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STUDENTS' MATHEMATICS PERFORMANCE AND SELF-EFFICACY BELIEFS IN A RICH ASSESSMENT TASKS ENVIRONMENT

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Abstract

This study investigated the students' mathematics performance and self-efficacy beliefs in a rich assessment tasks environment (RATE) in Central Mindanao University Laboratory High School. It made used of a quasi-experimental research design with Grade 8 students as respondents. Results showed that students from both groups have low performance in their pretest, but improved to high performance in both posttest and retention test after the intervention period. Students have positive self-efficacy beliefs before and after the intervention. Analysis of covariance (ANCOVA) indicated a comparable mathematics performance of those students who were exposed to RATE than those exposed to non-RATE. RATE potentially increase the performance and improve the self-efficacy beliefs of the low performing students as shown in the comparable results.

Keywords: Rich Assessment Tasks, Self-Efficacy Beliefs, Mathematics Performance

Introduction

"Nobody ever got taller by being measured"

- Professor Wilfred Cockroft.

Mathematics is one of the most significant and colorful subjects in any discipline. Jose (2015) cited that Mathematics is an aid to represent and attempt to resolve problem situations in all disciplines. It is an interdisciplinary tool and language. Mathematics is not only a language and a subject in itself, but it has also a big role in fostering logical and critical thinking to the students.

Some researchers considered Mathematics as the queen of all sciences because scientific, technological and social breakthroughs are given emphasis by the language of numbers. Thus, this subject should not be taken for granted because it has a big role for the advancement of our society. In learning this subject area, there are many reasons how the performance of the students is affected, to name a few, teaching processes, strategies, environmental factors, students' motivations and assessments are some of the factors affecting children in learning effectively the context of mathematics. They should be emphasized to lessen the decreasing literacy rate in mathematical skills of the students. Despite of the innovative teaching strategies evolved today, performance of the students in Mathematics remains low and alarming.

This is shown in the result of the Third International Mathematics and Science Study (TIMSS) where the Philippines ranked as 39th out of 41 participating international countries according to Mullis as cited by Cordova and Tan (2018). It implies that educational system in our country has a problem in different aspects especially on mathematics education. Retention and simple recall are some basic concerns that we need to address for the improvement of the system. Still, in recent results in National Achievement Test, most schools and institutions did not make it to the passing rate set by the National Educational Testing and Research Center (NETRC).

Moreover, a study of Liu and Koirala (2009) found out that efforts are needed for promoting mathematics self-efficacy for high school students because it was positively associated with mathematics achievement. Research has indicated that self-efficacy could

be increased by using the right instructional strategies, such as helping students to set learning goals, providing timely and explicit feedback, encouraging students to study harder, and using high achieving students as models.

According to Henhaffer (2014), other educational policy makers believe that it is the act of assessment that will lead to improve learning, when in fact it is the action that follows, using the information gained from the assessment that is potentially most powerful. Having said that, there are many examples of the way in which changes in assessment at the state level have led to changes in both teaching and assessment practice across schools. Moreover, research showed that an increasing consensus emerged among classroom teachers that traditional forms of assessment were inadequate in meeting all the revised goals which teachers held for assessment. The argument was that if we value genuine understanding, problem solving and group skills, and the ability to use what has been learned in "real" situations, then we need to broaden the repertoire of assessment techniques from the classic pen and paper test, combining "informal" assessment with a greater range of formal methods of assessment. Clarke and Clarke (2006) has argued that it is through our assessment that we communicate most clearly to students those activities and learning outcomes we value. It should address the needs of the students with the various activities and tasks assigned to them to cater their individual differences and multiple intelligences in learning process. A type of assessment tasks which are meaningful but at the same time manageable would lead to successful learning outcomes.

It is a big challenge for the mathematics educators to let the student love the subject. Nonetheless, every student is allotted to experience success and achievement in this area. We should help them to connect the concepts and theories they learned from the book to the contextualization and utilization of knowledge through real world application. Once the students know the significance of the study, they will be having a positive attitude and utilization towards the subject. Thus, we should need a variety of assessment tasks to engage them properly in learning process. In the mathematics classroom, it is through tasks, more than in any other way, that opportunities to learn are made available to the students.

Hence, it gives the researcher an idea to conduct a study on the students' self-efficacy beliefs and mathematics performance using the Rich Assessment Tasks Environment (RATE).

Conceptual Framework

The course Mathematics is one of the core subjects taught in the Philippine educational system. As many centuries passed by, it is vital to the development of the society and improving the lifestyle of mankind through technology. In a traditional classroom setting, it can be taught through Lecture-Discussion Method or Explicit Method with an assessment in paper and pen test. Today, there are many changes in society that affect also the learning processes of the students, researchers suggest to use innovative, engaging activities and provide opportunity for the student to transfer their knowledge in a meaningful and useful applications. One of the methods is Rich Assessment Tasks Environment.

One guiding principle in the Assessment of Learning states that "Assessment tool should match with the performance objective". Accurate alignment of the assessment tools to the designed objectives will make your instruction valid and reasonable. Thus, attaining the set goals for a lesson will give students successful learning outcomes and worthwhile lesson and learning.

In using Rich Assessment Tasks Environment, John Dewey's Learning by Doing Theory (1916) is integrated. Students develop the sense of ownership in their own learning by applying fruitful and meaningful activity to them wherein they can apply what they have learned in realistic context. In the RAT environment, students can work within groups to attain and achieve common goals. Going outside the four corners of the classroom to apply the learnings they had in real-life situations was introduced.

Lev Vygotsky's scaffolding theory (1978) which describes the type of assistance offered by a teacher or peer to support learning. The teacher offers assistance with only those skills beyond the student's capability. The teacher will provide instruction for the students to do the tasks effectively and smoothly. In the RAT environment, the teachers will constantly monitor students progresses as they are performing the activities given to

them. Extends help when they are in trouble and correct some misconceptions so that they can have a worthwhile learning experiences.

Self-efficacy constitutes a key component in Bandura's Social Cognitive Theory (1977). A person's belief, concerning his/her ability is one of the indicator to successfully perform a given task or behavior. It was found that self-efficacy is a major determinant of the choices that individuals make, the effort they expend, the perseverance they exert in the face of difficulties, and the thought patterns and emotional reactions they experience. It is included in the study to check the level of self-efficacy beliefs of the students. Because if they are confident to do the given tasks to them, they can achieve properly the set goals designed for them.

Methodology

This section presents the methodology of the study. It includes the research design, locale of the study, sampling procedure, instrumentation and statistical techniques used in the investigation.

The study made use of a quasi-experimental research design with the experimental group exposed to rich assessment tasks environment. Students in both groups were given pretest on mathematics and self-efficacy beliefs before the conduct of the investigation. Similar questionnaires were given to the students after the intervention. The study was conducted at Central Mindanao University Laboratory High School, University Town, Musuan, Bukidnon, Philippines. Mathematics performance of the students were measure using the teacher-made test which was validated by mathematics teachers and found to be reliable after pilot-testing. The Self-efficacy beliefs questionnaire adapted by Tano (2011) was utilized by the researchers. Descriptive statistics and analysis of covariance (ANCOVA) were utilized to analyze the data gathered during the investigation.

Results

This section presents the results of the study.

Level of Performance of Students

Table 1. Level of performance of students in the pretest.

Range	Level of Proficiency	GROUP				Qualitative Interpretation
		RATE n=46		Non-RATE n=46		
		f	%	f	%	
90%-	Exemplary	0	0%	0	0%	Very High Performance
86%-	Above	0	0%	0	0%	High Performance
80%-	Average	0	0%	0	0%	Moderate Performance
75%-	Below	1	2%	5	11%	Low Performance
65%-	Deficient	45	98%	41	89%	Very Low Performance
	MEAN	**13.80**		**16.46**		

Table 1 above shows that level of performance of the students before the conduct of the study. It can be gleaned from the table that majority of the students in both groups have very low performance in Mathematics. This finding confirms the study conducted by the TIMMS on the ranked of the Philippines among other countries.

Table 2. Level of performance of students in the posttest.

Range	Level of Proficiency	GROUP				Qualitative Interpretation
		RATE n=46		Non-RATE		
		F	%	F	%	
90%-100%	Exemplary	3	7%	4	9%	Very High Performance
86%-89%	Above	1	26%	10	22%	High Performance
80%-85%	Average	2	58%	25	54%	Moderate Performance
75%-79%	Below	4	9%	7	15%	Low Performance
65%-74%	Deficient	0	0%	0	0%	Very Low Performance
	MEAN	**30.93**		**30.72**		

Table 2 indicates the mathematics performance of students in both groups after the study. The table shows that there is an evidence of improvement in the mathematics performance of the students after the investigation. In the RATE group, only 9% of the students has low performance compared to a 15% in the other group. Subsequently, 91% of the students exposed to RATE performed from moderate to exemplary performance

than 85% of the non-RATE group. This shows the potential of RATE in increasing the performance of the students in Mathematics.

Self-Efficacy Beliefs of Students Towards Mathematics Before and After Intervention

Table 3. Students' self-efficacy beliefs before and after intervention

SELF-EFFICACY BELIEFS TOWARDS MATHEMATICS	GROUP					
	RATE n=46			Non-RATE n=46		
	Mean	QD	QI	Mean	QD	QI
Pretest	3.62	Agree	P	3.60	Agree	P
Post-test	3.66	Agree	P	3.65	Agree	P

Legend:

Range	Qualitative Description (QD)	Qualitative Interpretation (QI)
4.51-5.00	Strongly Agree	Highly Positive (HP)
3.51-4.50	Agree	Positive (P)
2.51-3.50	Undecided	Moderate (M)
1.51-2.50	Disagree	Negative (N)
1.00-1.50	Strongly Disagree	Highly Negative (HN)

As presented in table 3, students' self-efficacy beliefs for both the RATE and non-RATE are positive even before and after the conduct of the study. The mean scores indicate an increase values however these do not guarantee an increase in their beliefs towards Mathematics.

Analysis of Covariance (ANCOVA) of Posttest Results Between Interventions

Table 4. Comparison of students' performance on the posttest.

GROUP	N	MEAN	SD
RATE	46	30.93	3.60
Non-RATE	46	30.72	4.39
TOTAL	92	30.83	3.99

Source	SS	Df	MS	F-value	Sig.
Group	24.398	1	24.398	1.665	.200^{ns}
Pre-test	143.735	1	143.735	9.807	.002
Error	1304.395	89	14.656		
Total	88872.000	92			

Note: ns – not significant at 0.05 level

Analysis of Covariance (ANCOVA) of Retention Test Results Between Interventions

Table 5. Comparison of students' performance on the retention test.

GROUP	N	MEAN	SD
RATE	46	32.41	4.73
Non-RATE	46	32.28	4.55
TOTAL	92	32.35	4.62

Source	SS	df	MS	F-value	Sig.
Group	11.550	1	11.550	0.551	.460^{ns}
Pre-test	72.446	1	72.446	3.455	.066
Error	1866.033	89	20.967		
Total	101222.000	92			

Note: ns – not significant at 0.05 level

Tables 4 and 5 reveals the ANCOVA results for both the post-test and retention test between students exposed in RATE and those in non-RATE. As shown in the two tables, there is no significant difference in the mathematics performance of students in the different groups as reflected by the F-value of 1.665 with p-value of 0.200 for the post-test and F-value of 0.551 with p-value of 0.460 for retention test. These imply that the students exposed to RATE and non-RATE eventually become comparable in terms of their mathematics performance after the study. In table 1, notice that the mean score of students in the RATE group is 13.80 against 16.46 of the non-RATE. This mean scores prior to intervention indicated that students in the non-rate group perform higher than those in the non-RATE. Making the RATE and non-RATE group comparable afte study would mean that RATE has potentially improved the performance of the low performing students. This finding is supported by Clarke and Clarke (2006) when they elaborated that rich assessment tasks can lead to better learning outcomes.

Summary

The RATE group has a mean score of 14.00 in the pretest which indicates that students score is below average indicating a very low performance. The non-RATE group has a mean score of 16.5 which also indicates that students' scores are below average indicating a very low performance in the pretest. On the posttest, the RATE group

obtained a mean score of 30.92 indicating a "high performance" result, while the non-RATE group had a mean score of 30.7 indicating also a "high performance". Retention test results showed a "high performance" for the RATE group which obtained a mean score of 32.41. Moreover, a "high performance" level also had been obtained by the non-RATE group with a mean of 32.28.

On the self-efficacy beliefs of the students, the overall mean score before the intervention is 3.75 and 3.60 in the RATE and non-RATE group, respectively. This shows that students have positive self-efficacy beliefs towards Mathematics as a subject. After the intervention, the overall mean score of students is 3.85 and 3.65 in the RATE and non-RATE group, respectively. This implies that both groups have positive self-efficacy beliefs towards Mathematics after the intervention.

The F-value between groups is 1.665 with a probability of 0.200 ($p>0.05$) indicating that there is no significant difference, thus the null hypothesis that the students' performance when exposed to RATE is comparable with those who are exposed to non-RATE in terms of posttest failed to be rejected. The F-value between groups is 0.61 with probability value of 0.806 ($p>0.05$) which indicates a no significant difference, thus the null hypothesis that students' performance when exposed to RATE is comparable to those who are exposed to non-RATE in terms of retention failed to be rejected.

Conclusions

Based on the findings of the study, the following conclusions are drawn:

The students' performance, in the RATE and non-RATE groups are statistically comparable in both the posttest and retention test. There is a great increase in the level of performance of students from deficient to exemplary performance for the RATE group while from deficient to exemplary performance also for the non-RATE group.

Students in both RATE and non-RATE groups have positive self-efficacy beliefs towards Mathematics as a subject before the intervention. After the treatment, both groups remain to have a positive self-efficacy beliefs towards the subject.

The performance of the students in Mathematics when exposed to RATE is comparable to those who are exposed to non-RATE environment. RATE has potentially improved the performance of the low performing students making them comparable to those with higher scores before the conduct of the study.

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