Mathematics Performance and Self-Efficacy of Grade-9 Students in a Differentiated Assessment

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Abstract: The study assessed the mathematics performance and self-efficacy of Grade 9 students at Central Mindanao University Laboratory High School (CMULHS) in a Differentiated Assessment (DA). It aimed to a) determine the mathematics performance of students exposed to DA and those exposed to non-DA in terms of pretest, posttest, and retention test; b) ascertain the self-efficacy of the students towards Mathematics exposed to DA and those exposed to non-DA; c) differentiate the mathematics performance of students exposed to DA and those exposed to non-DA in terms of post-test, and retention test; and d) compare the self-efficacy of the students towards Mathematics exposed to DA and those exposed to non-DA. This study used the quasi-experimental research design. The mathematics performance of the students in the pretest, posttest and retention test when exposed to DA and non-DA varies from very low to high. The self-efficacy level of the students varies from moderately low to moderately high. There was a highly significant difference in the post-test and retention scores of those students exposed to DA compared to those exposed to non-DA. Moreover, the DA group had a significantly higher self-efficacy level towards Mathematics compared to the non-DA group.

Key Words: differentiated assessment, self-efficacy, mathematics performance

Introduction

Nowadays, classrooms are made up of distinct learners which possess different potentials, socio-economic status, culture and ethnic origin. This diversity of learners makes teachers' job more demanding and complicated. Each teacher is expected to differentiate their instruction in order to meet the needs of the learners in a diverse classroom. However, teachers have not been trained for such an overwhelming task. Aside from these problems, teachers are often confronted with poor academic performance especially in Mathematics. The performance of the Filipino learners in the 2003 Trends in Mathematics and Science Study (TIMSS) showed a low achievement scores in Science and Mathematics (Gonzales, 2004).

Recognizing these challenges as well as the burden placed on teachers, the researchers decided to investigate the effects of using differentiated assessment in teaching mathematics. It is in this context that the researchers of this study were encouraged to use differentiated assessment and improve the mathematics performance of the students and increase their self-efficacy towards Mathematics.

Review of Literature

Improving the quality of education in the country has been the focus of the Philippine government. Unfortunately, the sorry state of the top universities in the country as compared to the universities around the world reflects an alarming trend and our universities are struggling to keep up with globalization (Heydarian, 2016). A World Bank study has shown that, despite a renewed focus on basic education by the Philippines government, further increases in both capital and recurrent public spending are needed (Al-Samarrai, 2016).

Mathematics Performance

Several studies have been conducted already that describes the performance of Filipino students in Mathematics. The results of the Trends in Mathematics and Science Study (TIMSS) administered in 2003 revealed low achievement scores in Science and Mathematics of selected Grade 4 and Grade 8 students from sample schools (Gonzales, 2004). The Philippines placed 23rd among 25 countries for both Science and Mathematics for Grade 4 and 42nd in Science and 41st in Mathematics among 45 countries for Grade 8 students.

In the Philippines, numerous studies have been conducted to determine the mathematics performance of the Filipino students. For example, Asparin (2013) found out that the mathematics achievement of the second year high school students of Bukidnon National High School is extremely poor as well as students' level of problem solving skills such as understanding the problem, devising a plan, carrying out a plan, and looking back. Cordova and Tan (2018) supports the study of Asparin when they found out that the mathematics proficiency of Grade 9 students from the six private high schools of Valencia City is beginning and that the mother's educational attainment best predicts mathematics performance. The study of Andamon and Tan (2018) also shows a moderate performance and level of Conceptual understanding among the Grade 7 students from six Catholic Schools in Valencia City. Based on NCAE results, the students of CMULHS had better general scholastic aptitude but poor entrepreneurial skill (Tan & Balasico, 2018). Moreover, they found out that student's mathematical ability is the best predictor of student's performance.

To improve the quality of mathematics education, innovative strategies were tried out by many researchers and these strategies were proven to be effective in enhancing student's mathematics performance. The use of these new strategies in teaching Mathematics showed promising results in enhancing student's mathematics performance. The study of Saligumba and Tan (2018) showed that the use of Gradual Release of Responsibility Instructional Model (GRRIM) helped improve the student's performance in Trigonometry while Asparin and Tan (2018) studied the use of enhanced GRRIM and showed significant results of the student's performance in Calculus. Pagtulon-an and Tan (2018) also made use of rich assessment tasks which led to an increase in student's mathematics performance. In addition, many innovative strategies such as process-oriented guided-inquiring learning (Ucang & Tan, 2013), communication strategies (Ciubal-Fulgencio & Tan, 2018), reciprocal learning (Guita & Tan, 2018), dyad cooperative learning (Aguanta & Tan, 2018), concrete-pictorial-abstract approach (Salingay & Tan, 2018), flipped classroom (Segumpan & Tan, 2018) and metacognitive scaffolding (Dagoc & Tan, 2018) were studied by various researchers and were proven to be effective in increasing students' mathematics performance.

Aside from improving the mathematics performance of each students, these innovative strategies were able to improve other factors that affect their mathematics performance such as attitude (Salingay & Tan, 2018; Aguanta & Tan, 2018; Ciubal-Fulgencio & Tan, 2018; Duque & Tan, 2018), mathematics anxiety (Segumpan & Tan, 2018; Guita & Tan, 2018), and self-efficacy (Saligumba & Tan, 2018; Pagtulon-an & Tan, 2018).

Differentiated Assessment

Our students go to school with varied capacities, learning styles and personalities. For example, Halberda, Mazzocco and Feigenson (2008) show that there are large individual differences in the non-verbal approximation abilities of 14-year-old children, and that these individual differences in the present correlate with children's past scores on standardized maths achievement tests. This findings is supported by the study of De Smedt, Verschaffel and Ghesquiere (2009) where they found out that learners differ in their mathematics achievement and the ability to compare numerical magnitudes was predictively related to mathematics achievement.

Since Tomlinson (1999) wrote the initial book on differentiated instruction, teachers across the United States of America have begun to implement a wider variety of activities in their classes. This book offers teachers a powerful and practical way to meet a challenge that is both very modern and completely timeless: how to divide their time, resources, and efforts to effectively instruct so many students of various backgrounds, readiness and skill levels, and interests.

Differentiated assessment, on the other hand, is an ongoing process where teachers collect data before, during, and after instruction from various sources to determine learners' needs and strengths (Chapman & King, 2005). Chapman and King emphasizes that students are differentiated in their knowledge and skills because they vary in the ways and speeds at which they process new idea and connect it to previous knowledge and understanding.

As Wormeli (2006) emphasizes, assessments are most useful and appropriate when students are given with materials that are not only developmentally fitting, but cover the important standards. The author stresses out that the types of questions and how they are formulated can differ depending on the learner, but the challenge with differentiation is ensuring that students also show competency with the essential standards.

Teachers are always directed to check if all the students satisfy the standards set the government. For example, Varsavsky & Rayner (2013) conducted a study about the use of differentiated assessment to address the needs of the high-achieving students and found out that such additional tasks given to them were well perceived by the students even if no additional points were given nor special credit recognition given for completing it.

Classrooms all around the world will continue to increase in size and diversity. Unfortunately, research into the problems because of learners' diversity has been both general and sparse. Further research is needed to address the difficulties of the students and the teachers brought about by this cultural diversity as well as learning disabilities and develop instructional models such as differentiated assessment to address the gap in mathematics achievement.

Self-Efficacy

Renowned Psychologist Bandura (1977) defined self-efficacy as an individual's belief that he or she will be able to complete a specific task. He believed that a crucial component to accomplishing something is our confidence that we can. Bandura postulates four sources of self-efficacy information: mastery experiences, vicarious experiences, verbal-social persuasion, and physiological and emotional arousal which have to do with the level of emotional and physical readiness of the individual to undertake a specific task.

Mastery experience is the most influential source of self-efficacy which is the evaluation of one's prior experience (Bandura, 1977). Normally, successful outcomes often raise their self-efficacy while failures lower it. Sewell and St. George (2000) found out that the use of CPS can have positive effects on self-efficacy for learning, and be a valuable framework to involve learners in decision-making that leads to social action.

Aside from understanding the results of their actions, a lot of people base their self-efficacy beliefs through observing others do a particular task (Bandura, 1977). Vicarious experience is a lesser source of self-efficacy in comparison to mastery experience but when people have no previous experiences, they tend to learn more by just observing others. Mastery models demonstrate a task proficiently and confidently, while coping models make clear the difficulties students experience in undertaking a particular task and the techniques they use to overcome these (Sewell & St. George, 2000).

Individuals can also develop self-efficacy beliefs based on the feedbacks and judgments they receive from others (Bandura, 1977). Positive reinforcements can encourage and improve self-efficacy beliefs while negative advices can weaken it. Sewell and St. George (2000) also made use of verbal persuasion in increasing the self-efficacy of students as part of the CPS technique. Along the CPS process, encouragement was supported by the provision of specific, differentiated feedback. Clear feedback about specific skill development, especially when combined with specific, proximal goals, can be an important influence on self-efficacy (Alderman, 1999).

The self-efficacy of a person can also be attained from the emotional status of a person such as stress, mood states, anxiety and arousal. Maloney, Schaeffer and Beilock (2013) pointed out several emotional impediments to mathematics performance, namely mathematics anxiety and stereotype threat and how these affective factors can lead to avoidance of Mathematics and mathematics-related fields. They suggested a number of potential interventions aimed at reducing the negative consequences of anxiety and stereotype threat on mathematics performance.

The study of Jose (2015) showed that students under the ICT-GDLE displayed a higher mathematics self-efficacy as compared to the students under Non-ICT-GDLE. In the study conducted by Asparin (2013), he found out that self-efficacy as a psychological factor and understanding the problem as one of the problem-solving abilities were best predictors of mathematics achievement.

On the other hand, Siegle and McCoach (2007) showed that teachers can modify their instructional strategies with minimal training and this can result in increases in students' self-efficacy. These results suggest that the intervention was effective for students of varying ability levels and students of both genders.

Another study conducted by Liu and Koirala (2009) provides solid evidence of the influence of mathematics self-efficacy on mathematics accomplishment among high school sophomores across the United States. Their findings suggest that in addition to promoting students' attitude towards Mathematics, it is more important to encourage their self-efficacy in order to enhance achievement in Mathematics.

Usher and Pajares (2009) also carried out a study to develop and validate items with which to assess Bandura's (1997) theorized sources of self-efficacy among middle school mathematics students. Results from the Phase 3 of the study revealed that each of the four sources of self-efficacy correlated significantly with the four mathematics self-efficacy measures and with motivation-related constructs such as mathematics self-concept, invitations, task goals, and optimism.

Methodology

The researchers used the pretest-posttest quasi-experimental design in conducting this study. Descriptive method was also used in collecting the data followed by quantification, statistical analysis, interpretation of results and discussion. The study was conducted at Central Mindanao University Laboratory High School (CMULHS), University Town, Musuan, Bukidnon 8710.

The participants of this study were the Grade 9 students of CMULHS who were enrolled in Math 9 for SY 2017-2018. One section served as the experimental group (46 students) while the other served as the control group (45 students).

This study made use of a 42-item Teacher-Made Test to assess students' mathematics performance (pretest, posttest and retention test) before and after instruction when exposed to differentiated assessment and non-differentiated assessment. The test obtained a KR21 reliability coefficient of 0.903 using the item analysis software developed by Bermundo, Bermundo and Ballester (2004). The 24-item Sources of Mathematics Self-Efficacy Scale based on the work of Usher and Pajares (2009) was used to determine the self-efficacy of students.

Descriptive Statistics (frequency counts, percentage, mean and standard deviation) and Analysis of Covariance (ANCOVA) were used to describe the Mathematics performance and the self-efficacy level of the students.

Findings

Table 1 presents the mathematics performance of students exposed to DA and those exposed to non-DA in terms of pre-test. The overall mean score of the DA group in the pre-test is 16.09 which indicates a very low performance while the overall mean score of the non-DA group is 14.67 which also indicates a very low performance.

Table 1. Mathematics performance of students exposed to DA and those exposed to non-DA in terms of pre-test.

Range	DA			Non-DA		
	f	%	Interpretation	f	%	Interpretation
90% - 100%	0	0	Very High	0	0	Very High
86 % - 89%	1	2.17	High	0	0	High
80% - 85%	1	2.17	Moderate	1	2.22	Moderate
75% - 79%	8	17.39	Low	2	4.44	Low
65% - 74%	36	78.26	Very Low	42	93.33	Very Low
		$\bar{x} = 16.09$	(Very Low)		$\bar{x} = 14.67$	(Very Low)

This study shows that both groups had a very low level of performance in the pre-test. It supports the study of Segumpan and Tan (2018) when they found out that the students' performance in Mathematics before exposure to a Flipped classroom is very low. Moreover, this study supports the study of Saligumba and Tan (2018) when they found out that the mathematics performance of students exposed to Gradual Release of Responsibility Instructional Model (GRRIM) and non-GRRIM is also very low.

The mathematics performance of students exposed to DA and those exposed to non-DA in terms of post-test is presented in Table 2. The overall mean score of the DA group in the post test is 31 which indicates a high performance while the overall mean score of the non-DA group is 24.44 which indicates a low performance.

Table 2. Mathematics performance of students exposed to DA and those exposed to non-DA in terms of posttest.

Range	DA			Non-DA		
	f	%	Interpretation	f	%	Interpretation
90% - 100%	20	43.48	Very High	5	11.11	Very High
86 % - 89%	10	21.74	High	7	15.56	High
80% - 85%	11	23.91	Moderate	11	24.44	Moderate
75% - 79%	4	8.70	Low	7	15.56	Low
65% - 74%	1	2.17	Very Low	15	33.33	Very Low
		$\bar{x} = 31$ (High)			$\bar{x} = 24.44$ (Low)	

This result supports Ciubal-Fulgencio and Tan (2018) when they found out that students exposed to Mathematics Communication Strategies environment (MCS) have a higher performance compared to the students exposed to non-Mathematics Communication Strategies environment (non-MCS. However, it opposes to the study of Pagtulon-an and Tan (2018) when they found out that the mathematics performance of students exposed to rich assessment tasks environment (RATE) is of the same level when compared to those exposed to non-RATE.

Table 3 presents the mathematics performance of students exposed to DA and those exposed to non-DA in terms of retention test. The overall mean score of the DA group in the retention test is 25.30 which indicates a moderate performance while the overall mean score of the non-DA group is 19.80 which indicates a low performance.

Table 3. Mathematics performance of students exposed to DA and those exposed to non-DA in terms of retention test.

Range	DA			Non-DA		
	f	%	Interpretation	f	%	Interpretation
90% - 100%	8	17.39	Very High	2	4.44	Very High
86 % - 89%	8	17.39	High	2	4.44	High
80% - 85%	6	13.04	Moderate	7	15.56	Moderate
75% - 79%	11	23.91	Low	10	22.22	Low
65% - 74%	13	28.26	Very Low	24	53.33	Very Low
	$\bar{x}$ = 25.30 (Moderate)			$\bar{x}$ = 19.80 (Very Low)		

This finding conforms to the study of Ciubal-Fulgencio and Tan (2018) when they found out that students exposed to MCS have a higher retention than the students exposed to traditional learning. It also conforms to the study of Salingay and Tan (2018) when they found out that the level of performance of students in Mathematics exposed to Concrete-Pictorial-Abstract (CPA) approach in terms of retention test scores is higher than those who are exposed to non-CPA approach.

Self-Efficacy of the Students towards Mathematics before and after the Intervention

Table 4 presents the self-efficacy level of students towards mathematics between DA and non-DA group before intervention. Results show that before the intervention, the DA group had a moderately high self-efficacy with an overall mean score of 2.97 while the non-DA group had a moderately low self-efficacy with an overall mean score of 2.23.

Table 4. Self-efficacy level of students towards Mathematics between DA and non-DA group before intervention.

Self-efficacy Towards Mathematics	DA		Non-DA	
	Mean	Interpre-tation	Mean	Interpre-tation
I make excellent grades on math tests.	2.91	MH	2.11	ML
I have always been successful with math.	2.65	MH	1.93	ML
Even when I study very hard, I do poorly in math.*	3.63	H	2.76	MH
I got good grades in math on my last report card.	3.72	H	2.73	MH
I do well on math assignments.	3.54	H	2.80	MH
I do well on even the most difficult math assignments.	2.30	ML	1.60	ML

Seeing adults do well in math pushes me to do better.	3.74	H	3.07	MH
When I see how my math teacher solves a problem, I can picture myself solving the problem in the same way.	2.83	MH	2.44	ML
Seeing kids do better than me in math pushes me to do better.	3.83	H	3.02	MH
When I see how another student solves a math problem, I can see myself solving the problem in the same way.	3.02	MH	2.11	ML
I imagine myself working through challenging math problems successfully.	2.76	MH	2.38	ML
I compete with myself in math.	3.60	H	2.70	MH
My math teachers have told that I am good at learning math.	2.17	MH	1.29	L
People have told me that I have a talent for math.	2.20	ML	1.24	L
Adults in my family have told me what a good math student I am.	2.67	MH	1.73	ML
I have been praised for my ability in math.	2.04	ML	1.00	L
Other students have told me that I'm good at learning math.	2.50	ML	1.76	ML
My classmates like to work with me in math because they think I'm good at it.	2.30	ML	1.40	L
Just being in math class makes me feel stressed and nervous.*	3.00	MH	2.40	ML
Doing math work takes all of my energy.*	2.61	MH	2.44	ML
I start to feel stressed-out as soon as I begin my math work.*	3.00	MH	2.56	MH
My mind goes blank and I am unable to think clearly when doing math work.*	3.41	MH	2.62	MH
I get depressed when I think about learning math.*	3.54	H	2.80	MH
My whole body becomes tense when I have to do math.*	3.24	MH	2.58	MH
Overall Mean Interpretation	2.97	MH	2.23	ML

*negative indicators (scoring is reversed)
Legend:

Range	Qualitative Interpretation
4.51 – 5.00	Very High (VH)
3.51 – 4.50	High (H)
2.51 – 3.50	Moderately High (MH)
1.51 – 2.50	Moderately Low (ML)
0.51 – 1.50	Low (L)
0.00 – 0.50	Very Low (VL)

This finding does not conform to Saligumba and Tan (2018) when they found out that both groups exposed to GRRIM and non-GRRIM have a moderately low self-efficacy towards Mathematics before the intervention. It also contradicts to the study of Pagtulon-an and Tan (2018) when the results of their study showed that both groups exposed to RATE and non-RATE have a positive self-efficacy beliefs towards Mathematics before the intervention.

Table 5 shows the self-efficacy of level of students towards mathematics between DA and non-DA group after intervention. After the intervention, the self-efficacy level of the DA group is still moderately high with an overall mean score of 2.78 but is lower than their self-efficacy level before the intervention. On the other hand, the self-efficacy level of the non-DA group slightly increased to 2.44 as compared to their self-efficacy level before the intervention but is still moderately low.

Table 5. Self-efficacy level of students towards Mathematics
between DA and non-DA group after intervention.

Self-efficacy Towards Mathematics	DA		Non-DA	
	Mean	Interpreta-tion	Mean	Interpreta-tion
I make excellent grades on math tests.	2.85	MH	2.31	ML
I have always been successful with math.	2.52	MH	2.07	ML
Even when I study very hard, I do poorly in math.*	3.13	MH	2.84	MH
I got good grades in math on my last report card.	3.15	MH	2.47	ML
I do well on math assignments.	3.37	MH	2.80	MH
I do well on even the most difficult math assignments.	2.26	ML	2.00	ML
Seeing adults do well in math pushes me to do better.	3.52	H	3.00	MH
When I see how my math teacher solves a problem, I can picture myself solving the problem in the same way.	2.72	MH	2.53	MH
Seeing kids do better than me in math pushes me to do better.	3.37	MH	3.04	MH
When I see how another student solves a math problem, I can see myself solving the problem in the same way.	2.65	MH	2.51	MH
I imagine myself working through challenging math problems successfully.	3.00	MH	2.49	ML
I compete with myself in math.	3.39	MH	3.10	MH
My math teachers have told that I am good at learning math.	2.54	MH	1.98	ML
People have told me that I have a talent for math.	2.43	ML	1.82	ML
Adults in my family have told me what a good math student I am.	2.61	MH	2.09	ML
I have been praised for my ability in math.	2.48	ML	2.02	ML
Other students have told me that I'm good at learning math.	2.50	ML	2.07	ML
My classmates like to work with me in math because they think I'm good at it.	2.35	ML	2.20	ML
Just being in math class makes me feel stressed and nervous.*	2.59	MH	2.36	ML
Doing math work takes all of my energy.*	2.13	ML	2.13	ML
I start to feel stressed-out as soon as I begin my math work.*	2.48	ML	2.49	ML
My mind goes blank and I am unable to think clearly when doing math work.*	2.74	MH	2.71	MH
I get depressed when I think about learning math.*	2.96	MH	2.96	MH
My whole body becomes tense when I have to do math.*	2.87	MH	2.56	MH
Overall Mean Interpretation	2.78	MH	2.44	ML

*negative indicators (scoring is reversed)

Legend:

Range	Qualitative Interpretation
4.51 – 5.00	Very High (VH)
3.51 – 4.50	High (H)
2.51 – 3.50	Moderately High (MH)
1.51 – 2.50	Moderately Low (ML)
0.51 – 1.50	Low (L)
0.00 – 0.50	Very Low (VL)

The results of this study contradicts to Saligumba and Tan (2018) when they found out that both groups exposed to GRRIM and non-GRRIM still have a moderately low self-efficacy towards Mathematics after the intervention. Moreover, this study does not conform to Pagtulon-an and Tan (2018) when they found out that both groups exposed to RATE and non-RATE have a positive self-efficacy beliefs towards Mathematics after the intervention.

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Analysis of Covariance (ANCOVA) of Post-test and Retention Test Results Between Treatments

Table 6 shows the analysis of covariance (ANCOVA) of post test results between treatments. As shown in the table, the DA group with mean 31.00 performed way better than the non-DA group with mean 24.44.

Table 6. Comparison of post-test results between DA and non-DA group

Group	Mean	SD	N
DA	31.00	4.482	46
Non-DA	24.44	7.597	45
Total	27.76	7.008	91

Source	SS	df	MS	F-value	Sig.
Group	711.556	1	711.556	24.565	0.000*
Pretest	894.098	1	894.098	30.867	0.000
Error	2549.014	88	28.996		
Total	74538.000	91			

*Significant at 0.05 level

There are already several studies conducted that corresponds to this study that used varied teaching strategies to enhance the quality of mathematics performance. The results of this study does not conform to Pagtulon-an and Tan (2018) when they found out that there is no significant difference in the mathematics performance of students exposed to RATE and those exposed to non-RATE in terms of post-test scores. On the other hand, the study of Ciubal-Fulgencio and Tan (2018) corresponds to the result of this study wherein there is a significant difference on the students' performance when exposed to Mathematics Communication Strategies (MCS) as compared to those exposed to non- Communication Strategies (MCS).

The result of this study also corresponds to Abbas & Abdurrahman (2015) when the findings of their study showed that there is a significant difference on the performance of students taught geometry using differentiated instructional technique with those taught with the mere traditional learning method. With the same study in differentiated instruction, Muthomi & Mbugua (2014) came up with the result that differentiated instruction has had a positive impact on students' achievement and serves beneficial in improving the students' academic scores.

Table 7 presents the analysis of covariance (ANCOVA) of retention tests results between treatments. As presented in the table, the DA have a high retention level compared to students exposed to non-DA. Furthermore, the mean score of the DA group in the retention test which is 25.30 is definitely higher than the non-DA group's mean score which is 19.30.

Table 7. Comparison of retention test results between GRRIM and non-GRRIM group

Group	Mean	SD	N
DA	25.30	8.403	46

Non-DA	19.80	6.950	45
Total	22.58	8.160	91

Source	SS	df	MS	F-value	Sig.
Group	442.171	1	442.171	9.493	0.003*
Pretest	1203.880	1	1203.880	25.845	0.000
Error	4099.059	88	46.580		
Total	52399.000	91			

*Significant at 0.05 level

The result of this study is in line with the study of Ciubal-Fulgencio and Tan (2018) wherein the result of their study shows that students exposed to Mathematics Communication strategies (MCS) has higher retention than those students exposed to non-Mathematics Communication strategies (MCS). This study also supports Salingay and Tan (2018) when they found out that those students exposed to Concrete-Pictorial-Abstract (CPA) approach have a significantly higher retention test scores than those exposed to non-CPA. On the other hand, the result of this study contradicts to the result of the study of Saligumba and Tan (2018) wherein they found out that there is no significant difference in the retention test scores between those exposed to Gradual Release of Responsibility Instructional Model (GRRIM) and those exposed to non-GRRIM. This study also contradicts to the study of Pagtulon-an and Tan (2018) when they found out that the students' retention test scores in the Rich Assessment Task Environment (RATE) is not significantly higher than those exposed to non-RATE.

Analysis of Covariance (ANCOVA) in the Students' Self-Efficacy towards Mathematics when Exposed to DA and Non-DA

Presented in Table 8 is the analysis of covariance (ANCOVA) in the student's self-efficacy towards mathematics when exposed to DA and non-DA. Table 8 shows an F value of 4.190 and a p-value of 0.044 implying a significant difference in the self-efficacy of two groups exposed to DA and non-DA .Furthermore, it can be observed that the mean score of the DA group is higher compared to the non-DA group.

Table 8. Comparison of Self-efficacy levels between groups

Group	Mean	SD	N
DA	2.7763	0.58771	46
Non-DA	2.4396	0.71749	45
Total	2.6098	0.67308	91

Source	SS	df	MS	F-value	Sig.
Group	0.709	1	0.709	4.190	0.044*
Pretest	23.293	1	23.293	137.569	0.000
Error	14.900	88	0.169		
Total	660.570	91			

*Significant at 0.05 level

The result of this study supports the result of the study of Jose (2015) wherein he found out that there is a significant difference in the self-efficacy of students exposed to ICT-GDLE as compared to those exposed to non ICT-GDLE. On the contrary, the result of this study contradicts to the study of Saligumba and Tan (2018) when they found out that there is no significant difference in the self-efficacy of students exposed to GRRIM as compared to those exposed to non-GRRIM.

Conclusion

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

The mathematics performance of the Grade 9 students in terms of pre-test both for the DA group and non-DA group is very low. After the intervention, the DA group had a high performance while the non-DA group had a low performance. The mathematics performance of the DA group in terms of retention test is moderate while the non-DA group had a very low performance.

The self-efficacy of the DA group towards Mathematics before and after the intervention is moderately high while the self-efficacy of the non-DA group before and after the intervention is moderately low.

Those students exposed to DA have a significantly higher post-test and retention test scores as compared to those exposed to non-DA.

Moreover, the self-efficacy level of students exposed to DA is significantly higher than those exposed to non-DA.

Suggestions and Recommendations

The results and findings of the study led to the following recommendations for further research and actions:

Educators may use innovative strategies such as the Differentiated Assessment to improve the students' mathematics performance since it is shown in this study that there is an increase in the students' performance before and after the intervention.

Differentiated assessment is also an effective strategy in increasing the self-efficacy of the students towards mathematics. The use of differentiated assessment in every part of the lesson is affective in addressing the gap of the mathematics performance of the students in the classroom.

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