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The Effects of Four Methods of Teaching on Achievement in Basic Mathematics

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Abstract - The study aimed to determine the achievement level of the students in the four experimental groups based on the pre-test and post-test results along knowledge, comprehension, application and analysis skills; the effect of the methods of teaching towards students' achievement in mathematics; and the interaction of the students' achievement scores as influenced by methods of teaching and mental ability. The subjects of this study were the first year students enrolled in the Bachelor of Science in Business Administration of Surigao del Sur Polytechnic State College, Tandag Campus who had taken Basic Mathematics. Constructivist and lecture methods of teaching showed comparable performances during the posttest. Cooperative learning method and reporting method of teaching had exhibited significant difference while the other methods of teaching showed no significant difference. The methods of teaching had greatly influenced the performance of the students.

The methods of teaching and mental ability had interacted with each other which resulted to the high performance level of the students.

Keywords - teaching, business administration, achievement level

INTRODUCTION

The two important questions that a mathematics instructor often asks are: "How do I successfully teach Mathematics concepts and skills so they are understood and remembered?" and "How can I effectively teach this math content?" Rather than focusing solely on content, instructional question must also relate to the needs of the learner (Sherman, 2005).

In the course of teaching mathematics, there are several factors that contributed to the underlying performance of the students in mathematics. Obviously, the prime factor is the teacher himself who makes use of his own ability to present the lesson using different modes of approaches and strategies. Many students are hard to convince to go with certain approaches because there are other factors that hinder them.

According to Mabry (2005), good teaching is paramount to successful student learning. However, becoming a good mathematics teacher requires knowledge of subject matter, pedagogical content, and curricula. But the reality of most mathematics teachers is that learning is often disconnected from their classroom towards outside environment and needs to be reinforced.

The teacher must transfer responsibility for learning to the students gradually and offer support at every step. The teacher must clearly establish the purpose behind any activity including what exactly students are supposed to do to successfully perform learning tasks (Fisher, 2008).

The study of Senoc (2007) showed that the poor showing of Filipino students in mathematics which is evident in the national achievement tests for both public elementary and secondary school children would result to the slow advancement of Philippine technology compared

to other countries. This was also further stressed in the data from DepEd's National Educational Testing and Research Center (NETRC) which revealed that while students can comprehend mathematics' basic principle, "they have difficulty in applying such basic principles to prove and analyze data in geometry and comprehend basic concepts on algebra, geometry and statistics.

So, it is on this level of pedagogy that teachers must do something inside the classroom on how to improve the performance of the students in mathematics instruction. The use of varied teaching approaches for the purpose of student' development must be given the first priority of the teacher so as to allow the academic environment to become participative.

OBJECTIVES OF THE STUDY

This study aimed to determine the effects of the four methods of teaching in Basic Mathematics. Specifically, the study sought to find answer to the following:

1. The achievement level of the students in the four experimental groups based on the pretest and posttest results along knowledge, comprehension, application and analysis skills;
2. The significant difference in the students' achievement level and the four methods of teaching based on the pretest and posttest results;
3. The significant effect of the methods of teaching towards students' achievement in mathematics; and
4. The significant interaction of the student achievement scores in mathematics as influenced by the methods of teaching and mental ability.

MATERIALS AND METHODS

This study used the Comparison Group Pre-test/Post design to determine the effects of the four methods of teaching in Basic Mathematics. In this design, the research substitutes statistical (controls) for the absence of physical control of the experimental situation.

The design is illustrated as follows:

Groups	Pretest	Treatment	Posttest
Constructivist	Q_1	T_1	Q_2
Reporting	Q_1	T_2	Q_2
Cooperative Learning	Q_1	T_3	Q_2
Lecture (control)	Q_1	T_0	Q_2

This study used a validated teacher-made test in assessing the performance of the subjects in Basic Mathematics. Scheffe Computation was used to determine if there is a significant difference in the achievement level of the students between the pre-test and post-test results. Analysis of Covariance was also used to determine if there is a significant effect of four methods of teaching on the achievement scores of the subjects and to determine if there is a significant interaction of the student achievement scores as influenced by the four methods of teaching and mental ability.

RESULTS AND DISCUSSION

The Achievement Level of the Students in the Four Experimental Groups Based on the Pre-test Results

Table 1. The cognitive skills of the subjects in the pretest and posttest

Methods	Mean Computation								
	Knowledge (5-items)		Comprehension (7-items)		Application (10-items)		Analysis (16-items)		Average
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Mean
Constructivist	2.31	2.72	4.22	4.92	4.72	5.33	6.36	7.08	4.71
Reporting	1.69	2.59	3.10	4.28	3.90	5.72	6.33	7.59	4.40
Cooperative Learning	2.08	1.51	3.65	4.32	3.92	5.03	5.57	6.60	4.09
Lecture	2.36	2.68	4.18	4.71	4.26	5.97	5.69	8.55	4.80

Data as shown in Table 1 showed that the subjects in the lecture group being the controlled method of teaching in the experiment had performed better as compared to the other group of subjects.

While the subjects were still adjusting with the other methods of teaching like cooperative learning method, constructivist method and reporting method, the lecture method showed an indication that it has been used for a period of time by the teachers. So the subjects were already accustomed to it. However, the data also revealed that constructivist and lecture methods showed comparable performances with each other. Moreover, this can be explained that since the methods of teaching were already given to the subjects in the experimental period, there was an intellectual change that caused the increase in the mean of every group of subjects in the posttest as compared to their means in the pretest.

This conforms to the study of Senoc (2007) that the constructivist approach is as good as the lecture method. This can be deduced that since most of the instructors were using the lecture method in imparting their lessons, the subjects were already used to it.

The study confirms the findings in the study of Galvadores (1995) that the post test of the pupils' achievement scores exposed to the modeling method was greater than the pretest achievement scores.

The study conforms to the study of Garcia (1987) on change adaptability of teachers in relation to teaching efficiency that the most important component in education next to the students is the teachers. The role of the teacher is very crucial in shaping and forming the student, and in providing him with the necessary experiences in preparation for life. Her findings strongly suggest that change adaptability has a very high correlation with teaching efficiency.

The Significant Difference in the Students' Achievement Level

and the Four Methods of Teaching

Table 2. Comparison of methods of teaching in the posttest

Methods of Teaching	Result in Step 1	Result in Step 2	Result in Step 3	Test Statistic	Decision
Constructivist and Reporting	1.841	1.5123	1.217	2.79	**
Constructivist and Cooperative Learning	2.597	1.5512	1.674	2.79	**
Constructivist Learning and Lecture	0.123	1.5123	0.081	2.79	**
Reporting and Cooperative Learning	4.438	1.4910	2.977	2.79	*
Reporting and Lecture	1.718	1.4518	1.183	2.79	**
Cooperative Learning and Lecture	2.72	1.4910	1.824	2.79	**

Legend: * significant
**** not significant**

When one method of teaching is compared to the other method of teaching using the Scheffe computation, data in Table 2 showed that there is significant difference in reporting and cooperative learning methods where the computed data of 2.977 is greater than the critical value of 2.79. Hence, it rejected the null hypothesis on the significant difference of the students' achievement level and the four methods of teaching in the posttest. Likewise, the data also showed that it failed to reject the null hypothesis in the constructivist and reporting methods, constructivist and cooperative learning methods, constructivist and lecture (control) methods, reporting and lecture methods, cooperative learning and lecture methods since the computed data is less than the critical value.

This study affirms the study of Luna (1989) which cited that one of the difficulties of teaching at all levels lies in the ability of students to grasp new concepts and to make learning more lasting to those whose rate of assimilation is not as fast as expected. This means that one method of teaching differ from each other depending on the ability of the students to comprehend immediate understanding on the lesson presented. Even if the students will be grouped to the most unfamiliar method of teaching but if their ability to grasp information is high, this will cater genuine learning.

The data in this study support the findings of Gulac (1993) that there is a significant difference in the achievement scores among the groups subjected to the different methods of teaching using the Traditional Method, Individual Instruction Method and Cooperative Group Instruction Method. The students in the Cooperative Group had superior achievements compared to the achievements of students under the Individual Instruction and Traditional Method.

Table 3. The Achievement Level of the Students in the Pretest and Posttest and the Methods of Teaching

Source of Variation	SS'	df	MS'	F-Ratio Computed	F-Ratio Critical	Decision
Factor A	5,987.74	1	5987.7	8.52	3.92	*
Factor B	21,327.39	3	7109.1	10.12	2.68	*
Interaction	17,528.2	3	5842.7	8.32	2.68	*
Error Within	74,656.93	106.3	702.65			

Legend: * = significant

With respect to the methods of teaching that influenced the achievement level of the students in the pretest and posttest, the analysis of covariance as shown in Table 3 yielded a computed F-value of 10.12 which is greater that the critical value of 2.68 at 0.05 level of significance. Thus, the null hypothesis that there is significant difference in the achievement level between the four groups of students based on their pretest and posttest results is rejected. This implies that there is a significant performance done by the methods of teaching to the

achievement level of the subjects from the pretest up to the posttest period.

This study relates to the study of Garay (2001) that there is a significant difference observed in the pre-test and post-test scores of the cooperative learning and the traditional method groups. This also affirms the findings of Cezar (2001) that there is a significant difference between pretest and posttest performance in the four classes. The findings pointed out that the students learned significantly under the four methods of teaching. There was only a very slight difference among the scores which revealed that the four groups were comparable. The level of posttest achievement of the students in the four methods of teaching increased from very low to low. However, the present study negates with the findings of Cezar that the experimental group performed better than the control group as shown in the achievement test results after the treatment.

The Significant Effect of the Methods of Teaching towards Students' Achievement Scores

Table 4. The effect of the methods of teaching to the performance of the students

Source of Variation	Original Sum of Squares	Adjusted Sum of Squares	Degree of Freedom	Adjusted Mean Square	F-Value Computed
Between	159.82 98.63 260.57	200.64	3	66.88	3.11
Within	3281.94 1952.09 4297.28	3136.18	146	21.48	
Total	3441.76 2050.72 4557.85	3336.82	149		
Tabular Value at 5% Level of Significance					2.60
Decision	*				

Legend: * = significant

As to the significant effect of methods of teaching to the performance of the students, results shown in Table 4 revealed that

the computed value is 3.11, greater than the critical value of 2.60 at 5% level of significance. Hence, the null hypothesis is rejected. So, there is significant effect of the methods of teaching to the performance of the students. This implies that the methods of teaching had greatly influenced the performance of the students.

This study negates the findings of Senoc (2007) that there is no significant effect of the methods of teaching on the achievement scores in Statistics when students are grouped in terms of mental ability. This means that in this study, the subjects had really responded positively on the methods of teaching given to them especially on the lecture and constructivist methods.

The present study also disconfirms the findings of Garay (2001) that there was no significant effect of the instructional techniques on the mathematics achievement.

The Significant Interaction of the Student Achievement Scores as Influenced by the Methods of Teaching and Mental Ability

Table 5. The interaction of the students' achievement scores as influenced by the methods of teaching and mental ability

Source of Variation	SS'	df	MS'	F-Ratio Computed	F-Ratio Critical	Decision
Factor A	5,987.74	1	5987.7	8.52	3.92	*
Factor B	21,327.39	3	7109.1	10.12	2.68	*
Interaction	17,528.2	3	5842.7	8.32	2.68	*
Error Within	74,656.93	106.3	702.65			

Legend: * = significant

The analysis of covariance as shown in Table 5 yielded a computed value of 8.52 greater than the critical value of 3.92 at 0.05 level of significance on the students' achievement as influenced by the mental ability. Thus, the data revealed that there is a significant effect of mental ability on the students' achievement.

On the other hand, the analysis of covariance also yielded a computed value of 8.32 greater than the critical value of 2.68 at 0.05 level of significance for the students' achievement as influenced by the mental ability and method of teaching. Thus the null hypothesis on the interaction of students' achievement as influenced by the mental ability and methods of teaching is rejected. This means that the achievement of the students had mixed effect with respect to their mental ability and methods of teaching.

This implies that the teacher will make use of a method which will prove to be effective to the type or group of students. This means further that if the mental ability of the students is from average to above average, then constructivist, cooperative learning and reporting methods of teaching can be applied. However, the lecture method might be applicable if the mental ability of the students is from average to below average.

This study disconfirms the findings in the study of Senoc (2007) that there is no significant interaction of the students' achievement scores in Statistics as influenced by their mental ability and method of instruction.

CONCLUSIONS

Based on the findings, the following conclusions are presented:

1. Constructivist and lecture methods of teaching showed comparable performances during the posttest.
2. Cooperative learning method and reporting method of teaching had exhibited significant difference while the other methods of teaching showed no significant difference.
3. The methods of teaching had greatly influenced the performance of the students.
4. The methods of teaching and mental ability had interacted with each other which resulted to the high performance level of the students.

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