IMPACT OF MATHEMATICS DISCOURSE ON STUDENTS' MATHEMATICS PERFORMANCE TO ONE OF THE STATE UNIVERSITIES IN CARAGA REGION

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Abstract

This study was undertaken to investigae the effects of student-to-student discourse and journal writing on the achievement, conceptual understanding and retention of students in fundamentals of mathematics. Specically, the study explored whether the combination of student-to-student discourse and journal writing is an effective instructional method to improve student achievement, conceptual understanding and retention score compared to conventional method it utilized a qualitative-quantitative pretest-posttest quasiexperiment design of research. Th study was conducted at Surigao del Sur State University-Tagbina campus, Tagbina, surigao del Sur. The participants were two intact classes of first year students which were randomly assigned as experimental and control group. Both groups were given pretest of the teacher-made achievement test and the conceptual understanding test before the actual experiment. The experimental group were grouped by six, they were given prompt for their journal writing and were also required to discuss and talk to each other to answer the questions and write their journal as a method. Moreover, control group was exposed to conventional mathematics instruction with seatwork, board work and assignment and both groups were administered with posttest. Results revealed that students taught using student-to-student discourse and journal writing have better performance in the achievement and conceptual understanding tests than the students taught using the convention al method. There is also a significant difference on students' retention score as influenced by student-to-student discourse and journal writing.

1. INTRODUCTION

Mathematics is a subject that develops the critical thinking of man and it is a tool for understanding the world. It is also used as a language of science (Crannell, 2002; Gravemeijer *et al.,* 2017).

According to Brillantes (1974) achievements in mathematics depends to a large extent on the ability of the students to understand, interpret statement and their mastery in performing the fundamental operations. This situation obviously can only worsen when dealing with at risk students. The low achievement of these students and their persistent failure will inevitably have a negative effect on their self-perception of mastery and their confidence, and have a similar effect on their progress (Jones *et al.,* 1997*).* Students should be prepared with mathematical skills, concepts, procedures and ways of thinking, reasoning, solving problems and communicating for their future.

Hence, classroom teaching should be directed toward helping students not only to learn mathematical concepts, principles and procedures, but more essentially to equip them with fundamental skills and proper tools in understanding the processes of problem solving and in applying mathematics to problems in other disciplines (Valdez, 2002).

Problem solving in mathematics has attracted mathematics educators great attention because the skills are used in solving the daily life situations (NCTM,1989). It is one of the most important skills that schools need to develop since students must be prepared to face challenges and solve problems of the future (Lardizabal, 1991; Migalang, 1999) but when something blocks a problem solver will then there is a problem (Henderson and Pingry, 1953; Schoenfeld, 1991).

Moreover, the destiny of any problem solving effort and curriculum reforms ultimately lie in the hands of the classroom teachers (Pejouhy, 1990). In order to promote a classroom situation where creative problem solving is the central focus, the practitioner must become skillful in posing problems that need solutions. The typical read-it-carefully and think-before-you-solve-it approaches are inadequate(Luna, 1991; Migalang, 1999). Migalang (1999) suggested an approach in teaching word problem, the problem posing approach, where students generate new problems and reformulate problems. It recommends a change from asking students to solve problems to develop problems through changing their questions, adding new data, eliminating some data, changing variables or constructing a new problem based on the original idea (Leung, 1993; Obaob, 1993; Silver, 1994; Silver and Cai, 1996; Migalang, 1999). This problem posing is not new as an approach in teaching word problem, however, this approach is important as developing the ability to solve the problem of one of the SUCs in Caraga region. Thus, this study was conducted.

Conceptual Framework

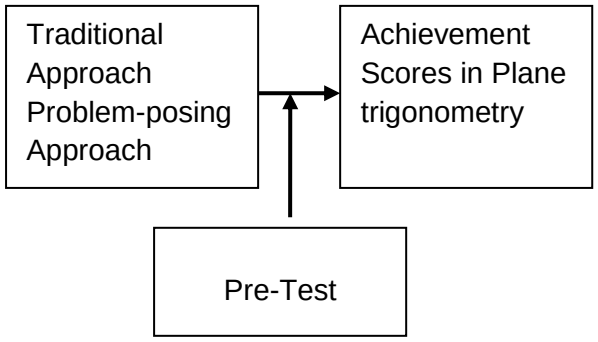

Figure 1. A Paradigm Showing the Relationship of Variables

The theory that the traditional approach of mathematics classroom instruction and integration of problem-posing approach in mathematics word problem prior to the study of problem solving aid teachers in teaching problem solving needs further verification, hence this study is to be undertaken.

2. METHODOLOGY

Research Design

The pretest-posttest quasi-experimental control group design was used in this study. There was one treatment represented by the teaching approach (T). The control group was subjected to the traditional approach while the experimental group was treated with the three types of problem posing *viz;* pre-solution problem posing, within-soulution problem posing and post-solution problem posing. Both groups were given pretest (Q_1) and posttest (Q_2).

Subjects of the Study

The subject of this study was the first year college students of Surigao del Sur State University- Tagbina Campus (SDSSU-TC) formely Surigao Sur Polythechnic State College – Tagbina Campus (SSPSC-TC). The three sections were randomly selected using lottery sampling method out of the three sections, two sections were selected without replacement, same method used the in getting the control group and experimental group. Each group had a maximum of 30 students making it 60 students as the total number of respondents.

Research Instrument

The teacher-made achievement test consisting of items on; similar polygons, trigonometric function, solution of rigth triangles, bearing, angle of depression, angle of elevation, subtended angles and solution of oblique triangles. The test was composed of 30 multiple-choice items and administered for 120 minutes.

Validation

The framed test item based on table of specification which were shown to three mathematics teachers for content and face validity and administered to second year students of who had taken trigonometry for validation. 25 Items were left after item analysis was done. The reliability index was 0.61 using Spearman Brown formula.

Data Gathering Procedure

The selected two sections from first year among the three sections of SDSSU-TC formerly SSPSC-TC. The lottery sampling method was employed same as the identification of control group and the experimental group. At the beginning of the study, pretests were given to both groups for two hours, and after which treatment started.

In the experimental group used problem-posing approach as a strategy in teaching word problem by introducing the meaning of the problem to the class. This was followed by giving the students the difference between the pre-solution problem posing and the within solution problem posing and post-solution problem posing. The students were given examples on how to pose problems or ask questions of their own from the given situation or story or pre-solution problem-posing. In the within solution posing, the students were asked to formulate problems out of a given problem and in the post-solution problem posing, the students modify the condition or goal of an already solved problem to generate another problem while in the control group, the researcher used the traditional lecture-discussion approach.

The students of diffent group were given post-test using the teacher-made test on problem solving after the treatment. Statistical analysis and interpretation followed after the collection of the data. The pretest and posttest scores were the primary data of the study.

Statistical Tool and Analysis

Mean and standard deviation were used in determining the profile performance of the control and experimetal groups. However, analysis of co-variance was used in determining the difference of the achievement of the respondent between the groups.

3. RESULTS AND DISCUSSION

Table 1. Mean and standard deviation of the pretest and posttest scores of achievement test

SV	Pre-Test	Post-Test	Difference
Experimental Mean	5.47	18.63	13.16
Control Mean	4.60	16.63	12.03
Group STDEV	1.77	2.86	1.09
Group STDEV	1.30	1.77	0.47

In pretest, the mean of experimental group was 5.47, while 4.6 for the control group. It entails that experimental group is a little better than the control group but their pretest scores are very low since the items answered were 20. It also suggests a poor background in solving mathematical word problems.

However, in the posttest, the experimental group has mean of 18.63 while 16.63 reaped by control group. It necessitates that students assigned to experimental group has higher leap in their problem solving performance as compared to control group. The mean difference in experimental group was 13.16 and 12.03 for the control group after pretest and posttest of both group. It implies that problem-posing approach had positive impact to students learning than traditional approach. Similar variability were observed in both groups as evidenced by the standard deviation values of 1.77 and 1.30, repectively. The standard deviation of the experimental group is 2.86 while the control group is 1.77. This means that the experimental group posttest score became more varied compared to that of the control group after the treatment.

Table 2. One-Way Analysis of Covariance (ANCOVA) on the Students' pretest and posttest scores.

SV	**ASS**	**Df**	**AMS**	**Comp. F**	**Crit. F**
Treatment	152.12	1	152.12	27.97*	4.0
Error Within	309.97	57	5.44		
Total	462.06	58			

SV = Sources of Variation; ASS = Adjusted Sum of Squares; Df = Degrees of Freedom; AMS = Adjusted Mean Squares; Comp. f = Computed F; Crit. F = Critical F

* = Significant at 5% level.

A computed F-ratio yielded a value of 27.97, which is greater than the critical value at 0.05 level. This means that the students exposed to the problem-posing approach performed better than those exposed to traditional approach in teaching word problem and even enhanced the student problem solving ability and is better than the traditional approach. According to Migalang (1999) states that, problem-posing approach is more effective than traditonal approach. Student's problem-posing performance is highly correlated with their performance in solving word problem and this problem-posing approach could be taken as means of problem solving (Silver, 1994). This study further reveals that when students are asked to pose questions, they develop critical thinking and are able to learn to analyze the problem.

4. CONCLUSION

Based on the finding of the study the following conclusions were drawn:

1. Both groups have little background in solving word problem as shown in the pretest results;

2. There was a marked increase on the posttest performance in both groups; and

3. With regard to the achievement scores of both groups, problem-posing is more effective than the traditional approach. It improves students' ability to solve word problems in plane trigonometry and its communication skills.

5. RECOMMENDATION

In the light of the findings and conclusions of the study, the following recommendations were presented:

1. Mathematics teachers should use problem-posing in solving word problems in plane trigonometry;

2. A longitudinal study should be conducted to test its sustainability over longer period of time; and

3. Similar studies should be conducted to test this approach to othet mathematics courses, including other factors such as; sex, year level, academic performance, and attitude to give more emphasis on the applicability of the method.

References

Crannell, A. (n.d.). *Writing in Mathematics*. Retrieved December 13, 2018, from http://www.fandm.edu/Departments/Mathematics/: https://www.acer.org/files/FarkotaThesis.pdf

Henderson, K. B. (1953). Problem solving in mathematics. The learning of mathematics: Its theory and practice) . *21st Yearbook of the National Council of Teachers of Mathematics*, 228-270.

Koeno Gravemeijer, M. S.-L. (2017). What Mathematics Education May Prepare Students for the Society of the Future? *International Journal of Science and Mathematics Education, 1*(1), 105-123.

Lardizabal, A. (1991). *Principles and Methods of Teaching* (3rd edition ed.). Quezon City, Philippines.: Phoenix Publishing House.

Leung, S. (1993). The Relation of Mathematical Knowledge and Creative Thinking to the Mathematical Problem Posing of Prospective Elementary School on Tasks Differing in Numerical Information Content. *Dissertation Abstracts International, 54*(06), 2082 A.

Luna, C. A. (1991). *The Effects of Three Methods of Remedial Teaching on Students' Achievement in Selected Topics of College Algebra.* Manila: Unpublished Doctoral Disseration, De La Salle University.

Migalang, G. R. (1999). *"Presolution Problem Posing As an Approach in Teaching Problem Solving: Its Effects on Student Achievement in Mathematics.* Cagayan de Oro City: Unpublished Master's Thesis. Mindanao Polytechnic State College.

Miller, S. a. (1997). Educational Aspects of Mathemathecal Disabilities. *Journal of Learning Disabilities, 30*, 47-56.

National Council of Teachers of Mathematics. (1989). Curriculum and Evaluation Standards for School Mathematics. *Reston, VA*, 20,70 & 138.

Obaob, G. S. (1993). *Creative Approach in the Teaching of Problem Solving: Its Effects on Pupil's Achievement.* Cebu City: Unpublished Master's thesis, Cebu State College.

Pejouhy, N. H. (1990). *Teaching Math for the 21st century. , 72(1).* (Vol. 72). Phi Delta Kappan.

Schoenfeld, A. H. (1991). On mathematics as sense-making: An informal attack on the unfortunate divorce of formal and informal mathematics. (D. P. In James Voss, Ed.) *Informal reasoning and education*, 311-343.

Silver, E. (1994). *On Mathematical Problem Solving.* (Vol. 14). For the Learning of Mathematics.

Silver, E. C. (1996). An Analysis of Arithmetic Problem-Posing by Middle School Students. *Journal For Research in Mathematics Education, 27*, 521-539.