

Correlates Teaching Methods to Students' Academic Performance

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Abstract

This study aimed to compare the academic performance of the students using the four methods of teaching Algebra courses. It investigates how the pretest and posttest scores of the students in Algebra differ, as influenced by the four learning methods. The subjects utilized in the study were the First Year students of the College of Teacher Education who took up the College Algebra course. The study employed a pretest-posttest quasi-experimental design. A researcher-made test in Algebra was used to gather the data. The questionnaire underwent validity and reliability tests. The study used One-Way Analysis of Covariance to find the significant difference between the four methods of teaching. The findings of the study show that there is a significant difference in the scores of the students, after being exposed to the four methods of instruction. The problem-solving method showed to have a better effect than the other three methods, namely: structuring, puzzle, and lecture methods.

Keywords: academic performance, methods of teaching, structuring, puzzle, problem-solving

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1.0 Introduction

The teaching method is the teacher's unique way of presenting a topic to the learners, characterized by adeptness in performing the steps with utmost care to ensure the attainment of the learning objective (Salandan, 2012). Many course learning outcomes and the associated tasks require proficiency in a wide range of generic academic skills. Some of these capabilities that are embedded in the academe assume student competency and do not explicitly help the students develop them. Teachers can help enhance these abilities by using simple strategies that can form part of their day-to-day teaching (Spiller & Ferguson, 2011).

According to King *et al.*, as cited by Peterson (2011), it becomes evident that it is not the placement in the general education classroom that makes the difference for the education of students, but it is the instructional strategies used by the teachers. Hence, this study determined which method of teaching algebra is more effective in enhancing the academic performance of the students. The principle of "learner at the center" (Sherman, 2005) implies that more than one teaching method is necessary to achieve the desired results. The most effective method that benefits the dissimilar learner is multidimensional and systematic. It examines all the conditions within and surrounding the child, such as the curricular content, context of the classroom, academic and social behavior, and ways in which students process information and respond to the feedback.

Some students entering college lack the basic arithmetic proficiency and problem-solving skills that are needed to succeed in a college-level mathematics course, specifically in Algebra. Suarez (2004), in her study, stipulated that success in mathematics has been identified as a predictor of baccalaureate degree completion. Within the coursework of college mathematics, College Algebra has been identified as a high-risk course due to its low success rates. This problem results in a high rate of failures in Algebra, which has always been a problem in many colleges and universities in the Philippines. This problem is seen to have been prevailing at Surigao del Sur State University. As a concerned mathematics instructor of Surigao del Sur State University, the researcher was motivated to conduct a study to investigate the possible factors that cause this problem.

This scientific endeavor can be a springboard for all mathematics instructors, in their way of teaching, to further improve the students' academic performance, particularly in Algebra. This study used and discussed some methods that teachers can employ that are useful in helping the students gain the necessary background information and prerequisite knowledge in mathematics. The researcher believes that the variety of pedagogies in teaching algebra can be used to improve the performance of students. These methods, aside from the lecture method, can be in the form of structuring, puzzle, and problem-solving methods.

2.0 Framework

This study leans on the concept that a student-centered classroom results in better performance compared to a classroom rigorously manned by a teacher. Higher Order Thinking Skills (HOTS) designed activities propel students academically rather than using spoon-feeding activities.

Carl Roger's Facilitation Theory supports the claim of this study. The basic premise of this theory is that learning will occur when the educator acts as facilitator, that is, by establishing an atmosphere in which the learner feels comfortable considering new ideas and not being threatened by external forces. The facilitative teacher here is less protective of their constructs and beliefs, and more able to listen to learners, especially to their feelings. On the other hand, learners are encouraged to take responsibility for their own learning, providing much input for the knowledge, which occurs through their insights and experiences. Learners are encouraged to consider that the most practical evaluation is self-evaluation. Learning needs to focus on factors that contribute to solving significant problems or achieving effective results (Lim, 2009).

3.0 Locale of the Study

Surigao del Sur State University is a newly converted State University in the country under Republic Act No. 9888, approved on February 22, 2010. It has six (6) campuses spread in the province of Surigao del Sur. Based on the University mandate, SDSSU Tandag is the campus for Advanced Studies, Engineering, Arts and Sciences, and Teacher Education. This campus is a seat of governance of the six (6) campuses of the system under R.A. 7377 in 1992. The Cantilan campus is considered the College of Technological Education. SDSSU-Cagwait campus concentrates its flagship program on Industrial Technology, SDSSU-San Miguel campus is identified as the College of Forestry and Agriculture; SDSSU Lianga campus specializes in Fishery and Marine Sciences, and SDSSU Tagbina is a campus for Agri-Business and Commercial Sciences. The university ensures quality graduates; hence, it subjects its programs and curricular offerings to quality assurance through accreditation and monitoring by the recognized accrediting agency in the country, the Accrediting Agencies for Chartered Colleges and Universities in the Philippines (AACUP), Inc., as well as the Commission on Higher Education.

4.0 Problem Definition

The study compared the academic performance of students who were instructed under the four teaching methods, thereby identifying which method is most effective in enhancing the academic performance in Algebra.

5.0 Methodology

This study used a pretest-posttest quasi-experimental design to determine the academic performance of students using the four methods of teaching Algebra. This design is the same as the classic controlled experimental design, except that the subjects cannot be randomly assigned to either the experimental or the control group; the researcher cannot control which group will get the treatment. In other words, subjects have the same chance to be in the control or experimental group or either to receive or not receive the treatment.

This study used a researcher-made achievement test in Algebra which was subjected to validity and reliability tests. It consists of twenty-three items of multiple choice test that includes topics on Linear Equations and Functions, Quadratic Equations, and Systems of Equations based on the College Algebra syllabus. A Table of Specifications was also formulated to guide the researcher in constructing the test items.

To test the validity of the questionnaire, content and construct validity were conducted. In the content validity, the researcher identified five experts in mathematics who had been teaching mathematics for many years to check whether each item has relevance to the topics, whether there is coherence in the statement, and the proportion of questions included in the entire instrument.

After the content validation of the test with the experts, a try-out of the content-validated questionnaire was conducted for students who have already taken up Algebra for item analysis. These were selected second-year and third-year students of the College of Teacher Education. An item analysis of the result was applied to come up with a final instrument.

Construct validity of the instrument was also done by the researcher. The selected fourth and third-year students of the College Teacher Education were made to answer the four sets of questionnaires to establish the construct validity. It includes Concurrent validity, Convergent validity, Divergent validity, and Known-Group or Test-Retest Validity. The study used Pearson correlation to establish these four validations.

For concurrent validity, the instrument being pilot-tested by the researcher made test was the National Achievement Test (NAT) of 2009 retrieved from the Division Office of the Department of Education.

The researcher applied the following steps and procedures in the data gathering process: Four sections were randomly chosen from all the sections enrolled in Algebra. The four sections were also randomly assigned to the four methods of teaching; it was assigned and identified using the fishbowl random sampling technique.

The pretest of the achievement test in Algebra was administered before starting the formal instruction done on the first day of the experimentation period. The students were oriented on how the class was to be conducted for them to be responsive to the activities prepared for them. Before the conduct of the experiment, the researcher made sure that each group has the same mental ability using their grades in Math 1 (Fundamentals of Mathematics), which were retrieved from the Registrar's Office.

The students were grouped into five with six to seven members in the **Structuring method**. Each group was provided with an instructional sheet that directed them on how to do the given activities to be able to learn different concepts in Algebra. The instructional sheets contain detailed explanations of how to undergo the given task. They were also given problem exercises which were included in the instructional sheet to measure how far they had learned from the activity performed. They were allowed to ask questions to the instructor-researcher if ever they wanted to clarify something.

The purpose of this method is to let students formulate ideas, questions, and conclusions from the activities they performed using the appropriate instructional sheet given by the instructor. During the interaction time, the instructor-researcher moved around the classroom to act as the facilitator.

The purpose of this method is to let students formulate ideas, questions, and conclusions from the activities they performed using the appropriate instructional sheet given by the instructor. During the interaction time, the instructor-researcher moved around the classroom to act as the facilitator. As a resource person, the instructor asked thought-provoking questions to guide the students in analyzing the given problems for them to come up with a correct solution to a particular problem in the instruction sheet. After providing ample discussion time, the researcher proceeded to group presentations to further facilitate learning.

In the **Puzzle method**, the researcher followed the following steps: Divide students into five groups with five to six members in each group. The groups should be diverse in terms of gender and ability. Appoint one student from each group as the leader. Initially, this person should be the most mature student in the group. Divide the day's lesson into segments. Assign each student to learn one segment, ensuring that students have direct access only to their segment. Give students time to read over their segment at least twice and become familiar with it. There is no need for them to memorize it. Form temporary "*expert groups*" by having one student from each home group join other students assigned to the same segment. Give the students in the expert groups time to discuss the main points of their segment; then, rehearse the presentations they will make to their jigsaw group. Bring the students back into their home groups. Ask the students to present their segment to the group. Encourage others in the group to ask questions for clarification. The researcher-instructor moved from group to group, observing the process. If any group is having trouble (*e.g.*, a member is dominating or disruptive), an appropriate intervention must be made. Eventually, the group leader should handle this task. Leaders can be trained by whispering the instructions on how to intervene until everything in the group is in place again. At the end of the session, give a quiz on the material so that students' understanding of the discussed segments will be measured.

In the **Problem Solving method**, students were also grouped into five groupings. Each group was asked to discuss in a round table manner the problem assigned to them. The members in the group were given a chance to share their idea(s). After all, students had communicated their ideas in the group, they consolidated their thoughts and had the final answer to the solved problem. Then, they presented their solutions to the whole class. In solving the problem, they were asked to follow the steps discussed at hand by the researcher.

In the **Lecture method**, the teacher-researcher employed "*chalk-talk*" instruction. In every meeting, the lessons are started with definitions and giving of formulas, then giving of examples. After which, seat work and board work followed. The students were given a chance to ask questions for clarification.

6.0 Results and Discussions

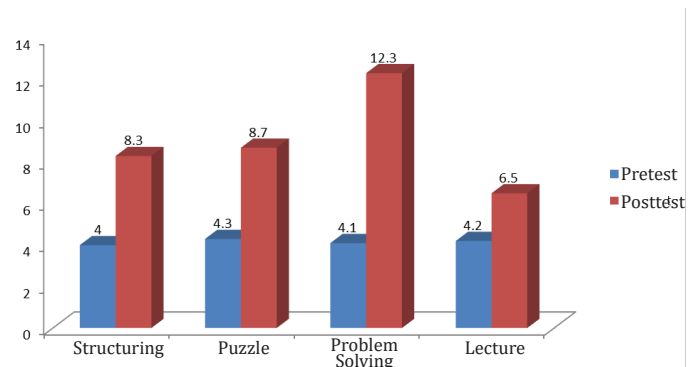


Figure 1. Pretest & Posttest Mean Scores

In terms of academic performance, it can be gleaned that the pretest mean scores of students in the four methods are relatively the same. This can be inferred that students have equal knowledge of the topic included in the study. On the other hand, the figure also underscores the post-test result. It can be noted that all of the mean scores increased. However, the problem-solving method posted a substantial increase.

Analyzing figure 1, Table 1 demonstrates the Mean Gain scores of each method and the standard deviation for the pretest and post-test mean scores.

Table 1. Mean Gain scores of each method and the Standard Deviation for the Pretest and Post-test mean scores.

Method	Pretest	Posttest	Gain Score	Standard Deviation	
				pretest	posttest
Structuring	4.0	8.3	4.3	0.1291	2.43
Puzzle	4.3	8.7	4.4		
Problem Solving	4.1	12.3	8.2		
Lecture	4.2	6.5	2.3		

It can be gleaned from the table above that the problem-solving method posted the highest mean gain score of 12.3, while the Lecture method earned a meager value of 2.3 mean gain score. In the standard deviation, the pretest yielded a slight variation from the mean; the post-test yielded a higher variation from the mean. This can be attributed to the fact that mathematics requires convergent thinking. To each problem, there corresponds to a unique solution which can only be done through problem-solving. This contradicts the study of Wynegar & Fenster (2009) that the lecture method can deliver instruction more effectively in learning College Algebra.

To compare the academic performance of students using the four methods of teaching on the achievement scores of the students, the One-Way Analysis of Covariance was used.

Table 2. Analysis of Covariance of Students' Achievement Scores in College Algebra in Terms of Methods of Instruction

Source	Adjusted Sum	df	Adjusted Mean Square	F	P-value
Methods	440.18	3	146.73	16.69	0.00
Error Within	1107.7	126	3.79		
Total	1547.88	129			

The analysis yielded the computed F-value of 16.69. Since P-value is 0.000, it is less than 5% of significance. Therefore the hypothesis that there is no significant difference in the post-test scores of the students based on the four teaching methods is rejected. The result implies that there is a significant difference in the post-test scores of the students. This further means that the knowledge content of the students after being exposed to the method of teaching increased.

To determine further which method of teaching has a better influence on the achievement scores of the students, a posteriori test on significance was applied using the Scheffe method.

Table 3. Scheffe Test of the Four Methods of Teaching

	Structuring	Puzzle	Prob	Lecture
Structuring	---	1.98	3.81*	2.34
Puzzle	1.98	---	2.97*	4.45*
Problem Solving	3.81*	2.97*	---	5.27*
Lecture	2.34	4.45*	5.27*	---

Legend: *Sig @ 0.05 Critical value: 2.75

Comparing the adjusted post-test mean of the structuring and puzzle method, the Scheffe test yielded an r-value of 1.98, which is less than the critical value of 2.75. This implies that the effects of the structuring and puzzle methods on the achievement of the students are relatively the same. This implies further that structuring is as good as the puzzle method.

In the comparison of the structuring and the lecture method, the Scheffe test yielded an r-value of 2.34, which is less than the critical value of 2.75. This also implies that structuring and lecture method are relatively the same. It can be deduced that structuring is as good as the lecture method.

Comparing the adjusted post-test mean of the structuring and problem-solving method, the Scheffe test yielded an r-value of 3.81; It is greater than the critical value of 2.75. This implies that the problem-solving method has a better effect on the achievement of the students compared to the structuring method.

It is also depicted in the Scheffe table that the problem-solving method yielded an r-value of 2.97 when compared to the puzzle method, which is slightly more significant than the critical value of 2.75. This can be deduced that the problem-solving method has a better effect compared to the puzzle method. Comparing the adjusted post-test mean of the lecture and problem-solving method, the Scheffe test garnered an r-value of 5.27, which is greater than the critical value of 2.75. The result reveals that the problem-solving method has a better effect on the achievement of the students compared to the lecture method. These results indicate that students exposed to the problem-solving method of teaching College Algebra for the specific topics included in the study performed better compared to the students exposed to the structuring method, puzzle, and lecture method. This result further implies that among the four methods of teaching College Algebra used in this experiment, the problem-solving method has a more significant effect on the achievement of the students. This can be attributed to the fact that this course, especially on topics involving Linear Equations and Functions, Quadratic Equations, and Systems of Equations, involves computation and lengthy solutions that can only be done accurately through the problem-solving methods.

This result conforms to the study of Hofmann and Hunter (2003). Their study entitled "Just-in-Time Algebra: a Problem Solving Approach Including Multimedia and Animation" brought forth positive results of the problem-solving method in teaching Algebra. However, this result contradicts the findings by the study of Senoc (2007), where the lecture method came to be a more effective method in improving the achievement scores of the students in Statistics. This result also contradicts the findings of the study by Sanchez (2004), where the constructivist method came out to be a more effective method in improving the students' achievement in mathematics.

7.0 Conclusion

The concepts on learning the subject taught through different methods which are experienced by the students under study have mirrored the theory from which this study was anchored. The knowledge content of the students after being exposed to different teaching methods increased. Problem-solving method has shown to have a better effect on the students' achievement scores which can be attributed to the fact that the course content included in the study needs computation and lengthy solutions that can only be done through problem-solving method.

8.0 Future Scope

The researcher envisions replicating this study to five other (5) campuses of SDSU. Mathematics is said to be one of the most hated subjects; hence the role of teaching methods is of paramount importance. Any teacher who foresees a fruitful and enjoyable teaching career should ensure that the teaching method employed is appropriate for the topic imparted. The success of the daily classwork centers on the choice of a definite procedure that could lead to achieving the classroom goals.

9.0 References

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