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Effect of Multimedia Teaching to the Achievement of Junior High School Students in Trigonometry

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ABSTRACT

Modernization means advancement of technology. Since technology is now fast growing in any instance, it also affects student's behavior in their studies. This study was conducted to determine the effect of interactive multimedia instruction on the achievement of junior-high-school students in the subject Trigonometry. Design 10, the non-equivalent control-group format was used to conduct the experiment during the fourth quarter of school year 2010-2011. The section, third-year Mayon with 35 students made up the experimental group, while that of third-year Apo with 35 students became the control group comprising of 70 third-year students of Daniel R. Aguinaldo National High School as the subjects of the study. The experimental group was evaluated based on treatment X, which used the interactive multimedia instruction. The traditional method of teaching was used by control group and isolated from the experimental intervention and was evaluated during the pre-test and post-test periods. Data were retrieved using the test made by the investigator. It came out that both groups displayed learning improvement at the end of the study, but the magnitude of an increase significantly differed. The study concludes that interactive multimedia instruction

led to higher improvement of teaching trigonometry than the conventional method adopted by the control group.

Keywords **-** Multimedia Instruction, academic achievement, non-equivalent control group design, Davao City, Philippines

INTRODUCTION

In modern time, technology has an increasing impact on human life. It changed the ways we teach and learn because of the advancement of technology (Chuang, 1999). The survey, conducted by TIMSS in 2003 showed the overall performance of the students from Tunisia, Egypt, Morocco, Botswana, Ghana, and South Africa on mathematics test was very low as compared to the international country mean score. It also observed that these African countries make the least use of technology in their mathematics curricula. In United States, most of their students decline their score in Math (Coulson, 2012). Moreover, the competitiveness of the Philippines in the world wide assessment test had slid down to the lower rank (COMSTE, 2009). According to Briones (1990), the teaching-learning process involves a chain reaction between the teacher and the students. The Integration of technology as a new strategy in teaching mathematics will help teachers to make lessons interesting for the learners. In the learning process, students learn more if they involve on it. There is a higher percentage that students understand the lesson when they have interacted.

In incorporating multimedia in classroom instruction, teachers can capture the attention and engage learners into tasks while making it easy to explain difficult concepts that inspire creativity and bring about fun (Schroeder, 2010).

OBJECTIVES OF THE STUDY

The purpose of the study was to provide empirical facts on the effect of teaching using multimedia on the achievement of junior-high-school students in the subject, Trigonometry. Specifically, the study determined: 1) the pre-test and post-test mean scores of the experimental and control groups in the following areas such as a) the graph of sine, the b) cosine function, the c) six trigonometric functions, the d) right triangle trigonometry, the e) solving right triangle, the f) Law of Sines, and the g) Law of Cosines; 2) the mean gain scores in each of the specified areas taken by the experimental and the control group; and 3) the pre-

test and post-test mean scores in each of the areas taken by the experimental and control groups.

MATERIALS AND METHODS

Design 10 is known as the non-equivalent control group design by Campbell and Stanley (1967). The design is diagrammed as follows:

Experimental Group	O_1 X	O_3

Control Group	O_2	O_4

where:

O_1	=	pretest of the experimental group
O_2	=	pretest of the control group
O_3	=	posttest of the experimental group
O_4	=	posttest of the control group
---	=	non-random assignment of subjects

Design 10 was used because both the experimental and control groups were naturally assembled. As such, it was not possible to transfer the students from one group to another. The subjects gave informed consent to the researcher by signing the form in compliance to research ethics protocol. As signified by the broken lines, the two groups were not formed by random assignment however; they were comparable for they had more or less the same characteristics. The experimental group was evaluated based on treatment X which made use of the multimedia instruction, while control group was isolated from the experimental intervention, which was evaluated during the pre-test and the post-test periods. The O_1 and O_3 were two evaluations of the experimental group before and after its exposure to treatment X, while O_2 and O_4 were the pre-test and post-test evaluations of the control group respectively.

The instrument used in the study is the teacher-made test. The content validity was carefully checked and validated by the panel of validators. It was pilot-tested to 40 students to establish the reliability and construct validity of the test. The results showed that the test instrument had a reliability index of 0.785 which meant good internal consistency. The instrument was utilized during the administration of a pre-test and a post-test to both groups to determine the

students' academic achievement in the subject, Trigonometry before and after the experiment. A 60-item questionnaire was made up of the following: the six trigonometric functions with 10 items; right triangle trigonometry with 11 items; solving the right triangle with 17 items; graph of sines and cosines made up of 12 items; law of sines with four items, and lastly, the law of cosines with six items. The study was conducted at Daniel R. Aguinaldo National High School (DRANHS) during the fourth-grading period of the school year 2010-2011. The participants were third-year special science classes made up the scholars of the Department of Science and Technology. There were two sections used as participants, namely III-Mayon and III-Apo, that both composed of 35 students with seven boys and 28 girls.

The following steps were observed in the conduct of the study: 1) Presentation of the research topic; 2) Permission to conduct the study was sought from the Officer in Charge of Daniel R. Aguinaldo National High School; 3) Development of the test; 4) Selection of subjects in the experimental and control groups; 5) Administration of the Pre-Test; 6) Conduct of the experiment; 7) Administration of the posttest; and 8) Analysis and interpretation of data (see Figure 1).

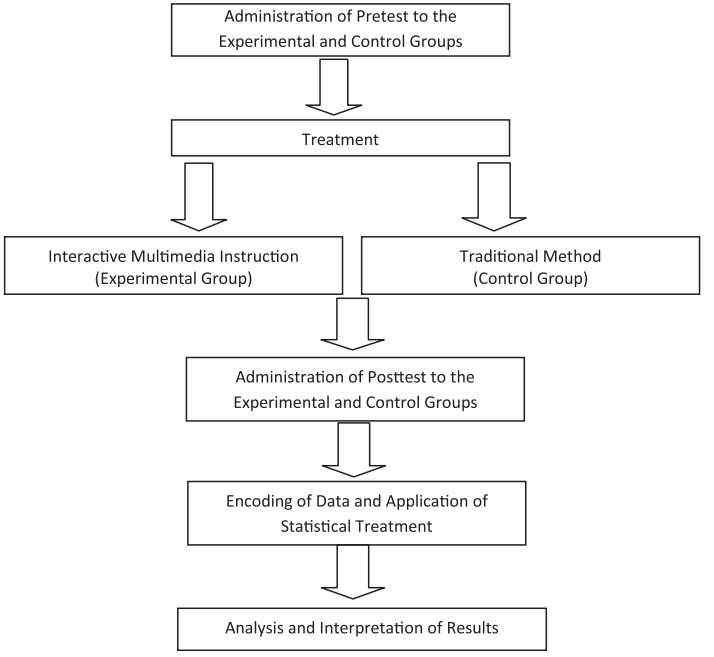

Figure 1. Flowchart of the Research Procedure

RESULTS AND DISCUSSION

Pre-test of the Experimental and Control Groups.

Table 1 presents the pre-test mean scores of experimental and control groups. The overall mean score of the control group was 16.23 while the experimental group, 15.94, both described as very poor. This was an indication that the students had a very poor background in the six areas of Trigonometry under study, before the conduct of an experiment. It should also be noted that students from public schools, the students had no idea about trigonometry since it was only taken by those about to be seniors students. The result led to no significant difference since the computed p-value was 0.84 that was greater than 0.05. It indicated that both experimental and control groups almost had the same knowledge in trigonometry.

Table 1. Pre-test mean scores

Sub-topic	Groups	Mean	Qualitative Description	Mean Difference	T	Df	Sig. (2-tailed)
Six Trigonometric Functions	Exp.	5.09	Fair	0.29	0.60	68	0.55
	Control	4.80	Fair				
Right Triangle Trigonometry	Exp.	1.86	Very Poor	0.46	0.86	68	0.40
	Control	1.40	Very Poor				
Solving Right Triangle	Exp.	3.63	Very Poor	0.57	0.10	68	0.92
	Control	3.57	Very Poor				
Graph of Sines and Cosines	Exp.	4.74	Poor	0.40	0.75	68	0.46
	Control	4.34	Poor				
Law of Cosines	Exp.	0.29	Very Poor	-1.20	-4.69	68	0.00
	Control	1.49	Very Poor				
Law of Sines	Exp.	0.34	Very Poor	-0.29	-1.60	68	0.12
	Control	0.63	Very Poor				
Overall	Exp.	15.94	Very Poor	-0.29	-0.20	68	0.84
	Control	16.23	Very Poor				

Post-test of the Experimental and Control Groups

The overall mean score of the control group was 38.23 with a verbal description of satisfactory while the experimental group took the mean score of 50.31 which means very satisfactory. The computed p-value of the overall post-test was 0.00

which was less than 0.05. This showed that there was a significant difference between the achievement results of the two groups. The post-test difference mean scores of the experimental and the control group were 12.09, which can imply that the teaching method used by the experimental group using the multimedia instruction made a greater impact than the method used by the control group that was subjected to conventional teaching. The use of the conventional way of teaching mathematics should be discouraged. Instead, the use of new techniques that will lead to participate in class discussions and lead them to be an active participant in learning should be encouraged. This idea has been supported by Amora (1998), claiming that the adequacy of instructional materials was essential in teaching-learning process.

Table 2. Post-test mean scores

Sub-topic	Groups	Mean	Qualitative Description	Mean Difference	T	Df	Sig. (2-tailed)
Six Trigonometric Functions	Exp.	8.23	Very Satisfactory	3.43	6.34	68	0.00
	Control	4.80	Fair				
Right Triangle Trigonometry	Exp.	9.51	Very Satisfactory	1.89	2.68	68	0.01
	Control	7.63	Satisfactory				
Solving Right Triangle	Exp.	13.29	Satisfactory	3.31	4.80	68	0.00
	Control	9.97	Fair				
Graph of Sines and Cosines	Exp.	11.34	Very Satisfactory	2.49	4.82	68	0.00
	Control	8.86	Satisfactory				
Law of Cosines	Exp.	5.26	Very Satisfactory	0.60	2.80	68	0.01
	Control	4.66	Satisfactory				
Law of Sines	Exp.	2.69	Satisfactory	0.37	1.83	68	0.07
	Control	2.31	Fair				
Overall	Exp.	50.31	Very Satisfactory	12.09	7.05	68	0.00
	Control	38.23	Satisfactory				

Table 2 showed that there was a significant difference in terms knowledge after the use of the two methods. It also showed that the method used in the experimental group which was the use of multimedia instruction made a greater

impact on the achievement of the students. It also showed that the other five areas also had a significant difference in favor of the method used by the experimental group. It showed that both groups had a significant difference. After the experiment, it was found out that there was a significant difference between the two methods used by the experimental group and the control group. The result showed that the method used by the experimental group made a greater impact than the method used by the control group since the mean scores of the experimental group was greater of that of the control group.

Mean Gain Scores

Presented in Table 3 is a test on the significance of the difference of the mean gain scores of the two groups.

As shown in Table 3, since the computed p-value was 0.00 (less than 0.05), it would mean that there was a significant difference between the mean gain scores of the two groups. Although both groups displayed a learning improvement at the end of the experiment, the magnitude of an increase significantly differed. The control group had a poor learning gain while the learning gain of an experimental group was fair.

Interactive multimedia can address good teaching and learning practice requirements which aim to engage students in active rather than passive learning (Kennedy and McNaught, 1997). Through a transformative rather than a pre-emptive or expository model of design, aims are possible to be attained. In the modern era, almost everything in the world has become computer-integrated. More interactive teaching by integrating modern technology in teaching will help make classroom instruction more active and more interesting.

Table 3. Mean gain scores

Sub-topic	Groups	Mean	Qualitative Description	Mean Difference	T	Df	Sig. (2-tailed)
Six Trigonometric Functions	Exp.	3.14	Poor	3.14	4.48	68	0.00
	Control	0.00	Very Poor				
Right Triangle Trigonometry	Exp.	7.66	Satisfactory	1.43	1.55	68	0.13
	Control	6.23	Fair				
Solving Right Triangle	Exp.	9.66	Fair	3.26	4.22	68	0.00
	Control	6.40	Poor				

Graph of Sines and Cosines	Exp.	6.60	Fair	2.09	2.83	68	0.01
	Control	4.51	Poor				
Law of Cosines	Exp.	4.97	Very Satis-factory	1.80	5.29	68	0.00
	Control	3.17	Fair				
Law of Sines	Exp.	2.34	Fair	0.66	2.32	68	0.02
	Control	1.69	Poor				
Overall	Exp.	34.37	Fair	12.37	5.60	68	0.00
	Control	22.00	Poor				

Pre-test minus Post-test within the Experimental Group

Table 4 shows the pre-test minus post-test mean scores within the experimental group. Among the six areas in the subject, Trigonometry using Statistical Packages for the Social Sciences, the computed p-value was 0.00 that was less than 0.05. Therefore, the difference of means before and after conducting the strategy used for an experimental group was significantly different. The use of multimedia in teaching was effective based on the students' test result.

The same finding was true in the study of Herrington and Oliver (1996) which found out that the multimedia has a significant future in education. The body of research accompanying its continual development is aiding considerably in improving the effectiveness of technologies as a delivery medium. As a new medium, some of the instructional designs that accompany materials development are pioneering and innovative.

Table 4. Pre-test minus post-test of the experimental group

Sub-topic	Mean	Std. Deviation	T	Sig. (2-tailed)
Six Trigonometric Functions	-3.14	3.11	-5.98	0.00
Right Triangle Trigonometry	-7.66	3.61	-12.54	0.00
Solving Right Triangle	-9.66	3.00	-19.05	0.00
Graph of Sines and Cosines	-6.60	2.51	-15.55	0.00
Law of Cosines	-4.97	1.04	-28.21	0.00
Law of Sines	-0.34	0.97	-14.31	0.00

Pre-test minus Post-test within the Control Group

Pre-test minus Post-test mean scores within the control group are presented in Table 5. Among the six areas in the subject, Trigonometry, five of the areas showed that the computed p-value was 0.00 that was less than 0.05 while in the area of the six trigonometric functions, the computed p-value was 1.00 that was greater than 0.05. This would mean that the traditional way of teaching was effective among five areas in trigonometry while in the area of six trigonometric functions was not effective.

Although both groups displayed learning improvement at the end of the experiment, the magnitude of an increase significantly differed. It showed that the method used for the experimental group which was the use of teaching multimedia instruction had a high impact on the achievement results of the students than the method used for the control group that was the traditional way of teaching.

Table 5. Pre-test minus post-test of control group

Sub-topic	Mean	Std. Deviation	T	Df	Sig. (2-tailed)
Six Trigonometric Functions	0.00	2.76	0.00	34	1.00
Right Triangle Trigonometry	-6.23	4.09	-9.01	34	0.00
Solving Right Triangle	-6.40	3.45	-10.98	34	0.00
Graph of Sines and Cosines	-4.51	3.56	-7.50	34	0.00
Law of Cosines	-3.17	1.72	-10.89	34	0.00
Law of Sines	-1.69	1.37	-7.30	34	0.00

The findings were attributed to the two methods used by the researcher that was employment of the multimedia instruction for the experimental group and the conventional methods for the control group.

It is also supported by Sangalang (2004) when he discovered that learning gains like good student performance in final tests or comparisons between pre- and post-test results were analyzed for multimedia and classroom subjects. It turned out that gain for multimedia students were found to be between 38 and 56 percent greater than classroom counterpart.

Integration of technology in learning is an effective strategy in teaching Mathematics. Results show that students appreciate the lesson and become an active learner in using Multimedia Instruction. It also leads them to gain skills that are related to technology while learning Mathematics.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn: 1) as to the pre-test scores, both groups had no significant difference in terms of knowledge in the five areas of trigonometry. The control group manifested greater ideas on the topic than the experimental group before the experiment; 2) after the experiment, there existed a significant difference between the post-test means score in the six areas. The experimental groups underwent multimedia instruction while the control group used the conventional way of instruction. The method of instruction used by the experimental group had a greater impact on achievement; therefore, the interactive instruction was found out to be more effective than the conventional way of teaching; 3) since the mean gain scores of the experimental group significantly differed from that of the control group, the experimental group experienced greater learning that increased after treatment compared to the control group. Therefore, the use of interactive multimedia instruction was more effective than the use of the conventional way of teaching in the subject, Trigonometry; 4) between the pre-test and the post-test mean scores of the experimental group, it was shown that in all areas covered, there was a significant difference. Multimedia instruction was effective in teaching Trigonometry; and 5) as to the pre-test and post-test mean scores of the control group taking the five areas, there was a significant difference while in the area of the six trigonometric functions, that there was a significant difference. Not all areas found the conventional method effective.

In teaching Mathematics, the integration of multimedia instruction is effective in the learning-process. It is remarkable that there is higher impact to the achievement of students who undergo multimedia instruction than those who uses the traditional way of teaching. Students in the experimental group have shown slightly higher performance than the control group.

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