The Use of Multimodal Approach in Teaching Algebra (Measurements) of Grade 7 in Camp Vicente Lim National High School S.Y. 2014-2015

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ABSTRACT

The study aimed to examine the use of multimodal approach in the understanding of Measurements by Grade 7 students of Camp Vicente Lim National High School S.Y 2014-2015. This study utilized an experimental design. Through this design, the level of performance of the grade 7 students on the subject of Mathematics are presented and analyzed. The data were statistically interpreted using experimental statistics such as mean, t-test, z-test and Pearson correlation. A total of 74 grade 7 students served as participants in this study. The researchers found out that there is no significant difference in the pre test and post test results of the two groups. Hence, the researchers recommended that Camp Vicente Lim National High School can trigger the use of multimodal approach by delivering the modalities accurately and in a way that students can understand the lesson very well.

Keywords–*multimodal, measurement, experimental design*

INTRODUCTION

If there is one valuable treasure that a person must dream of, it is education. For education is the best tool in order for an individual to attain prosperity in life, fulfilment in his existence and serenity in his well being. Education gives meaning to our life that is it can only be fulfilled when we make use and make education part and parcel of our everyday existence. The level of education defines an individual's personality and success.

Robertson (2002) stated that "Instruction ends in the school-room, but education ends only with life" Nowadays, education is one of the most important things that a person should have, no matter of social status, gender and religion that a person possesses. Educating students to become skilful users of mathematics and to appreciate its usefulness is of dominant importance for the future. In this high-tech and globally competitive society, it is becoming more and more important that all citizens be confident in their ability to do mathematics. Knowledge in mathematics is an important skill necessary to succeed in today's world. All students deserve equal access to learning math, and teachers must make the effort to ensure this. The National Council of Teachers of Mathematics (NCTM, 2000), asserts that "excellence in mathematics education requires high expectations and strong support for all students"

Moreover, the NCTM notes, "Equity requires accommodating difference to help everyone learn mathematics". The NCTM has taken a prominent stand that, as educators, we must take an equity-for-all-students approach to teaching mathematics. All students have the right to learn mathematics and feel confident in their ability to do math. Teachers must see to it that "mathematics can and will be learned by all students". Mathematics is consists of different fields with Algebra as one of those. Algebra is branch of mathematics that use instead letters for numbers. For specificity, the researchers focused on a certain topic under algebra which is measurements.

According to Sullivan (2011), a measurement is a number followed by a unit. Likewise, measurement is the procedure of identifying the relationship between two numbers. It is the method of finding the relative amount of a material that can be expressed in terms of numbers such as area, length, volume, mass, and time. As cited by Bitter, Edwards, and Hatfield (1993) in their book entitled "Mathematics Methods for Elementary and Middle School", the objectives of measurements is that students should learn the fundamental concepts of measurements through concrete experiences; they

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should be able to measure angles, capacity, distance, mass (weight), temperature, and time as well as to calculate simple areas, perimeters, and volumes; they should be able to perform measurement in both metric and customary systems using the appropriate tools and level of precision.

Today, learning mathematics should be accessible to all students. In this case, the teachers' teaching approach must be aligned to students learning style. As future mathematics teachers, the researchers aim to study the use of multimodal approach on the performance of grade 7 students in Camp Vicente Lim National High School (CVLNHS).

The result of the study may help students to better understand and retain the information in mathematics. They may be able to appreciate and enjoy mathematics learning in various ways. For Mathematics teachers, this may helps them to be creative in using the different sensory modalities. It also helps them how to manage and balance the use of every modalities so they can teach the lesson effectively. Teachers may also be able to reach out to the diversity of the students. For school administrations, this study may help to increase the students' performance average in subject of mathematics. It may help them to have students that are competitive in the mathematics area. And for future researchers, this study is also helpful as a guide on how to choose appropriate learning styles that may be applicable to all students.

Conceptual Framework

Careful planning of teaching strategies is very important in order to achieve the learning goals and come up with desired learning outcomes. More so, the teacher has to keep each student's interest, performance, readiness and needs in mind (Bacay, 2012).

The aim of the study is to compare the performance of students under Multimodal as a teaching strategy wherein the teacher uses the six sensory modalities (*Numbers, words, symbols, diagrams, stories,* and *real things*) versus the performance of students under the traditional approach. Whereas the traditional approach is a commonly used approach in teaching where the teacher gives the lesson to be learned by the students, the teacher is also the controller of the learning environment and responsible in making decisions pertaining to the curriculum guide and its particular outcomes. The multimodal approach makes use of six different modes of representation (numbers, words, symbols, diagrams, stories, and real things) of mathematical knowledge to deepen understanding and flexibility in thinking .The Multi-Modal Strategy (MMS) is an attempt to translate these modes of representation into a systematic and practical technique for teaching mathematics. This technique will stress linkages among different modes of representation, thus deepening understanding. It will also focus on a variety of experiences to make the learning of mathematics more enjoyable and challenging to the students (Yoong, 1999).

In terms of the variables that are used in this study, the independent variables include two different methods of teaching, that is, both the multimodal approach and traditional approach.

The output that was measured reflects the student performance, the said output being influenced by the implementation of either the traditional or multimodal approach. The difference between the scores of their pretest and post test served as guide if the learning had been obtained.

OBJECTIVES OF THE STUDY

This study aimed to examine the use of multimodal approach in the understanding of Measurements by Grade 7 students of Camp Vicente Lim National High School. Specifically, this study shows the results of the level of performance of the Control group and Treatment group based on their pre test and post test result, a significant difference between the pre test and post test results of the treatment group; the pre test and post test results of control group; the pre test results of the two groups; and the post test results of the two groups. The perception of the treatment group and teacher handling both groups on multimodal approach, a significant relationship between the treatment group perception on the multimodal approach and their posttest results, and implications derived from the findings of the study were also answered in the study.

REVIEW OF LITERATURE

Algebra

Mason, Graham, and Johnston-Wilder (2005) stated that Algebra is most usefully seen as a language which expresses generalities, usually with numbers. In addition, they also emphasized that learners will only understand algebra as a language of expression if they perceive and express generalities for themselves. As a branch of mathematics, Algebra uses mathematical statements to describe relationships between things that vary over time. These variables include ideas such as the relationship between supply of an object and its price. When using a mathematical statement to describe a relationship, letters are often used to represent the

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quantity that varies, since it is not a fixed amount. These letters and symbols are referred to as variables.

Additionally, Algebra is the area of mathematics that uses letters and symbols to represent numbers, points and other objects, as well as the relationships between them. Such values, therefore, enables a simplification of general statements and facilitates a wide range of problems to be solved efficiently. Moreover, it even allows some problems yet to be solved to be determined. One of the topics in Algebra specifically for the 7^{th} grade is Measurements which deals with the measure of objects, things and et cetera. This can be taught using different modalities.

Measurements

Measurement is defined as the length, width, thickness, depth, magnitude and degree of something in terms of a selected unit. In ancient times, people used parts of their body or objects such as seeds, stones, and shells as measuring devices. Some of the units used during that time were cubit, span, palm, digit, inch, foot, fathom and pace. Eventually, two systems of measurement became prevalent, namely, the English system and the metric system. The English system uses the inch, foot, and yard in measuring lengths while the metric system uses basic units based on decimal relationships. On the other hand, more specific tools are used to measure quantities and these include estimation, perimeter, circumference, area and volume (Acelajado, Abalajon, Molano-Cachero, Parungao, Ramos-de Armas, & De Guzman, 2003).

Multimodal Approach/ Multimodal Learning

It is not new to everyone that not all learners are the same. Each student in a classroom has a unique and complex system of thinking and learning. Effective teachers want to know better ways to reach their students because they have come to realize that cookie-cutter education usually spells disaster for many learners. Thus, a more effective plan of action must be considered so as to help students in their learning.

The multi-modal approach makes use of six different modes of representation (numbers, words, symbols, diagrams, stories, and real things) of mathematical knowledge to deepen understanding and flexibility in thinking. The Multi-Modal Strategy (MMS) is an attempt to translate these modes of representation into a systematic technique for teaching mathematics. It focuses on a variety of experiences to make the learning of mathematics more enjoyable and challenging to the students. The book, "A Multimodal Approach to Classroom Discourse", stated that the approach is demonstrated through the analysis of discourse in mathematics classrooms. It includes a description of the activity sequences together with the use of verbal and non verbal language, mathematical symbolism and visual images in the classroom. It is notable as well that the multimodal approach to pedagogy developed in this book is applicable to other curriculum areas (O'Halloran, 2011).

Alternatively, the focus of Casler-Failing (2011) in his paper was to research and report on multimodal and hands-on strategies currently being implemented in mathematics classrooms. The said paper proposed to gain further insight into multimodal and or hands-on strategies that promote enhanced student understanding in mathematics, with a primary focus on strategies that promote mathematical understanding. Mathematics has long been a concierge for students: if they perform well, they are met with much success and if they do not, they are limited in their future career opportunities (Moses and Cobb, 2001; Stone, 1998).

Multimodal teaching is a style in which students learn material through a number of different sensory modalities. For example, a teacher will create a lesson in which students learn through auditory and visual methods, or visual and tactile methods. Teachers can use any combination of learning modalities; however in multimodal teaching, a teacher must utilize more than one. This teaching style implements many strategies to ensure students understand and retain information. Correlatively, multi-modal learning as according to Lazear (2011) means that more information may be learned in different ways.

Multimodal approach may also be integrated with educational technology. For instance, Texas Instruments created a program titled *TI Math Forward*, a program for pre-algebra and algebra, which provides teachers with professional development opportunities, TI-Nspire technology for classrooms, and educational support for students (Fincher, 2012). The TI Math Forward program is based upon eight research-based components: (1) motivating technology, (2) teacher coaching and professional development, (3) enhanced content knowledge by teachers, (4) integrated curriculum, (5) aligned assessments, (6) additional instructional time, (7) common planning times for teachers, and (8) administrative and parental support.

Related Studies

In a study of Sankey, Birch and Gardiner (2010), the use of multimedia in conjunction with hypermedia have been successfully applied to many e-learning environments in order to both enhance these

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environments and to cater for a wider variety of student learning styles. Students may feel more comfortable and, eventually, perform better when learning in environments that cater for their predominant learning style. It has also been seen that presenting material in a variety of modes may also encourage students to develop a more flexible approach to their learning as recent findings in the field of cognitive science suggest that multiple intelligences and mental abilities do not exist as yes-no entities but within a continua which the mind blends into the manner in which it responds to and learns from the external environment and instructional stimuli. This suggests a framework for a multimodal instructional design that relies on a variety of pedagogical techniques, deliveries, and media (Picciano, 2009).

In addition, multimodal learning environments allow instructional elements to be presented in more than one sensory mode (visual, aural, written). In turn, materials that are presented in a variety of presentation modes may lead learners to distinguish that it is easier to learn and improve attention, thus leading to improved learning performance in lower-achieving students (Chen & Fu, 2003; Moreno & Mayer, 2007; Zywno 2003).This Mayer (2003) also upholds that students learn more deeply from a combination of words and pictures than from words alone.

Fadel (2008) found that, students engaged in learning that incorporates multimodal designs, on average, outperform students who learn using traditional approaches with single modes. Fundamental to the design of these learning environments are the principles of multimodal design, in which information is presented in multiple modes such as visual and auditory (Chen & Fu, 2003). Picciano (2009) also a similar major benefit, that it allows students to experience learning in ways in which they are most comfortable, while challenging them to experience and learn in other ways as well.

Additionally from the study of Sankey (2010) alone indicates the innovative use of educational technologies provides higher education institutions valuable opportunities for their staff to design media enhanced, interactive, more inclusive and engaging learning environments. The key motivation for incorporating educational technologies into the curricula is unquestionably the desire to improve the engagement and learning of students.

One of the focuses in the literature review of Casler-Failing was the hands-on strategy, one of the indicators utilizing physical manipulative. It is connected with the multimodal strategy since outlined in the Casler-Failing research in which hands-on strategy can be combined with multimodal strategy when used in teaching. Özgün-Koca and Edwards (2011) completed a research study to determine whether the integration of physical and virtual manipulatives enhanced mathematical understanding for sixty 8th grade algebra students in a Midwestern US school. This study was conducted under the assumption that students create mental schemas from the use of the physical manipulative that carry over to the virtual manipulative, which ultimately strengthens their understanding of the concept.

METHODS

The researchers used experimental method since they used two groups. The first group is identified as the treatment group whose participants are under the experimental process. On the other hand the second group is the control group in which the experiments are not administered to the participants of the group. In this study the treatment group used the multimodal approach of teaching and the control group used the traditional approach of teaching.

The researchers used pre-test, post-test, and survey questionnaire. Implementing a pre-test and a post-test is to analyze and identify the level of performance of the participants while the survey questionnaire is to know the perception of the participants learning Algebra. The data gathered served as basis. After the treatment, the post-test was given to both control group and experimental group using the same instrument used to both group during the pre-test. The post-test result serves as the end point of the data.

The participants of the study were Grade 7 students from two sections of Algebra classes at Camp Vicente Lim National High School (A.Y. 2014-2015). The teaching strategy that the researchers used is multimodal approach. The researchers chose two sections, one was the control variable and the other was the experimental variable. The two sections chosen because they were discussing the same lesson, so that, students factor, context and teacher factor were avoided.

Table 1. Population and sample of the study

Methods	**N**	**n**
Multimodal Approach in Treatment group	38	38
Traditional approach in Control group	44	36
Total	82	74

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Table 1 shows the population and sample size of the participants. The researchers were able to get all 38 participants taught under the multimodal approach for they had a grade of 75 and above in Mathematics. Same with the 36 participants out of 44 students taught under the traditional approach.

The researchers constructed a test instrument. The test was 30-item multiple choice type of test in Algebra, specifically Measurements. It includes only the topic such as volume, capacity, surface area, time, and temperature that the participants have learned during the seven (7) days of their Algebra class. The test covered topic in Algebra which include measurement.

The test was validated by two (2) Math professors and one (1) Math high school teacher. The researchers gave the exam to ten (10) grade 7 students of Camp Vicente Lim National High School who are not participants of the study but are in the same grade level of the target participants of the researchers.

Data Analysis

Frequency and percent distributions were used in presenting the academic performances of the students in Algebra. In comparing the performance in pre-test and post-test of the students who were exposed in the multimodal approach and the students who were exposed in the traditional method, the paired t-test was used. In comparing the pretest and post-test performances in pretest and post-test of the students who were exposed in multimodal approach and the students who were exposed in the traditional method, the independent z-test was used.

4. The correlation between the perception of students taught in modern teaching method and their level of performance in Algebra in the post-test was established using Pearson r correlation. To give interpretation to computed Pearson r correlation, the following guide was adopted.

To determine the level of performance of the participants, the grading system below was used:

74% and below – Beginning
75% -79% – Developing
80% -84% – Approaching Proficiency
85% -89% Proficient
90% and above – Advanced

To determine the level of perception of the participants, the grading system below was used: 4.21-5.00: Strongly Agree (SA); 3.41-4.20: Agree (A); 2.61-3.40: Moderately Agree (MA); 1.81-2.60: Disagree (D); 1.00-1.80: Strongly Disagree (SD).

III. RESULTS AND DISCUSSION

Table 2. The level of performance of the participants in multimodal approach and traditional approach during the pretest and posttest in Algebra (Measurements)

Level of Proficiency	Control Group Traditional Approach				Treatment Group Multimodal approach			
	Pretest		Post test		Pretest		Post test	
	(f)	(%)	(f)	(%)	(f)	(%)	(f)	(%)
Advanced	0	0	2	6	0	0	1	3
Proficient	1	3	1	3	12	31.5	15	39.5
Approaching Proficiency	10	28	13	36	14	37	15	39.5
Developing	21	58	17	47	12	31.5	7	18
Beginning	4	11	3	8	0	0	0	0
Total	36	100	36	100	38	100	38	100
Average	78%		79%		82%		83%	
Interpretation	**Developing**		**Developing**		**Approaching Proficiency**		**Approaching Proficiency**	

Table 2 presents the results of the pretest and post test of the participants of the two groups. The pretest result of the traditional approach, 4 participants (11% of the total participants) got a percentage of 74 and below and interpreted as *Beginning. 2*1 participants (58% of the total participants) got a percentage within the range of 75-79 and interpreted as *Developing.* 10 participants (28% of the total participants) got a percentage within the range of 80-84 and interpreted as *Approaching Proficiency.* Lastly, 1 participant (3% of the total population) got a percentage within the range of 85-89 and interpreted as *Proficient.* In terms of their posttest, 3 participants (8% of the total participants) got a percentage of 74 and below and interpreted as *Beginning.* 17 participants (47% of the total participants) got a percentage of 75-79 and interpreted

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as *Developing*. 13 participants (36% of the total participants) got a percentage of 80-84 and interpreted as *Approaching Proficiency*. 1 participant (3% of the total participants) got a percentage of 85-89 and interpreted as *Proficient*. Finally, 2 participants (6% of the total participants) got a percentage of 90 and above and interpreted as *Advanced*.

The performance of the participants under the multimodal approach in the pretest, 12 participants (31.5% of the total participants), got a percentage within the range of 75-79 and interpreted as *Developing*. 14 participants (37% of the total participants), got a percentage within the range of 80-84 and interpreted as *Approaching Proficiency*. Lastly, 12 participants (31.5% of the total participants), got a percentage within the range of 85-89 and interpreted as *Proficient*. While their posttest result shows that 7 participants (18% of the total participants) got a percentage of 75-79 and interpreted as *Developing*. 15 participants (39.5% of the total participants) got a percentage of 80-84 and interpreted as *Approaching Proficiency*. 15 participants (39.5% of the total participants) got a percentage of 85-89 and interpreted as *Proficient*. Finally, 1 participant (3% of the total participants) got a percentage of 90 and above and interpreted as *Advanced*.

As can be seen in table above, the highest performance attained by the participants of the traditional approach in their pretest is *Proficient* and *Approaching Proficiency* in their post test.They had an average grade of 78% in pretest and 79% in the post test and both average grades are interpreted as *Developing*. On the other hand, the participants of the multimodal approach attained their highest performance on the pretest and post test is *Proficient*. They had an average grade of 82% in pretest while 83% as the average grade during the post test and both average grades are interpreted as *Approaching Proficiency*.

Table 3. Test of significant difference of multimodal approach and traditional approach

Strategy	t-critical	t-value	Interpretation	Decision
Traditional approach	±2.030	-1.252	Not Significant	Accepted
Multimodal approach	±2.026	-1.257	Not Significant	Accepted

two-tailed test

The table above uses 5 percent error and degree of freedom of 35 for the traditional approach and 37 for the multimodal approach. As shown in the Table 3, the comparative analysis in the participants under the traditional approach results to computed t-value of -1.252 and participants under the multimodal approach results to a computed t-value of -1.257. It shows that both results were less than the t-critical value of 2.030 for the control group and 2.026 for the treatment group it leads to a decision of accepting the null hypothesis. It was concluded that there is no significant difference in the pretest and posttest result of the two groups. The reason why there is no significant difference is because the pretest and posttest of the two groups are increased and their increased average was closely attached with each other.

Table 4. Comparison between the pretest of multimodal approach and traditional approach

Critical Value	z-value	Interpretation	Decision Ho
± 1.96	4.667	Significant	Reject

α = 0.05 two-tailed test

As shown in the Table 4, the comparative analysis in the pretest of the two groups results to a computed z-value of 4.667 in absolute value which is greater than the z-critical value of ± 1.96. It was concluded that there was a significant difference in the pretest of the two groups. There is a significant difference because the students of the treatment group are more serious and interested with the topics which are not tackled already. Unlike in the control group, they are lazy to solve mathematical equations in the reason that the topics that are in the pretest are not yet discussed.

Table 5. Comparison between the posttest of the two groups

Critical Value	z-value	Interpretation	Decision Ho
± 1.96	4.238	Significant	Reject

α = 0.05 two-tailed test

As shown in the Table 6, the comparative analysis in the posttest of the two groups results to a computed z-value of 4.238 in absolute value which is greater than the z-critical value of ± 1.96. It was concluded that there was a significant difference in the posttest results of the participants. There was a significant difference because the participants in the treatment group had a better performance than the participants in the control group based on the results of their posttest. In an observation, participants of the treatment group are

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active in terms of discussion and activities so they gain much knowledge.

Table 6 above presents the perception of the treatment group toward multimodal approach. The group that underwent the multimodal approach had an *Agree* interpretation in number 5, indicating "It helps me to apply in real life situation the entire topic I had learned." This has an average of 4.11. Moreover, the participants strongly agree that the multimodal approach helps them to improve their performance (4.45).

Table 6. The perception of the participants about the multimodal approach

Multimodal Approach	WM	VI
1. It helps me improve my performance.	4.45	SA
2. It encourages me to develop discipline.	4.29	SA
3. It enhances my critical thinking skills.	4.29	SA
4. It makes the activity meaningful.	4.21	SA
5. It helps me to apply in real life situation the entire topic I had learned.	4.11	A
6. It enhances my creative skills.	4.21	SA
7. It increases my interest in Mathematics.	4.32	SA
8. It helps me to retain more information.	4.34	SA
9. It keeps me focused on my lesson.	4.34	SA
10. It increases my scores.	4.24	SA
Overall	**4.28**	**SA**

Most of the participants have the same opinion, they are strongly agree that the approach applied helps them to retain more information and keep them focused on the lesson (4.34). Likewise, the participants strongly agree that multimodal approach encourages them to develop discipline, enhances their critical thinking skills (4.29), makes the activity meaningful and enhances their creative skills (4.21). Similarly, the approach increases their interest in mathematics (4.32) and increases their scores (4.24).

Altogether the participants were presumed to have an affirmative perception regarding multimodal approach. The participants exposed to multimodal approach have a *Strongly Agree* perception with an average of 4.09 in the use of the approach in teaching Algebra especially in the topic of Measurement.

As shown in the Table 7, the correlation analysis in the perception of the treatment group and the result of their posttest results to a computed r-value of -0.251 which is less than the r-critical value of 0.3044. It was concluded that there was no significant relationship in the perception of the participants of treatment group and their posttest result.

Table 7. Relationship between the perception of participants of treatment group on multimodal approach and the result of their posttest

r-value	Interpretation	Conclusion	Decision
-0.251	Negatively Low Correlation	Not Significant	Accept

Tabular Value = 0.3044

The reason was participants are active in the discussion but some of them are not focused. They did like the activities but in the posttest, they are not serious solving the equations that leads to few increased scores.

The perception of the teacher handling both groups on multimodal approach

The teacher *Agreed* that the multimodal approach helps him to improve his teaching performance, helps him to develop discipline, enhance his creative skills and increases his students' scores. The teacher *Strongly Agreed* that the multimodal approach helps him to develop critical thinking, make the activity meaningful, helps him to apply in real life situation all the topic he had learned, increase his interest in Mathematics, helps him to retain more information and keeps him to focused in lesson.

CONCLUSION AND RECOMMENDATION

The execution of multimodal approach did help the participants to improve their level of performance in Algebra even though there is some factors such as emergency substituting teacher and attitude of the students towards the teacher. The level of performance of the participants who were exposed in multimodal approach is a bit higher compared to the level of performance of the participants in traditional method even though both scores improve in the post test. The multimodal approach can help to increase the creativity of teaching and learning.

It is recommended that the students are more active when the teacher can supplement the different modalities (numbers, diagrams, story, symbols, real thing, and word). There are some factors such as the way of teaching, environment, and the students themselves that may affect students' performance. This

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may be avoided by establishing a good teacher-student interaction that helps students to be focus. The teachers should let their students engage in the learning process in different ways such as letting them to experience and relate the topics in the real life situations. For the future researchers, they can generate the use of multimodal approach and they can integrate this approach to multimodal learners. Also, they can integrate the modalities in their proposed approach using multiple intelligences of the students.

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