for grades III, IV, and VI at the 1% significant level (cf. Table 6). This indicates how important the presentation of animated images is for the degree of understanding when learning mathematics.

Although a TV monitor, videocassette deck, computer, and other expensive equipment are required to use videos as auxiliary teaching materials, and it may not be possible to immediately provide all classrooms with such equipment, it is felt that such equipment is required to be installed in schools in the future through budgetary allocations and international aid programs.

4) Hypothesis 4

Hypothesis 4 was also supported by the experiment. According to the values shown in Table 8, although there were differences in the degree of understanding in grades III, IV, and VI, the pupils clearly learned words that they did not know prior to learning through the learning of mathematics in this experiment. The unknown words are understood, learned, and used to achieve the learning objective. Krashen (1985) mentioned the input hypothesis in a monitor model of his second-language learning theory, and these results accurately reflected that hypothesis.[10]

Figure 5 Differences of Means of Word Test Scores in Pre-Test and Post-Test

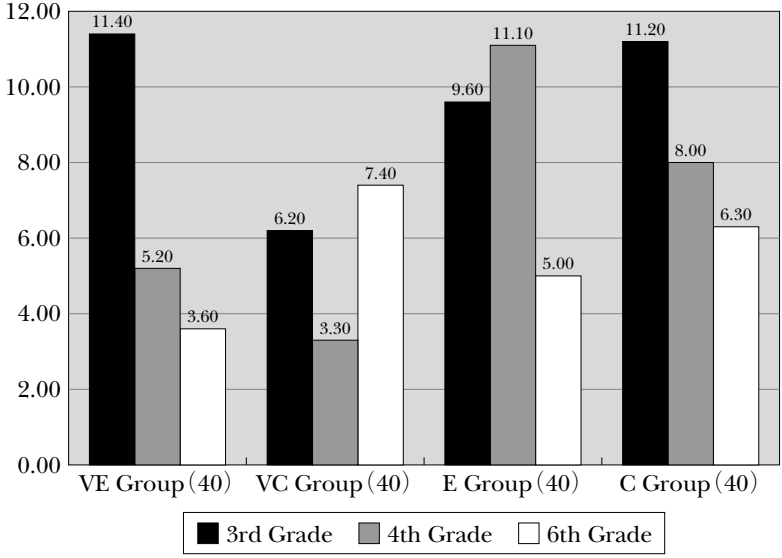


Figure 5 represents differences in the means of word test scores in pre-test and post-test. The value in the 3rd grade VE group was extremely high compared with other grades. This suggests that since 3rd graders were still not accustomed to using English for the language of instruction, they were able to learn numerous unknown words while being assisted by the video. In addition, the value for the 6th grade in the VC group shown in Figure 5 appears to be somewhat peculiar. Although these values would be expected to be lower than those for 4th graders, they were actually higher than the values for 3rd graders. A possible reason for this is that, since these pupils had been using English for the language of instruction when learning mathematics since the 1st grade and had learned words for mathematics in English, the Cebuano language conversely becomes unfamiliar to them, and they therefore learned numerous new words in Cebuano by being assisted by the video.

In addition, the means of difference in each group were such that the E group demonstrated the highest scores followed by the

C group, VE group, and VC group, while the groups that were not shown the video scored higher than the groups that were (cf. Table 8). As was previously mentioned, if animated images assist in the learning of unknown words, then the opposite must be true. Whether the presentation of animated images is effective in learning unknown words, in which situations they are effective, and other questions will require further verification.

5) Questionnaire Results

According to Figure 3, roughly 80% of the pupils of the 3rd, 4th, and 6th grades responded that they speak Cebuano rather than English at home (question (1)). In response to question (2), it is interesting to note that the number of pupils who responded that English was their preferred language gradually increases, although only slightly, from 3rd grade to 4th grade to 6th grade in that order. As is clear from question (1) and (2), in contrast to many of the pupils having spoken Cebuano since they were very young, are more familiar with it, and understand it better, more than half of the pupils indicated that they prefer to speak English. This may indicate that pupils naturally become aware of the fact that being able to speak English provides various advantages for the future in Philippine society. A question should have been asked regarding the reason for their preference for English.

Although roughly the same number (about 60%) of 3rd and 4th graders responded that they wanted their teachers to speak English in response to question (3), roughly 90% of the 6th graders indicated English. This is believed to indicate that, as pupils progress in school and their English ability develops, they begin to sense less difficulty in using English for the language of instruction and conversely welcome the use of English by their teachers. These results are thought to be the achievements of bilingual education in the Philippines. However, in looking at the results of lingua franca education started in 1999 and the results of a questionnaire to instructors conducted by Kim (2004: 107),[11] whether or not this is truly the case remains somewhat questionable, and further studies will be required in the future.

Conclusion

This study focused on the issue of language of instruction when learning mathematics at an elementary school in Cebu. The study consisted of comparing and verifying the degree of understanding of learning mathematics in English from the 1st grade with the case of being taught in the regional language of Cebuano (hypothesis 1), the effect of providing minimum essential words for learning in advance on the degree of understanding (hypothesis 2), the use of video as an effective aid for enhancing the degree of understanding (hypothesis 3), and the conditions surrounding learning unknown words during the course of learning (hypothesis 4).

Although hypotheses 2, 3, and 4 were supported in this experiment, only hypothesis 1 was not supported. For the pupils at Guadalupe Elementary School located in the center of Cebu, Cebuano is both a regional language and a native language, and for 3rd and 4th graders who lack adequate English ability in particular, the experiment was begun with the prediction that it would be self-evident that hypothesis 1 be supported. Why, then, was hypothesis 1 not supported? In order to answer this, one must consider whether the findings obtained in this experiment should be taken at face value, namely, since English used in mathematics and science courses is used as the language of instruction starting in 1st grade in the Philippines, although the English ability of 3rd graders is still underdeveloped, this is not that serious of a problem to the extent that a significant difference would appear, or whether an additional experiment is required in consideration of such factors as the degree of difficulty of the mathematics taught in this experiment or the degree of difficulty in achieving the learning objectives. Even when considering that the achievement rates for mathematics, science, and English are all below 50%, as shown in the basic indicators

relating to public elementary education in 2003 in Table 1, or considering the fact that, although an experiment was conducted involving the use of Tagalog, Ilokano, or Filipino as the language of instruction at elementary schools starting in 1999 in the Philippines (lingua franca education), that project has currently been terminated due to lack of funding (Kim: 2004), additional verification would be desirable.

It is also considered necessary to verify the following matters:

(1) Verification of the school age at which it would be appropriate to switch from a regional language to English during the course of bilingual education.

(2) Verification of the appropriate time when the use of a regional language for the language of instruction should be discontinued during the course of bilingual education, along with the manner in which the use of that regional language should be implemented.

(3) Verification of effective measures for assisting in understanding of subject matter by pupils who lack ability in the language of instruction during the course of bilingual education.

(4) Verification of which unknown words are learned easily during the course of learning, which words are difficult to learn, and if they are learned easily, what type of learning environment facilitated their learning.

(5) Verification of whether video presentations are effective in learning unknown words and the types of situations in which they function effectively.

Acknowledgements

I would like to express my deep appreciation to Mr. Koichiro Katsurai, former JICA expert member, Dr. Antonino Ogdoc, former chief of the secondary education division of DepED-Region VII, and Mr. Kazuyoshi Nakai, technical advisor for SBTP, to the teachers and pupils of Guadalupe Elementary School in Cebu for their kind cooperation in the experiment, and to Ms. Sol Torres for her assistance in conducting the experiment.

Notes

1. The education system in the Philippines is intimately related to that in the United States, as a result of the establishment of the modern public education system in

the Philippines (1901) by the colonial government during the time when the Philippines was a colony of the US (1898–1941) that continues to have a considerable effect even today.

2. "Fact Sheet Basic Education Statistics" published by the Department of Education of the Philippines.
3. "The World Factbook 2007 (Philippines)" by the Central Intelligence Agency (CIA) of the United States.
4. The number of languages listed for the Philippines is 175. Of those, 171 are living languages and 4 are extinct (Ethnologue Report for Philippines).
5. A pidgin, which is said to refer to the Chinese pronunciation of the word "business," is a hybrid proto-language used in trade between local residents and colonies. In particular, the hybrid English used in such former British colonies as China, Southeast Asia, and Melanesia is referred to as Pidgin English. This language does not have any native speakers, the grammar is simplified, and the vocabulary tends to be limited (source: *Kojien Dictionary*).
6. Creole is a language resulting from the acquisition by a subordinate group of the language of a dominant group, with phonological changes, simplification of grammar, and an admixture of the subordinate group's vocabulary, and serving as the mother tongue of its speakers, not solely for communication between people of different languages (source: *Webster's International Dictionary*).
7. Excerpts from scenes 0001 to 0004 of the video "Triangles and Their Perimeters":

Scene	English	Cebuano
0001	Triangle & Their Perimeters.	Triyangulo ug ang sukod sa daplin.
0002	Today's question. How long is the perimeter when we place twenty equilateral triangles?	Ang pangutana karon. Unsay gitas-on sa daplin kung sumpayon ang baynte ka triayangulo nga may managsama ang daplin?
0003	There is one equilateral triangle. The length of each side of the triangle is;	Anaay usa ka triyangulo nga may managsama ang daplin. Ang gitas-on matag daplin sa triyangulo;
0004	One, one, one. All the same.	Usa, usa, usa. Managsama ang isig ka daplin.

8. Although multiple range tests (such as the LSD method, Scheffe method, Tukey HSD method, or Bonferroni method) are used to determine the presence of a difference among methods of treatment, in this study a multiple range test according to the Tukey HSD method was used. In this experiment, although six comparisons were made between the means of the VE and C groups, VE and E groups, VE and VC groups, VC and C groups, VC and E groups, and E and C groups, in general, the greater the number of times comparisons are repeated, the higher the probability of making a type I error at least once. The Tukey HSD method is able to suppress this problem and is the most commonly used method for this type of analysis. In addition, although the number of data points (n) of each group must be equal when using the Tukey HSD method, the number of data points in each group in this study was 40, thus being equal for each group.
9. The reason why the value for df is 78 is because the number of students of both groups was taken to be the same number (40) for the purpose of calculation. Since the number of students in the VE group who knew the three words beforehand was 32, the mean for the VE group was calculated after adding the number

of students that was lacking (8).

10. Krashen emphasized that learning of a second language is not the result of speaking language but rather the result of inputting language that is able to be understood and stated that inputs can be understood by being assisted by the context. Krashen further stated that the ability to communicate in a second language is not acquired directly through guidance but rather the result of a student who is learning the language naturally acquiring the language structure when he or she has received an understandable input, resulting in the second language occurring spontaneously during the course of understanding input of the second language.
11. According to a questionnaire conducted by Kim (2004: 107), among all instructors at an experimental lingua franca school in the Caraga region, nearly 90% of the instructors replied that they recognized the efficacy of native language education, 75% were in favor of native language education, and 75% indicated they desired to teach using the native language.

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