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Metacognitive Strategies: Their Effects on Students' Academic Achievement and Engagement in Mathematics

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This study investigated the effects of metacognitive strategies on student's academic achievement and engagement in Mathematics. It was conducted in Aplaya National High School, Schools Division of Misamis Oriental, Philippines, during the school year 2015-2016. A total of 60 Grade 9 students were the participants of the study. Pretest-Posttest Quasi-Experimental research design was used. The data were gathered using the researcher-made academic achievement test and engagement scale in Mathematics. Mean and standard deviation were used to describe the data. One-way analysis of co-variance (ANCOVA) was utilized to test if the significant differences existed between the experimental and the control groups, while Pearson Product Moment Correlation was used to test if there is a significant relationship between the two groups. Findings revealed that the academic achievement of Grade 9 students when taught using metacognitive strategies was Very Satisfactory; while the students taught with the conventional teaching strategies was Fairly Satisfactory. There was a significant difference in the academic achievement of students in Mathematics in favor of the experimental group. Moreover, the engagement in Mathematics of both groups was on the average level, but there was no significant difference between them. In addition, there is a significant relationship between students' academic achievement and engagement in Mathematics.

Field of Study: Education

1. Introduction

Metacognition is simply defined as "thinking about thinking" (Lai 2011). It is the ability to control one's own thinking processes in problem solving and higher order thinking. With metacognition, skills are developed and less developed metacognitive skills imply poor achievement (Sahin & Kinder 2013). Thus, the issues on improving metacognitive skills of low-performing students concern the teachers.

In the Philippines, the twin goals of Mathematics in the K to 12 Basic Education Curriculum are critical thinking and problem solving (K to 12 Mathematics Curriculum Guide 2013). As observed, some students are not performing well in Mathematics because they have not developed the given skills. Problem solving and critical thinking are less developed because they entail students to go beyond their thinking.

In order to achieve the necessary skills for problem solving and critical thinking, a student must recognize what he knows and be able to process it. Thus, there is a need to improve students' metacognitive skills to address the present scenario. Nowadays, teachers are challenged to solve the low achievement of students in Mathematics. Teachers are expected

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to initiate effective strategies for students to learn best and perform well. As a possible solution to the problem, metacognitive strategies are developed. Metacognitive strategies refer to conscious monitoring of one's cognitive strategies to achieve desired results (Flavell 1979). These strategies permit students to use their metacognitive skills.

In Aplaya National High School, many students are not performing well in Mathematics. Many Grade 9 students least mastered the different competencies in Variations based on their test results. The necessity of improving students' academic achievement in Mathematics needs to be addressed. Metacognitive strategies, like concept mapping, journal writing and think-aloud, may help improve students' achievement if used in the teaching and learning of Mathematics. On a personal note, the metacognitive strategies initiated by teachers in the classroom were still ineffective due to students' lack of engagement. Students' engagement is the quality and quantity of students' psychological, cognitive, emotional and behavioral reactions to the learning process as well as to in-class and out-of-class academic and social activities to achieve successful learning outcomes (Gunuc 2014). All efforts exerted by teachers to increase students' achievement are useless with students' disengagement. Thus, students' engagement in Mathematics classes needs to be investigated on how it affects achievement.

Metacognitive strategies were studied by various researchers. A lot of studies were conducted to investigate the effects of their uses in the academic performance and engagement in Mathematics and other subject areas. Their findings suggest that metacognitive strategies are effective in improving students' academic achievement as compared to the traditional teaching strategies. However, the previous studies conducted were not aligned to the latest K to 12 Basic Education Curriculum in the Philippines set by the Department of Education. A study conducted by Sahin and Kinder (2013) shed light to the conceptualization of the present study. The studies of Ngozi ibe (2009) and Jayapraba (2013) helped the researcher to have a better methodology. The said studies gave a clearer direction of pretest-posttest research design. Attard's (2013) construct of engagement was integrated into the present study and was used in constructing the researcher-made Engagement Scale in Mathematics. The researches of Olson and Johnson (2012), Erasmus (2013) and Henjes (2013) provided the researcher an idea to consider the incorporation of concept mapping, think-aloud, and journal writing as metacognitive strategies.

1.1 Conceptual Framework of the Study

The study is anchored on Flavell's concept of metacognitive strategies. John Flavell (1979) posited that learning is maximized when students learn to think about their thinking and consciously employ strategies to intensify their reasoning and problem solving abilities. The use of metacognitive strategies ignites one's thinking and can lead to better learning and higher performance (Jayapraba 2013). With the use of metacognitive strategies in Mathematics classroom, students' critical thinking and problem solving skills will grow, and will lead to an increase of students' academic achievement later on.

The teaching strategies used in the classroom affect students' academic achievement (Ganyaupfu 2013). Students' academic achievements reflect how well they mastered the learning competencies and how effective are the teachers in facilitating the learning process. At present, the latest K to 12 Basic Education Curriculum of the Philippines incorporates the knowing, processing and transferring strategies based on Understanding by Design (UbD) of McTighe and Wiggins (Okabe 2013) as reflected on the suggested sets of activities in the K to 12 Learner's Material disseminated to schools. However, the low performance of

students in Mathematics is still unaddressed. The researcher investigated the use of metacognitive strategies namely concept mapping, think-aloud and journal writing to improve students' achievement. Concept mapping, which involves making of diagrams and depicting relationships, is initiated before the lesson properly starts. During the lesson proper, think-aloud dialogues happen where students voice out what they are thinking. At the end of the lesson, journal writing is implemented which requires students to monitor their learning progress on what they know, their difficulties and how they overcome it.

Teaching strategies, even the most effective one, alone do not merit successful learning process without students' engagement in class simply because engagement is associated with students' academic achievement (Gunuc 2014). Engagement comes in three levels: cognitive, behavioral and affective (Attard 2012). Cognitive engagement entails students' investing time and energy to study their lessons. Behavioral engagement involves participation and involvement in class while affective engagement is more on students' reactions about the class. Engagement is an important factor in the process of integrating metacognitive strategies in the teaching of Mathematics because it deepens the meaning of learning and facilitates the transfer of concept (Fouche & Lamport 2011). Therefore, students' engagement needs to be examined together with metacognitive strategies.

1.2 Statement of the Problem

The study investigated the effects of metacognitive strategies on students' academic achievement and engagement in Grade 9 Mathematics. The study was conducted in Aplaya National High School, Division of Misamis Oriental during the school year 2015-2016.

Specifically, this study sought to answer the following questions:

1. What is the academic achievement in Variations of Grade 9 students taught using the metacognitive strategies and of those students using the conventional teaching strategies?
2. Is there a significant difference in the academic achievement in Variations between the students taught with the use of metacognitive strategies and of the students taught with the conventional teaching strategies?
3. What is the engagement in Mathematics of Grade 9 students when taught using metacognitive strategies and those with the conventional teaching strategies?
4. Is there a significant difference in the engagement in Mathematics between the students taught with the use of metacognitive strategies and of the students taught with the conventional teaching strategies?
5. Is there a relationship between academic achievement and engagement of students?

The study was conducted in a scientific manner, and it was written using scientific format. The paper included a brief literature review, a detailed methodology, well-presented results, and comprehensive discussions of results and summary indicating limitations of the study. The literature review was written in thematic form taken into consideration influential papers and relevant related studies. The methods were explained in detail and described accordingly. The findings were presented in tabular form and organized in logical sequence, discussed comprehensively with light from previous studies conducted.

2. Literature Review

Metacognitive strategies and engagement have been present in the classroom. Various literature and studies emphasized the need to integrate it in the teaching and learning process. Amidst the fact that there are differences on several studies conducted in terms of participants, locale, subject areas, research designs and variables used, still it can't deny the fact that the varied researches is geared towards the improvement students' academic achievement.

2.1 Metacognitive Strategies

A study on the effects of metacognitive strategies for problem solving in fifth grade pupils' achievement, metacognition skills and attitude was conducted in a primary school in Central Anatolia Region of Turkey in school year 2011-2012 by Sahin and Kendir (2013). Experimental method was used with a pretest posttest control group design. Results showed that the experimental group had significantly higher posttest scores when compared to the control group. In addition, it was observed that students in the experimental group had developed a better attitude towards Geometry and Mathematics. Furthermore, the pupils had developed the ability to perceive the importance of problem solving, to understand problems, to be involved in planned studying, and to control and be aware of the problem solving process. A corresponding increase in pupils' achievement was evident.

In Nigeria, a study examined the effects of metacognitive strategies on classroom participation and student achievement in secondary school classrooms. Ngozi ibe (2009) made use of quasi-experimental design involving three intact groups, with two treatment groups (think-pair-share and metacognitive strategies) and a control group. Results revealed that metacognitive strategies were most effective in enhancing academic achievement followed by think-pair-share. The inclusion of metacognitive strategies in the classroom is recommended to help students learn more effectively.

Toit and Kotze (2009), in South Africa, scrutinized the metacognitive strategies of grade eleven students and their teachers. The findings revealed that planning strategy and evaluating the way of thinking and acting were used frequently by both students and their teachers. However, journal-keeping and thinking aloud were used seldom by teachers and students. Moreover, Jayapraba (2013) inspected the effects of metacognitive strategies and cooperating learning strategies on students' achievement. Results showed that metacognitive strategies were most effective in enhancing academic achievement. It was very clear that there is a significant relationship between metacognitive strategies and achievement.

In the Philippines, Avila and Baetiong (2012) studied the effects of an in-service training on the metacognitive strategies of public secondary teachers in the district of Talacogon, Agusan del Sur. Results indicated that in-service training on metacognitive strategies significantly affected the teacher-participants' attitude towards the use of metacognitive strategies and their performance in teaching. A qualitative study on metacognitive behavior by Pulmones (2007) at St. Scholastica's College in Manila revealed that continued engagement of students gives ample opportunities for students to demonstrate their planning, monitoring and evaluation behaviors. Purposely asking students to answer metacognitive questions allowed them the opportunity to reflect on their thinking. In Quezon, Bukidnon, Culaste(2011) stressed out that pupils should be provided with both

metacognitive strategies and cognitive strategies in order to enhance their cognitive and metacognitive skills. The researcher inspected the metacognitive dimensions on the cognitive skills of mathematical problem solving of two hundred seventy five grade six pupils and findings revealed that the pupils had low metacognitive prediction and evaluation dimensions.

The different metacognitive strategies employed in the study were studied independently by researchers. Concept mapping, think-aloud and journal writing was not taken as one strategy in the classroom. Erasmus (2013) used concept mapping in South Africa as a strategy to enhance students' learning and to engage the students. Results showed that students welcomed concept mapping approach as it assisted their learning and it allowed greater discussion and interaction among them. An investigation was made by Henjes (2007) examined how students' use of think-aloud strategies impact their success in solving word problems. Grade six pupils in Lincoln, Nebraska in school year 2006-2007 were the participants of the study. Results revealed that the use of think-aloud strategies play an important role in students' abilities to understand and solve word problems. Direct instruction and modeling of think-aloud strategies increased students' confidence levels to use the strategies on their own.

2.2 Engagement in Mathematics

Variety of studies looked into the effects of metacognitive strategies towards students' engagement in class, limited to concept mapping, think-aloud and journal writing. An investigation conducted by Skilling (2013) explored the factors that contribute to the shifts in student engagement in mathematics from primary to secondary school and to examine teacher practices that promote higher levels of engagement in Grade 7 Mathematics. Results showed that instructional strategies that directly addressed students, interests, values, competencies and self-efficacy were crucial in promoting engagement in Mathematics.

Hazelwood (2015) explored the effects of the use of active learning and relevance-building strategies like think-pair-share in maintaining student engagement. With the use of an engagement survey given on the first and the final lecture, it was discovered that there is no difference in students' engagement in the different degree programs across the semester. The researcher pointed out the need to deliver an authentic learning experience while engaging students from different degree programs. In addition, notable findings were gained from the study conducted by Reyes, Brackett, Rivers and Salovey (2012) when they discovered that students who are engaged in class obtain higher scores than those disengaged because they participate in the learning process.

Furthermore, the behavioral engagements of two learning environments, which are the traditional classroom and E- learning, were compared for significant difference by Li, Qi, Wang and Wang (2014) using variance analyses. Results showed that there was no significant difference between them when active learning strategies were used in both learning environments. In addition, Cakir and Saritepe (2015) looked into students' engagement and academic achievement using blended learning environment. With the use of quasi-experimental pretest posttest control group design, results indicated a meaningful increase in academic achievement of students in blended learning environment when compared to the face-to-face learning environment. However, there was no meaningful statistical differences were detected for students' engagement between both groups.

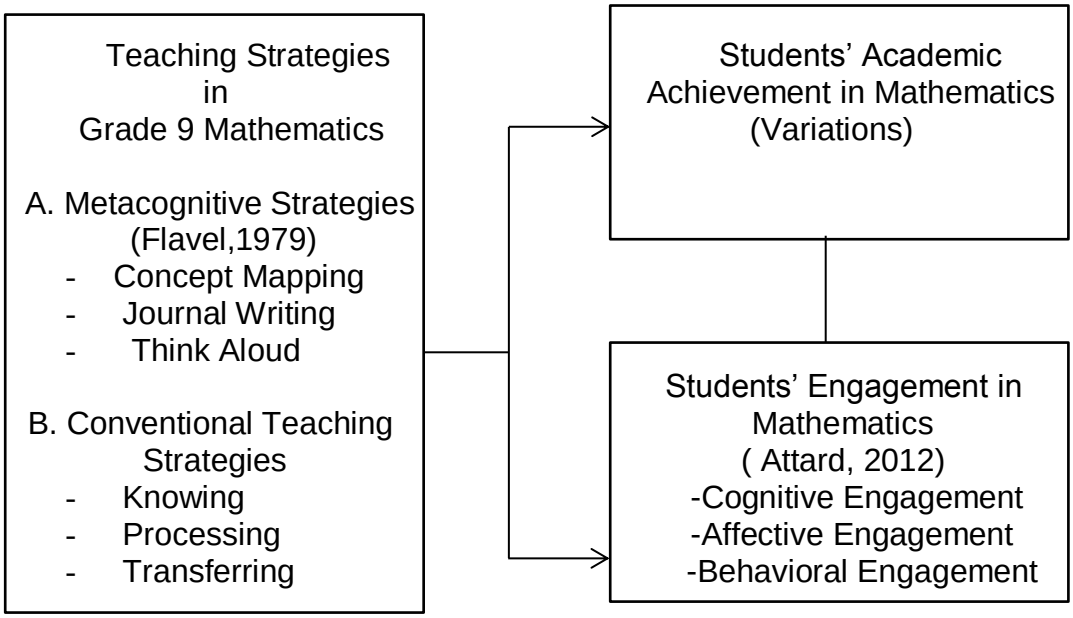
There were studies conducted on examining the relationship of student engagement and academic achievement. One of those studies conducted aimed to determine the extent to which student engagement explains or predicts academic achievement. Gunuc (2014) made use of correlational research and the results revealed that there were significant relationship between students' academic achievement and engagement in the cognitive, behavioral and emotional dimensions. In addition, it was found out that students with high level of student engagement had higher levels of academic achievement and that those with low level of student engagement had lower levels of academic achievement.

3. Methodology

The study made use of the Pretest-Posttest Quasi-Experimental research design. Two intact Grade 9 classes in Aplaya National High School, during the second grading period of the school year 2015-2016, were selected as participants of the study. One class was randomly assigned as the experimental group. The other one was assigned as the control group. All of the students in the two classes were present in the conduct of the experiment. However, only 30 students from each of the two classes were considered in the analysis of data. Thirty students from the experimental group were paired with 30 students from the control group based on gender and grade in Mathematics in the first grading period.

Figure 1 illustrated the conceptual model of the study. The teaching strategies were investigated in its effectiveness towards increasing students' academic achievement and in heightening student's engagement in Mathematics. Furthermore, possible relationship of students' academic achievement and engagement in Mathematics was also tested.

Figure 1: The Conceptual Model Showing the Parameter of the Study

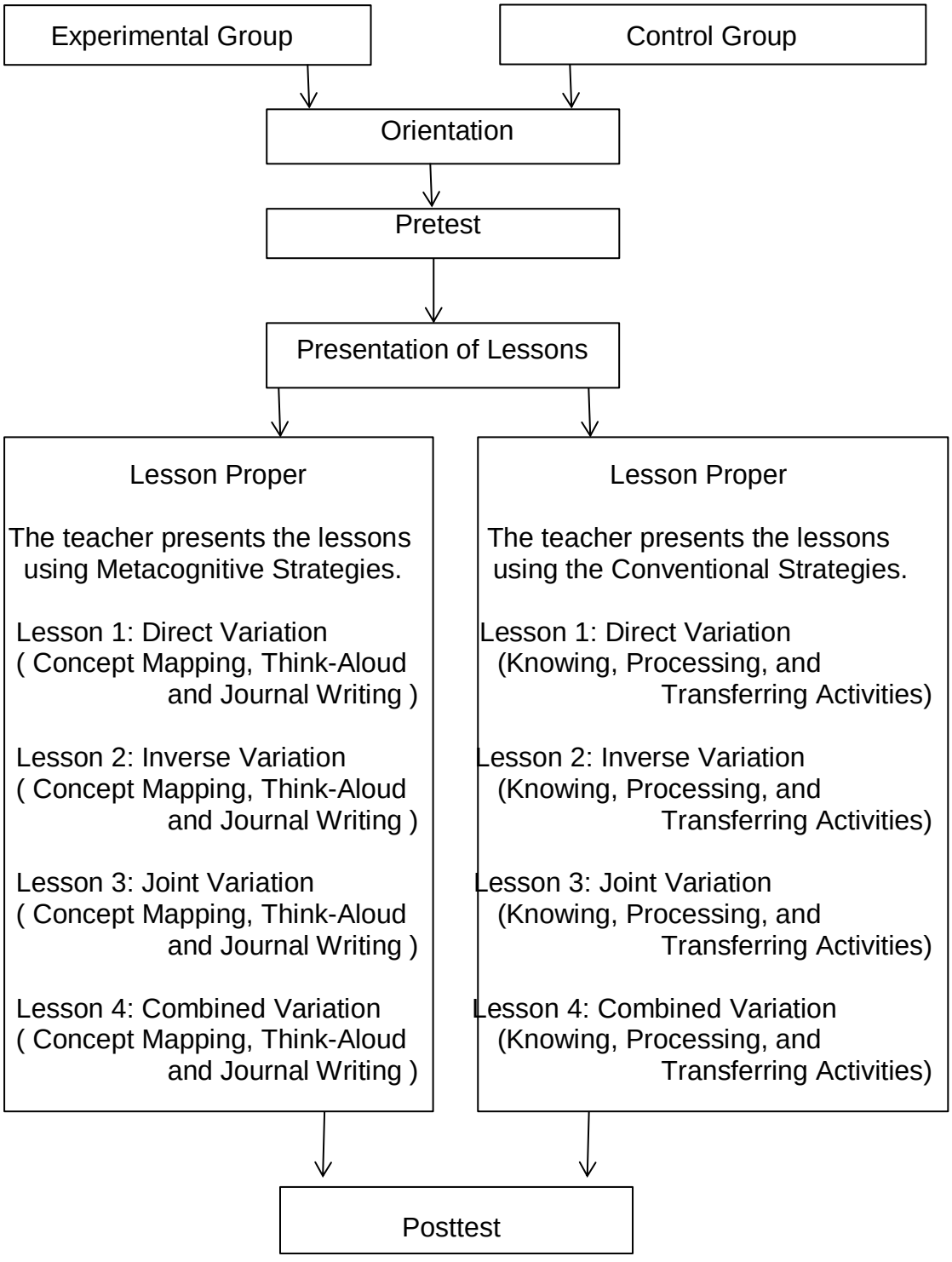


Before the conduct of the study, an approved letter request was granted by the approving authorities. The researcher secured free prior and informed consent from the participants and their parents, and an orientation was conducted. Lessons in Variations were developed by the researchers and were evaluated by a panel of experts in terms of the developed lessons' content and content accuracy, clarity, and appropriateness. Revisions were made

in the developed lessons based on the experts' comments and suggestions. The research instruments utilized in the study were 30-item researcher-made academic achievement test in Variations and 30-item researcher-made engagement scale in Mathematics, having 10 items per engagement level. The said instruments were subjected to revision based on experts' comments and suggestions, and were tested for their reliability. The reliability test result of the academic achievement test was 0.843 and for engagement scale in Mathematics was 0.873. This shows that the instruments were reliable, dependable and consistent to assess the academic achievement and the Mathematics engagement, respectively.

At the onset of the investigation, as shown in Figure 2 a pretest in Variations and engagement in Mathematics were given to both groups. Each test was answered individually by the participants. Only one teacher handled both groups, the researcher himself. Both groups had the same lessons and assessment, but they differ in the teaching strategies used. The experimental group was taught using metacognitive strategies; while, the control group was taught using the conventional teaching strategies. At the start of the lessons, the experimental group had concept mapping activities; while, the control group took knowing activities. The concept maps made by the students in the experimental group covered direct variation, inverse variation, joint variation and combined variation. On the other hand, the control group's knowing activities, as stipulated in the Learners' Material provided by the Department of Education, were more on revealing students background knowledge in different topics in Variations through problem and situation analysis.

Figure 2: Procedural Framework for the Conduct of the Experiment



In the lesson proper, the experimental group experienced think-aloud activities; while, the control group had processing activities. The experimental group experienced think-aloud strategies in different ways. In direct variation, think-aloud discourses happened by pair. Students say what's on their mind to their partner. Some pairs were asked to share their think-aloud episodes in the whole class. In inverse variation, an individual think-aloud dialogue with the teacher happened. The teacher posted problems and called students to think-aloud the processes involved in solving the given problems. Both joint and combined

variations made use of group think-aloud. The students think-aloud by cluster and brainstormed ideas to answer the given problems. They then reported their answers in class. In contrast, the control group utilized different processing activities usually done through problem solving, as specified in the Learners' Material.

At the end of the lessons, the experimental group underwent journal writing activities; while the control group undertook transferring activities. The conduct of journal writing was guided, accordingly. Students wrote about what concepts were discussed, what they learned, how did they stay engaged with the lessons, what difficulties did they encounter and how did they overcome the said difficulties. The control group had transfer activities, which were identified in the Learners' Material like after lesson response, think deeper activities, reflections, and demonstrating understanding. After a series of lessons, a posttest in Variations and engagement in Mathematics were taken by the students in both groups.

The data gathered were treated using appropriate statistical techniques. They were tabulated and organized into tables. The proper scoring procedures were followed accordingly. Mean and standard deviation were used to determine the academic achievement and engagement of the control group and of the experimental group. The one-way analysis of covariance (ANCOVA) at 0.05 level of significance was utilized to test the significant difference in the academic performance and in the engagement between the control group and the experimental group. The relationship of students' achievement and engagement was tested using Pearson Product Moment Correlation at 0.01 level of significance.

4. Results and Discussions

4.1 Academic Achievement of Students

Table 1 shows that the pretests results of both groups are generally comparable. Based on the achievement descriptions set by the Department of Education, both the control group and the experimental group did not meet the established expectations. However, their respective standard deviations indicated that the pretest scores of the students in the experimental group were more scattered compared with that of the control group. The frequency and percentage of pretest scores show that before the conduct of the study, the participants in both the experimental group and the control group least mastered the concepts behind Variations. Pretest results indicate that the students have poor academic achievement scores. The results suggest for strategies that will aid the improvement of students' academic achievement. It can be implied that when teachers may not incorporate effective strategies in the teaching and learning process, students' academic achievement would be on the same level, which is low. A similar finding in the pretest scores was revealed in a study conducted by Jayapraba (2013), wherein the Science achievement pretest scores are low in different groups.

Table 1: Achievement Scores of Students in Mathematics

Level of Proficiency	Range of Scores	Control Group				Experimental Group			
		Pretest		Posttest		Pretest		Posttest	
		f	%	*f*	%	*f*	%	*f*	%
Outstanding	26-30	0	0%	3	10%	0	0%	13	43%
Very Satisfactory	23-25	0	0%	3	10%	0	0%	3	10%
Satisfactory	21-22	0	0%	2	6%	0	0%	3	10%
Fairly Satisfactory	18-20	0	0%	14	47%	1	3%	8	27%
Did Not Meet Expectations	0-17	30	100%	8	27%	29	97%	3	10%
$\bar{x}$		10.47		19.20		10.53		23.27	
SD		2.22		3.80		2.92		5.15	

However, the posttest results of both groups showed that the experimental group had the greater posttest mean score compared with that of the control group. Based on the achievement descriptions set by the Department of Education, the experimental group met the Very Satisfactory rating; while, the control group gained Fairly Satisfactory rate. Furthermore, results presented using frequencies and percentages show that in the posttest results of the two groups, a greater number of percentages of the students in the experimental group reached the outstanding level; while, only a few of the students in the control group reached the same level. A bigger number of the students in the control group still did not meet the prescribed expectations; while only little number of students in the experimental group remained at the same level. Findings suggest that both groups increased their mean scores in the test, but it is the experimental group that had the greater improvement.

Results signify that the use of metacognitive strategies in teaching Variations increases students' achievement significantly higher than the conventional teaching strategies. Concept mapping, think aloud and journal writing influence the students in the experimental group to perform better as compared to the knowing, processing and transferring activities of the control group. The results are in consonance with the findings of Sahin and Kendir (2013) and Ngozi ibe (2009) that with the use of metacognitive strategies in the teaching and learning process, the posttest achievement scores of the students are enhanced as compared to those using the conventional teaching strategies.

4.2 Comparison of the Academic Achievement between Groups

Table 2 shows that there is a statistically significant difference in the academic achievement between the experimental group and the control group, in favor of the experimental group. The difference must have resulted from the use of metacognitive strategies. The data show that the teaching strategies obtained a p-value which is lower than the significance level of 0.05; thus, the null hypothesis which states that there is no significant difference in the academic achievement in Mathematics between the groups is rejected. The use of concept mapping, think aloud and journal writing gave more significant improvement in students' academic achievement than the use of knowing, processing and transferring activities.

Table 2: One-way ANCOVA Comparing the Results of Students' Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected	592.473	2	296.237	20.000	0.00
Model	433.427	1	433.427	29.263	0.00
Intercept	344.407	1	344.407	23.253	0.00
Pretest	240.450	1	240.450	16.234	0.00
Teaching	844.260	57	14.812		
Strategies	28488.000	60			
Error	1436.733	59			
Total					
Corrected					
Total					

R squared = 0.412 (Adjusted R squared = 0.392)

The findings are parallel to the earlier results of the researches conducted by Sahin and Kendir (2013) and Ngozi ibe (2009) that there was a significant difference in experimental group and control group, in favor of the experimental group. The group taught using metacognitive strategies achieved more than the group using the conventional teaching strategies. The different metacognitive strategies had different effects on the enhancement of students' achievement. Based on students' journal entries, the concept mapping activities allowed the students to draw connections and relationships of different terms associated with the given concept. It made them brainstorm and generate new ideas. With a clear picture of the lessons in mind, the different problems asked became easy to solve. The students' journal entries support the findings of Erasmus (2013) that concept mapping aids in the enrichment of students learning.

Moreover, think aloud is more efficient than other processing activities because in think aloud students were able not only answer the problems but they verbalize how to do things where they will be able to acknowledge their misconceptions and be able to correct mistakes later on. In problem solving, not all students were able to pinpoint their errors while other students solve without understanding the problem. The students' claims substantiate the investigation results of Henjes (2007), where think aloud strategy made students understand and solve problems easily. Journal writing activity made an impact on students learning. The participants were able to reflect on how they learn and were able to identify their difficulties. Similar results were showed in the study conducted by Olson and Johnson (2012) that journal writing gave students opportunity to deepen their understanding and content knowledge, and they were able to make connections.

4.3 Engagement in Mathematics of Grade 9 Students

Table 3 presents the over-all engagement in Mathematics of Grade 9 students in the two groups before and after the conduct of the study. Results indicate that before the conduct of the study, the participants in the experimental group had an average engagement in Mathematics based on the mean pretest scores; while, the control group also had an average engagement in Mathematics. The standard deviations in the pretest in both groups show that the answers of the students from the experimental group were more dispersed compared with the control group. The pretest results suggest intervention and improvement in the engagement of the students. The urgent call to initiate strategies to increase each level of engagement must be made. The findings support the study conducted by Gunuc

(2014) that there is a need for more studies to investigate appropriate strategies to increase student engagement.

Table 3: Students' Over-all Engagement in Mathematics

Engagement Level	Experimental Group						Control Group					
	Pretest			Posttest			Pretest			Posttest		
	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD
Cognitive Engagement	2.43	0.60	S	2.69	0.54	U	2.45	0.49	S	2.64	0.45	U
Behavioral Engagement	2.72	0.51	U	2.89	0.44	U	2.66	0.41	U	2.78	0.28	U
Affective Engagement	2.74	0.54	U	2.85	0.48	U	2.68	0.47	U	2.80	0.37	U
Over-all Engagement	2.63	0.53	U	2.81	0.46	U	2.60	0.42	U	2.74	0.34	U

Legend: A = Always, U = Usually, S = Sometimes, N = Never

On the other hand, posttest results reveal that after the conduct of the study the engagement of both groups was still on the average level. However, the posttest mean of students' responses was higher in the experimental group as compared to the control group. The level may not move upwards but there were significant increases in both sides. It could be inferred that with the use of metacognitive strategies, there is an increase in the students' engagement in Mathematics much better than the increase made in the conventional teaching strategies.

The results substantiate the notable findings of Reyes et al. (2012) that students who are engaged obtain higher scores than those disengaged because they participate in the learning process with a connection to the teacher and the lesson. In the previous results on the academic achievement of students between the control group and experimental group, it was discovered that the students who experienced metacognitive strategies performed better that those in the conventional teaching strategies. Results in the engagement support the findings that the more engaged the students in the lessons, the better they will achieve. Furthermore, the engagement results imply that the students taught with metacognitive strategies got higher mean posttest achievement scores compared to their pretest mean scores because they are more engaged.

In order to have a more comprehensive discussion of the results that transpired in students' engagement, each item in the different levels of engagement between the two groups were taken into consideration. The impact, brought by the different metacognitive strategies and conventional teaching strategies in the different levels of engagement, were discussed.

Table 4 presents the students' cognitive engagement in Mathematics results between the experimental and control groups. Pretest responses indicate that both groups had low cognitive engagement in Mathematics before the conduct of the study. The mean responses of both groups were comparable to each other. The standard deviations tell that the experimental groups' responses were more widespread compared with that of the control group. However, the posttest results after the conduct of the study suggest that both groups reached the average engagement level based on mean students' responses; while, the

experimental group still had the greater standard deviation. There is a need to look at the different items in the cognitive level of engagement in order to have a better interpretation of the engagement in Mathematics results.

Looking at the different cognitive items, more significant improvements were contributed by the use of metacognitive strategies as compared with the use of conventional teaching strategies. The experimental group converted all low engagement items in the pretest to average engagement in the posttest. On the other hand, some items in the control group's posttest results are still on low engagement level based on the pretest data. The relevant improvements were credited to the teaching strategies implemented. Concept mapping, think aloud and journal writing strategies gave more noteworthy results than knowing, processing and transferring strategies.

Based on interviews, concept mapping activities directed the students in the experimental group to be cognitively engaged in lessons. Students needed to look for other reference books, schedule a time to read in advance for the next topic, and study at night even to sleep late just to have sufficient information to support the concept maps that they will construct in the next meeting. On the other side, the knowing activities in the control group were not able to motivate students to read in advance and even stimulate students to stay awake late at night to study because the said activities did not hit much of the deeper understanding areas.

Table 5 shows the behavioral engagement in Mathematics of the students. Pretest and posttest mean responses of the experimental and the control groups were presented. Results reveal that before the conduct of the study, both groups had average behavioral engagement. After the conduct of the study, still, the two groups are in the average behavioral engagement level. However, the use of metacognitive strategies had higher increase compared to the use of conventional teaching strategies. The standard deviations in the pretest and posttest of the experimental group are more widespread.

Before the study is conducted, some behavioral engagement items like studying at home for the test and doing Mathematics projects creatively on time fall in the low behavioral engagement level of students in the experimental group. With the aid of metacognitive strategies, posttest results show that the said item reached the average behavioral engagement level. The control group's pretest results point that raising of hands to ask questions and doing projects creatively on time were on the low behavioral engagement level. The posttest results suggest that with the use of conventional teaching strategies, the students were not inspired to raise their hands to ask questions. As observed, think aloud strategies in the experimental group influenced the students to ask questions whenever they have queries because their misconceptions bother them in the process. Think-aloud strategies allow students to say what they were thinking; thus, the queries that they are keeping are mentioned.

Table 4: Students' Cognitive Engagement in Mathematics

Items	Experimental Group						Control Group					
	Pretest			Posttest			Pretest			Posttest		
	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD
Cognitive Engagement												
1.I am looking forward to learn more in Math.	2.50	0.57	U	2.80	0.61	U	2.37	0.49	S	2.77	0.50	U
2.I am reading my Math book in advance to be ready.	2.10	0.66	S	2.53	0.63	U	2.10	0.55	S	2.47	0.57	S
3.I have time to practice solving Math problems after school.	2.40	0.77	S	2.67	0.61	U	2.43	0.68	S	2.77	0.50	U
4.I am thinking a lot in Math class	2.33	0.61	S	2.63	0.77	U	2.30	0.60	S	2.63	0.77	U
5.In my free time, I spend time to look for more information	2.43	0.82	S	2.63	0.49	U	2.57	0.77	U	2.57	0.50	U
6.Whenever I am absent in class, I am asking peers to help me with my missed lesson.	2.63	0.67	U	2.90	0.66	U	2.60	0.56	U	2.80	0.55	U
7.I recognize the value of learning in our Math class.	2.43	0.73	S	2.67	0.66	U	2.47	0.68	S	2.57	0.57	U
8. I am investing time and efforts to learn a lot in our Math lessons.	2.57	0.82	U	2.70	0.75	U	2.53	0.78	U	2.57	0.63	U
9. I am awake late at night to study our lessons in Math.	2.27	0.79	S	2.60	0.62	U	2.40	0.77	S	2.43	0.50	S
10. I am trying to learn as much as I could in our Math class.	2.63	0.67	U	2.80	0.61	U	2.70	0.65	U	2.80	0.61	U
Subtotal	2.43	0.60	S	2.69	0.54	U	2.45	0.49	S	2.64	0.45	U

Legend: A = Always, U = Usually, S = Sometimes, N = Never

Table 5: Students' Behavioral Engagement in Mathematics

Items	Experimental Group						Control Group					
	Pretest			Posttest			Pretest			Posttest		
	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD
Behavioral Engagement												
1. I am listening to the teacher's discussion during Math class.	2.97	0.62	U	3.10	0.48	U	2.83	0.65	U	2.97	0.32	U
2. I am doing the seat works given by the Math teacher in class.	3.03	0.62	U	3.20	0.55	U	2.97	0.62	U	3.13	0.51	U
3.I am standing and answering my teacher's questions when called in Math class.	2.63	0.56	U	2.77	0.63	U	2.60	0.62	U	2.63	0.49	U
4.I am raising my hands whenever I know the answers.	2.50	0.78	U	2.63	0.56	U	2.53	0.78	U	2.57	0.50	U
5.I am doing my assignments in Mathematics.	3.03	0.49	U	3.10	0.48	U	2.87	0.57	U	2.90	0.40	U
6.I raise my hands and ask questions whenever I have queries about the lesson presented in Math class.	2.57	0.63	U	2.83	0.70	U	2.43	0.57	S	2.47	0.51	S
7.I am actively participating in the different activities in our Math class.	2.63	0.77	U	2.87	0.57	U	2.53	0.68	U	2.83	0.46	U
8.I am studying at home whenever there are Math tests.	2.40	0.86	S	2.63	0.62	U	2.50	0.78	U	2.63	0.49	U
9.I am writing down notes in my Math class.	3.00	0.59	U	3.10	0.61	U	2.97	0.62	U	2.97	0.49	U
10. I am doing my Math projects creatively on time	2.47	0.73	S	2.77	0.68	U	2.40	0.68	S	2.73	0.64	U
Subtotal	2.72	0.51	U	2.89	0.44	U	2.66	0.41	U	2.78	0.28	U

Legend: A = Always, U = Usually, S = Sometimes, N = Never

Table 6: Students' Affective Engagement in Mathematics

Items	Experimental Group						Control Group					
	Pretest			Posttest			Pretest			Posttest		
	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD
Affective Engagement												
1. I like the feeling when I am solving problems in Math.	2.53	0.68	U	2.77	0.63	U	2.50	0.68	U	2.83	0.59	U
2. I am helping my classmates in solving Math problems whenever they have difficulties.	2.63	0.67	U	2.90	0.66	U	2.60	0.68	U	2.80	0.55	U
3.I am sharing my ideas and notes to my classmates in Math class.	2.60	0.56	U	2.77	0.50	U	2.57	0.50	U	2.73	0.45	U
4.I am trying my best not to be absent in Math class.	2.80	0.66	U	3.10	0.76	U	2.70	0.60	U	2.80	0.61	U
5. I am happy that my teacher in Math encourages me to be involved in class.	2.80	0.61	U	2.87	0.57	U	2.70	0.54	U	2.83	0.46	U
6.I am glad that my classmates are willing to help me in answering Math problems.	2.80	0.61	U	2.83	0.59	U	2.77	0.63	U	2.73	0.52	U
7.I like the way my Mathematics teacher delivers the lesson in class.	2.83	0.65	U	2.90	0.66	U	2.77	0.63	U	2.83	0.59	U
8. My Math teacher tries his best for me to learn.	2.90	0.66	U	2.93	0.58	U	2.77	0.68	U	2.83	0.46	U
9.I enjoyed the activities in our Math class.	2.73	0.69	U	2.80	0.55	U	2.70	0.70	U	2.80	0.48	U
10. I am not bored in our Math class.	2.73	0.64	U	2.77	0.50	U	2.73	0.64	U	2.77	0.50	U
Subtotal	2.74	0.54	U	2.85	0.48	U	2.68	0.47	U	2.80	0.37	U

Legend: A = Always, U = Usually, S = Sometimes, N = Never

Table 6 shows the affective engagement in Mathematics of the students in the experimental and control groups. Both group's pretest and posttest results were on the average affective engagement level. The experimental group's responses were more dispersed compared to that of the control group. All the affective items in both groups in pretest and posttest reached the average engagement level. Both journal writing and transferring activities had guided the students to be affectively engaged in the Mathematics lessons. The level was in the average, but, when there was continuity and sustainability in the implementation, it would soon be reaching the high affective engagement level.

4.4 Comparison of Students' Engagement in Mathematics between Groups

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Table 7 shows that there is no significant difference in the engagement in Mathematics between the experimental group and the control group. The data show that students' engagement in Mathematics obtained a p-value (sig) which was higher than the significance level of 0.05. The null hypothesis which states that there is no significant difference in the engagement in Mathematics between the groups is not rejected. There is no sufficient evidence to support the claim that there is a difference made by the two teaching strategies in students' engagement in Mathematics. Results indicate that both groups are of the same level of engagement before and after the study were conducted.

Table 7: One-way ANCOVA Comparing the Results of Students' Engagement

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected	5.725	2	2.862	42.076	0.00
Model	2.148	1	2.148	31.582	0.00
Intercept	5.629	1	5.629	82.742	0.00
Pretest	0.51	1	0.051	0.747	0.391
Engagement	3.878	57	0.068		
Error	472.936	60			
Total	9.602	59			
Corrected Total					

The findings of Li et al. (2014), Hazelwood (2015) and Cakir and Saritepeci (2015) are parallel to the present results. The said researchers compared the engagement of students in different teaching strategies and found that there is no statistical difference detected between them even though there was a meaningful rise in average engagement scores of the experimental group as compared to the control group.

3.5 Relationship between Students' Academic Achievement and Engagement

Table 8 displays the results of the correlation analysis between students' academic achievement and engagement in Mathematics. The findings, as shown on the table, reveals that there is a significant relationship between students' academic achievement and engagement in Mathematics. This is supported by the p-value which was less than the set level of significance, which led the researcher to reject the null hypothesis.

Table 8: Relationship of Academic Achievement and Engagement of Students

Engagement	Group	Academic Achievement of Students	
		r	p-value
Cognitive Engagement	Control	0.822	0.000
	Experimental	0.648	0.000
Behavioral Engagement	Control	0.809	0.000
	Experimental	0.710	0.000
Affective Engagement	Control	0.763	0.000
	Experimental	0.703	0.000
Overall Engagement		0.741	0.000

In order to have a more comprehensive test of relationship, students' achievement was tested at each level of engagement. In the cognitive engagement, the null hypothesis had to be rejected in both experimental and control groups, since the p-value is less than the set level of significance. Similar results of correlation analysis appeared in other levels of engagement, wherein the null hypotheses were to be rejected in both groups between behavioral engagement and students' achievement and also between affective engagement and students' achievement.

Based on the results of the analyses, there is a significant relationship between cognitive engagement and students' achievement. There is also a significant relationship between behavioral engagement and students' achievement. In addition, affective engagement and students' achievement has a significant relationship. The said findings are parallel to the outcomes of the investigation made by another researcher on the relationship between engagement and achievement. Gunuc (2014) found that cognitive, behavioral and emotional engagements have a strong relationship with academic achievement.

Using Daleon's Interval Correlation, students' engagement in Mathematics and achievement has a high positive correlation. All the level of engagements in both the experimental and control group are of high correlation with achievement except the cognitive engagement of the experimental group that belongs to moderate correlation. Thus, on the average, it indicates that cognitive engagement has high positive correlation with students' achievement. Behavioral engagement and affective engagement have high correlation with students' achievement. It can be inferred from the results that the higher the engagement in Mathematics of the students, the greater the academic achievement scores they would obtain. For these reasons, it is very important to find ways and means to increase students' engagement in their classes. Effective strategies have to be incorporated in the teaching and learning process so that students will be highly engaged in the lessons, and in the long run, will improve students' academic achievement.

The student engagement in the teaching and learning process is one of the most important indicators of the quality of teacher's teaching strategies (Cakir & Saritepeci 2015). The more engaged are the students, the more effective are the teaching strategies utilized in class. Low engagement of students needs to be addressed because it implies the low quality of teaching strategies. The different strategies have to be scrutinized and studied before they will be applied in the classroom because students' achievement will be affected. In addition,

the strategies have to arouse students' interest, participation, and motivation so that they will be engaged in the lessons. Students' engagement matter because it is positively associated with students' academic achievement. The more involved are the students, the better they would perform.

4. Conclusions

Metacognitive strategies can help improve the academic achievement of students in Mathematics. Concept mapping, think aloud and journal writing, when incorporated into the lessons, developed a variety of metacognitive skills that aided the students to learn better. The said strategies assist students to develop the fundamental knowledge, skills, and understanding in Mathematics and aid them in the transfer of learning. Those strategies can influence students to be engaged in Mathematics classes cognitively, behaviorally and affectively. The more engaged the students are in the lesson, the more they will use their metacognitive strategies and better academic achievement scores they will obtain.

The study is not without limitations. There are various existing strategies that are considered metacognitive. However, the present study conducted made use of concept mapping, think-aloud and journal writing. Future researchers may use other metacognitive strategies not used. The study utilized a quasi-experimental design, which is more focused in on the effectiveness of the strategies. Details on the classroom discourse on the use of think-aloud were not taken deeply, same with the concept mapping and journal writing. A qualitative and mixed methods research design may be utilized to further enrich the results the study. Similar studies on metacognitive strategies, engagement and achievement may be conducted on a larger scope, different Grade level, another subject area and on a variety of research designs.

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