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STUDENTS' PROBLEM SOLVING SKILLS USING ROUGH DRAFT TALK STRATEGY IN MATHEMATICS CLASSROOM

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Abstract:
In reality, teachers of mathematics, at times, demand students to share ideas or pattern of solution for a mathematical problem to the class. With this comes the need for students to write a draft of their ideas or answers first before they can relay them for the teacher's affirmation and for classmates' benefit from listening. This study explored the effectiveness Rough-Draft Talk (RDT) in strengthening students' problem-solving skills in mathematics. A quasi-experimental research design was used in the study where two (2) intact classes were randomly assigned as the experimental group while the other was the control group. The experimental group was taught using RDT while the control group using the conventional teaching method. Findings revealed that students exposed to RDT performed better compared to those taught using the conventional method. The researcher recommends that teachers, curriculum developers and administrators are encouraged to use Rough-Draft Talk (RDT) to improve students' problems solving skills in mathematics.

Keywords: rough-draft talk (RDT), problem-solving skills, mathematics performance

1. Introduction

Mathematics is definitely one of the subjects that pervade life at any age and in any circumstance. However, mathematics education in the Philippines is facing a challenging situation because of the low performance of students in both international (e.g. Trends in Mathematics and Science Study (TIMSS), Programme for International Student Assessment (PISA)) and national assessments (National Achievement Test (NAT)) in

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mathematics. As the K-12 Basic Education Curriculum has been implemented in the Philippines for the past six (6) years, the national performance of junior high school students still remains very poor, which means it, has not reached the 75% standard level. One of the big schools in the Division of Bukidnon is Old Damulog National High School which is situated at the southernmost part of the province. The school's NAT performance in mathematics is only 46.46% and 57.56% for school years 2012-2013 and 2014-2015 respectively which is very far behind the standard level. However, there is a remarkable increase of 87.54% during the school year 2013-2014. The achievement rates are not increasing consistently which is not a good trend. The result is a clear indication of the lack of understanding of the mathematical competencies and inconsistent with the learning principle that mathematics must be learned comprehensively and with much depth (NCTM, 2000).

Rough-draft talk is talking to learn. It is mostly observed by teachers in mathematics that some students are reluctant to participate especially in whole-class discussions. Consequently, it follows that if they do not participate, their peers will not learn from them (Jansen, 2008). This is a challenge to all mathematics teachers to enhance their teaching performance and strengthen students' level of confidence. The K to 12 Basic Education Curriculum (BEC) is designed to cater this circumstance through launching the guiding skills and processes standards for mathematics which promote knowing and understanding; estimating, computing, and solving; visualizing and modelling; representing and communicating; conjecturing, reasoning, proving and decision-making, applying and connecting. The Department of Education (DepEd) believes that if these skills and processes would be utilized in the classroom teaching and learning, this will lead to a strengthened students' level of confidence. If individuals' self-confidence is high enough, their self confidence levels and motivations concerning academic success would also be high (Ozevin Tokinan, 2008). Hence, this study determined the effectiveness of Rough Draft Talk (RDT) in strengthening students' mathematical problem solving skills.

2. Literature Review

In reality, teachers of mathematics, at times, demand students to share ideas or pattern of solution for a mathematical problem to the class. With this comes the need for students to write a draft of their ideas or answers first before they can relay them for the teacher's affirmation and for classmates' benefit from listening. This type of strategy is coined by Jansen (2008) as the rough-draft talk. The rough-draft talk principles are associated with this flow of implementations:

1) Foster a culture supportive of intellectual risk taking. This explicitly tagging initial discussion of solutions as "rough drafts" encourages students to share in-progress thinking. This tagging reduces the threat of being wrong. A non-evaluative stance by the teacher empowers students. To create a culture of risk taking, a teacher used a non-evaluative routine to discuss students' thinking. She displayed a task and directed students to first use rough-draft talk in small groups. Groups shared

initial ideas at a document camera, and the solutions were not evaluated. Students asked questions of their peers only when they needed clarification. Next, students returned to their groups and revised their thinking toward final-draft solutions, comparing their original ideas to presenters' ideas. During second round of presentation (final drafts), students were encouraged to critique their peers' approaches. Then the teacher asked questions to guide students' thinking while highlighting important ideas.

2) Promote the belief that learning mathematics involves revision understanding over time. Revising mathematical thinking promotes learning through refining ideas. To enact the routine of "My Favourite Rough Draft," the class revised a student's explanation. After writing a first draft, students received peer feedback, in which two pairs exchanged explanations. Next, the class revised one explanation: the teachers' favourite rough draft. All together, they discussed how to revise toward a final draft using more precise language.
3) Raise students' statuses by expanding on what counts as a valuable contribution. When rough-draft talk is recognized as valuable for supporting learning, then more students can be positioned as competent mathematical thinkers (Cohen and Lotan, 2014). A teacher can ask a student to share, even if he or she is struggling to understand. In so doing, the teacher is making a public statement that this rough-draft talk is useful for the class's learning.

As an instructional method designed to engage groups in discussion about controversial issues, students' talk develops argumentation and group management skills. Students' talk is reasoned and involves asserting, justifying and challenging ideas; students are prepared to seriously consider alternative perspectives in the construction of a joint decision. Like exploratory talk, participants are expected to think critically about ideas and not people, working together to construct joint understanding. Closely resembling collaborative reasoning is Resnick's conceptualization of 'accountable talk'. Accountable talk is also intended to promote students' critical thinking; it requires that speakers justify their opinions with reference to evidence, listen to and build on the perspectives of others and adhere to standards of reasoning that emphasize logical connections (Michaels, O'Connor & Resnick, 2008).

However, the talk described in RDT strategy is found to be more reasonable, accountable, and reciprocal. Opinions are justified and participants revise their views having listened to others'. All embody the principles of dialogic talk: talk which holds different perspectives in tension, in which speakers build upon the contributions of others to construct a new understanding which features the 'voices' of many. Advocates of a dialogic pedagogy argue that classroom talk should encourage students to engage in dialogues where they can assume control, initiate ideas and contribute to shaping the verbal agenda (Hardman & Abd-Kadir, 2010), that talk should be challenging and provocative. The talk described may also support the creation of shared contextual foundations for the construction of understanding. Mercer argues that 'cohesive ties' create continuity in discussion, allowing speakers to connect old experiences to new, to

create a shared history and context, and make sense jointly. In its emphasis on consensus and reconciliation, collaborative talk is here conceptualized as the achievement of intersubjectivity, as a foundation upon which something new is explored.

3. Material and Methods

This study utilized pretest-posttest quasi-experimental control group design. The experimental group was taught using Rough-Draft Talk (RDT) while the control group was using the conventional teaching method. The study was conducted at Old Damulog National High School, a public institution situated in Damulog, the southernmost part of the province of Bukidnon, Philippines. The school is one of the 24 high schools in the 3rd district of Bukidnon. It started its operation in the year 1968 with only six (6) teachers and thirty nine (39) students. At present, the school is composed of 61 teachers, one (1) disbursing officer, one (1) bookkeeper and the principal. Students' population is approximately 1,527. The main instrument used in this study was the teacher-made 10-item open-ended problems in mathematics which requires students to analyze, interpret, and apply solution in solving mathematical problems. The said test underwent face and content validity and was pilot tested during the first quarter in other students in the school where the study was conducted and obtained a reliability coefficient of 0.71 which is highly reliable.

In gathering the data of this study, first a letter of request was addressed to the Division Superintendent through the school principal of Old Damulog National High School asking permission to conduct the study. The study was centered on Learning Materials for Mathematics 7 Chapters 4 and 5 which tackle on Measurements, and Algebra. The following topics were included: Subsets of Real Numbers, Significant and Digits, Scientific Notation, More Problems Involving Measurement Real Numbers, Measuring Weight/Mass and Volume, Measuring Angles, Time and Temperature, Constants, Variables and Algebraic Expressions, Verbal Phrases and Mathematical Phrases, Polynomials, Laws of Exponents, Addition and Subtraction of Polynomials, Multiplying Polynomials Dividing Polynomials, and Special Products. Activities were adopted by the researcher from various resources in Mathematics books and manuals, internet sources and the like. After the test, the researcher retrieved all the test materials including the answer sheets of the student participant. The researcher will give the answer sheets to the teacher-raters did the checking of the student respondents' works. The process of checking followed the rubric scoring procedure. There are three (3) Master teachers of ODNHS. The score of the student for his answer is the average from the score given by three (3) Master teachers.

The experimental group under RDT model is the idea that when teachers create spaces for rough-draft talk, they continue to choose mathematical tasks that promote particular understandings, buy they adjust their classroom discourse practices. For instance, to promote rough-draft talk, teachers talk more explicitly about how people learn and the role of talk in learning, highlighting that learning takes time and that talking

through in-progress ideas supports learning. Now, why this idea matters it's supported by research of Amanda Jansen (2008). What people tend to say is that they think of their role in class discussion as waiting to share thinking until they are sure they are right or is a fully work out solution. In that way, they are thinking about in their role in math class discussion as performing. As performing in answer that is probably fully work out solution. Teachers tend to think class discussion as a time for class to continue learns together so some students believe that their role in class discussion is to learn from talking.

In the control group, the students used DepEd K-to-12 4As. Students underwent with the four stages namely: activity, analysis, abstraction, and assessment. In the first step, the students were given an activity; this activity can be games, question and answer (Q and A), brainstorming, concept mapping, etc. In the second step, the students made connections and interconnections between the course material and real life experiences. In the third step, the students consolidated what have been learned and make it relevant. In the last step, the students have been given assessment to determine what have been learned and what needs to be further developed.

The descriptive measures such as the mean and standard deviation were used to describe the data obtained from the pre-test, and post-test for students' problem solving skills. The significant difference of students' problem solving skills was tested and analysed using one-way analysis of covariance (ANCOVA).

4. Results and Discussion

Table 1: Students' Problem-Solving Skills in Mathematics

	Control Group (n = 43)		**Experimental Group (n = 46)**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Mean	3.19	12.49	2.98	18.26
SD	1.367	2.175	1.926	3.838
Description	Beginning	Beginning	Beginning	Approaching Proficiency
Perfect Score: 30				

Table 1 shows the pretest and post-test mean scores, standard deviation and descriptive level of students' problem solving skills during the second quarter phase in Mathematics 7. In the pre-test, both groups showed beginning level problem solving skills which indicates that prior to the conduct of the experimental study, students' problem solving skills was more or less the same for both groups and both had poor prior knowledge of the mathematics content. However, in the post-test, the control group got a mean score of 12.49 and the experimental group is 18.26. It can be observed there was an increase in the post-test mean scores of control and experimental groups. However, student's in the control group remains at the beginning level which means that there was only little improvement and did not reach the mastery level. This further indicates that students in control group have not learned the required competencies and skills they need to learn during the experimental period. On the other hand, students in the RDT have shown

remarkable improvement from beginning level to approaching proficiency level in the post-test. This means that student's problem solving skills improved greatly when taught using RDT. This further means that the students in the experimental group under RDT had learned the required competencies and skills during the conduct of the experiment. A sample student output from the experimental group was shown in the following figure:

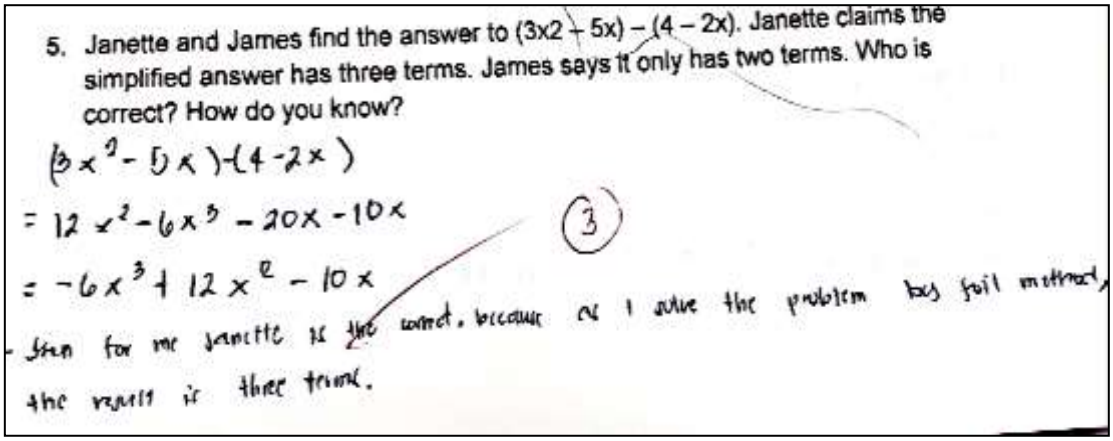

Figure 1: Student Mf5V7Exp1 Answer to Open-ended Item # 5

The above shows the solution of student Mf5V7Exp1 for the open-ended mathematical tasks on simplifying the algebraic expressions. The student was able to justify how she arrives with her answer and that is using the FOIL method. The student was able to write her answer in sentence form to address the question that was being asked. It was manifested that student in RDT promotes learning in such a way the students were given chance to think through talking which is the way that the students gain an understanding. This further indicates that the students were able to construct their written explanation well because they use to express their ideas in talking with their peers.

Table 2: One-way ANCOVA Summary of the Students' Problem Solving Skills in Mathematics

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Treatment	2	871.93	435.963	52.68	0.000*
Within	Error	130	1075.90	8.276	
Total	132	1947.83			
*significant at p<0.05 alpha level					

Table 2 shows the summary of the analysis of covariance of pretest and post-test scores in problem solving skills of second quarter lessons in Mathematics 7 for both the control and experimental group. The analysis yielded an F-value of 52.68 and probability-value of 0.000 which is less than 0.05 level of significance which led the researcher to reject the null hypothesis. This implies that there is a significant difference in the students' problem solving skills in Mathematics 7 in favor of the experimental groups which means that there is enough evidence to conclude that problem solving scores of the students exposed

to RDT are better than the problem solving scores of the students exposed to 4As method of teaching. The result further shows that RDT method of teaching is higher than 4As in developing problem solving skills. It can be noted that explicit promotion of RDT takes positive productive classroom discourse to a higher level because it provides a safe space for students to develop their understanding of mathematical concepts.

5. Conclusions

Based on the analysis and findings of the study, the researcher concludes that the level of students' problem solving skills are higher when taught using RDT and RDT is an effective method in enhancing students' level problem solving skills and the had a positive perception on the use of RDT in mathematics classroom.

6. Recommendations

Based on the findings and conclusions of the study, the researchers recommend that teachers may utilize the RDT as an approach to enhance the K-12 lesson guides. School administrators may also include a seminar-workshop on RDT during school-based in-service trainings. Finally, teachers and researchers could also use this method as a basis for future studies for more insights on instruction that needed to strengthen students' level of confidence in mathematics class and develop their problem solving skills.

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