IMPACT OF WHOLE BRAIN TEACHING BASED INSTRUCTION ON ACADEMIC PERFORMANCE OF GRADE 8 STUDENTS IN ALGEBRA: COMPENDIUM OF WBT-BASED LESSON PLANS

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Abstract

Improving students' academic performance requires the teacher's knowledge on different classroom instructions based upon how the brain gathers and stores knowledge. One classroom instruction that engages different parts of the brain in an active instructional setting is a method known as Whole brain teaching. This study was conducted to determine the impact of Whole brain teaching or WBT on academic performance of grade 8 students in Algebra. Quasi-experimental research method, specifically, pretest-posttest with control group using matched-subject design was employed in the study. Two heterogeneous classes were randomly selected and assigned as experimental and control groups. Pretest and posttest were used in measuring the academic performance of the students. The experimental group received instructions using WBT techniques whereas the control group underwent the same pacing and content using conventional teaching techniques. Based on the data gathered, the students' academic performance increased significantly after subjecting them to WBT techniques and conventional teaching techniques. However, results of the posttest comparison of both groups showed that there was a statistically significant difference between the academic performance of

experimental and control groups in favor of the experimental group. Thus, Whole brain teaching has a positive impact on academic performance of grade 8 students in Algebra.

Keywords

Academic Performance, Algebra, Brain Based Learning, Mathematics, Whole Brain Teaching

1. Introduction

The importance of mathematics is universally valued as many aspiring careers require a solid foundation in this subject. However, Filipino students have low achievements in this subject as reflected in national and international exams like National Achievement Test or NAT (Fernandez, 2013) and Trends in International Math and Science Study or TIMSS (Alpacion, Camañan, Gregorio, Panlaan, & Tudy, 2014). This has become a cause of great concern of the educational sector in the Philippines. According to Magno (2011), one contributory factor in Filipino students' low academic performance is the limited specification on how instruction is delivered and the strategies used in the teaching and learning process. In secondary level, English is the only subject that specified the teaching strategies and the type of instruction to be used. This has seen as necessary in other fields especially in mathematics due to the complexity of skills that needs to be learned. Likewise, Algebra, as a math discipline, is considered as one of the most abstract (Egodawatte, 2011). Due to its complexity and abstract nature, Algebra has the most number of least-mastered contents among the three learning areas in K to 12 grade 8 mathematics curriculum (Capate & Lapinid, 2015). Thus, it stirred the mind of educators and researchers to explore on appropriate classroom instructions and strategies that can inhibit the difficulties encountered by students in Mathematics, especially in Algebra.

Recommendations from brain research might be one means of promoting higher levels of learning and greater academic achievement (Darling-Hammond, 2007, as cited in Richardson, 2011). This research needs to be translated into brain-based learning strategies that can be used by educators. Brain-based learning is the engagement of strategies based on principles derived from information on how brain learns best to promote meaningful learning (Hakim, Cahya, Nurlaelah, & Lestari, 2015). These strategies can be used to elevate teachers' instruction and increase students' capacity to learn using ways in which they feel most comfortable.

One strategy that was established according to the principles of Brain based learning is Whole brain teaching or WBT. It is formerly known as Power Teaching introduced by Chris Biffle in 1999. Classroom problems such as student misbehavior and disengagement with the lesson brought about by lecture method led to the development of Whole brain teaching as a

method which promotes activities that engage different parts of the brain. It is a classroom instruction and strategy that uses a variety of techniques which incorporates gestures and sounds to stimulate the learner to think and learn.

Whole brain teaching is composed of seven core teaching techniques known as the Big Seven. These are Class-Yes, Five Classroom Rules, Teach- Okay, Switch, Scoreboard, Hands and Eyes, and Mirror. Advocates of WBT believed that the use of these techniques in the classroom improves students' engagement, motivation, behavior and academic achievement (Biffle, 2013).

1.1 Theoretical/ Conceptual Framework

A theory that supports the principles of Brain based learning is Whole Brain Theory by William Ned Hermann (Inocian, 2015). He created a whole-brain model which is metaphorically illustrated using a circle divided into four quadrants to classify the learners according to their preferences for thinking and learning in the four quadrants.
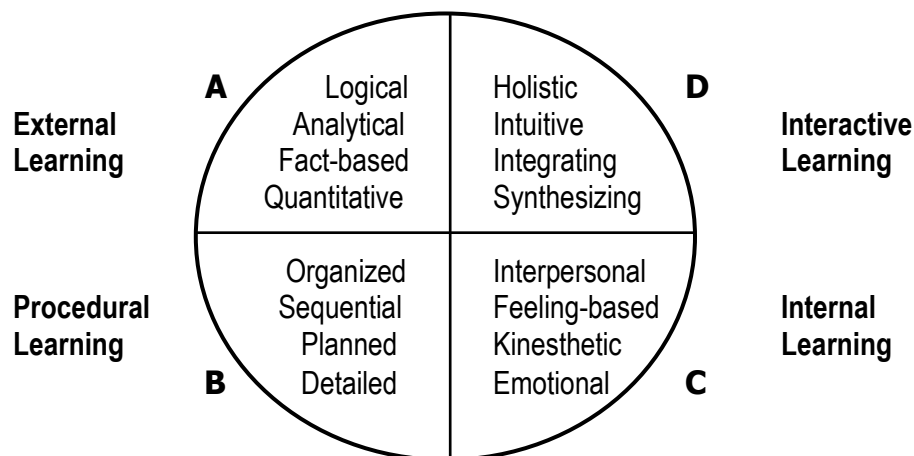

Figure 1: *Hermann's Whole-Brain Model*

According to Hermann, if a person develops a very strong preference for learning in one or two quadrants, he may reject learning on the other quadrants. Thus, his theory stresses the importance of utilizing the strengths and attending to essential weaknesses in all learners by providing equal learning opportunities for different learners, where each of the four learning styles (A, B, C, and D) were fulfilled in a single lesson (Bawaneh, Md Zain, & Saleh, 2011). It can be attained by using various methods, alternating with techniques and activities to address each of the four quadrants (Herrmann-Nehdi, 2002). It encourages whole-brain development as learning complex tasks involve a widely distributed network of brain areas (Worden, Hinton, & Fischer, 2011). Whole brain teaching is anchored on this theory as it supports the idea that

learner learns best when his whole brain is involved. Using a whole-brain approach to teaching and learning helps to reach and engage diverse learners, improve their retention and deliver memorable learning experiences (Herrmann-Nehdi, 2009).

Enlightened by Hermann's Whole brain theory, the researcher conceptualized a paradigm patterned after the Input- Process- Output model to illustrate the relationships of the variables and the research process of the study.
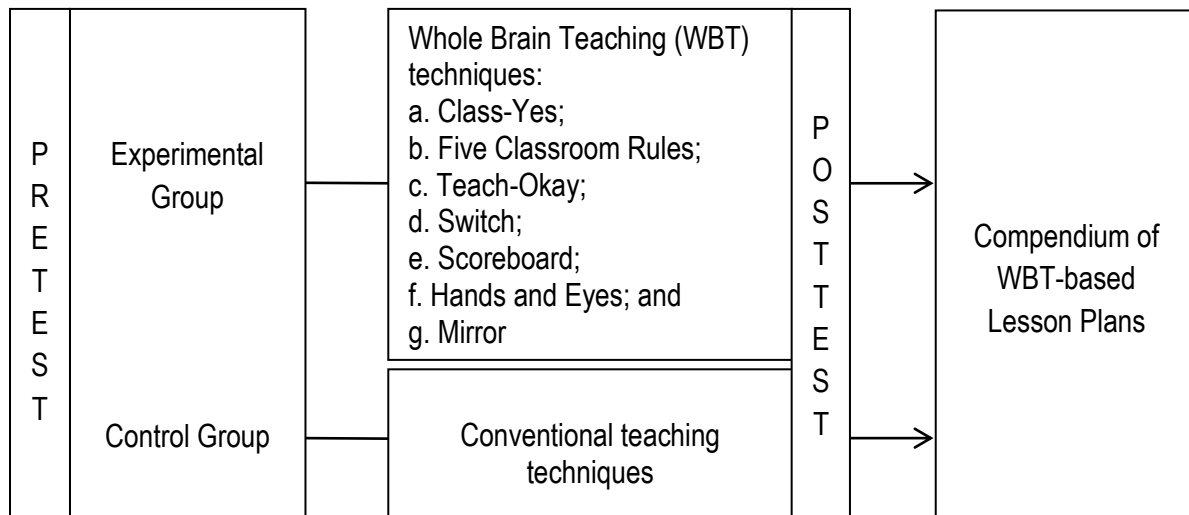

Figure 2: *Paradigm of the Study*

As presented in Figure 2, the input variables include the pretest and the respondents (experimental and control groups) of the study. The pretest was used to assess the performance of the students by comparing it with the posttest. The experimental and control groups were comprised of heterogeneous students to test the impact of WBT techniques to diverse learners. The process employed the kinds of instructions used for the experimental group which are WBT techniques and the control group which are conventional teaching techniques. After which, a posttest was administered to measure the academic performance of the students as a result of the kind of instructions used. The output variable is the compendium of WBT-based lesson plans which can be used by novice teachers in whole brain teaching techniques for teaching selected topics in grade 8 Algebra.

1.2 Statement of the Problem

This study aimed to determine the impact of Whole brain teaching on academic performance of grade 8 students in Algebra at General Emilio Aguinaldo National High School from June 13 to August 1 of school year 2017 - 2018.

Specifically, the study sought to answer the following questions:

1.2.1 What is the academic performance in Algebra as reflected in the pretest and posttest mean scores of the students taught using:

- Whole brain teaching techniques; and
- Conventional teaching techniques?

1.2.2 Is there any significant difference between the academic performance in grade 8 Algebra as indicated by pretest and posttest mean scores of the students taught using:

- Whole brain teaching techniques; and
- Conventional teaching techniques?

1.2.3 What is the impact of WBT-based instruction in Grade 8 Algebra?

1.3 Hypothesis

There is no significant difference between the academic performance in grade 8 Algebra as indicated by pretest and posttest mean scores of the students taught using Whole brain teaching and conventional teaching techniques.

1.4 Review of Related Literature

The quality and effectiveness of classroom instruction are imperative to lessen problems associated to teaching and learning mathematics (Dursun & Dede, 2004 as cited in Andaya, 2014). Thus, it is the role of the teacher to look for a classroom instruction that would address this need.

Brain based learning is a new pedagogy that maximizes students' brain capacity for emotional, social, cognitive, physical and reflective learning (Sesmiarni, 2015). Teachers should use brain-based instructional activities that are proven to increase students' capacity to gather and store knowledge (Sanchez, 2017) and increase students' academic performance (Sousa, 2008; Adebayo, 2005; Lucas, 2004; Lackney, 2003, cited in Awolola, 2011).

Studies by Awolola (2011), Rehman, Malik, Shafqat, Zafar, & Muhammad (2012) and Elsayed (2015) proved that Brain based learning and teaching method enhanced students' achievement in mathematics more than the conventional teaching method. In terms of enhancing the mathematical communication and mental arithmetic, the study of Khattab (2013), as cited in Al-Tarawneh (2016), showed no statistically significant difference between the students taught via brain based learning with that of the students taught via conventional way of teaching.

One Brain based learning pedagogy is Whole brain teaching which is believed to be effective in the teaching and learning process in terms of capturing students' interest, sustaining

their attention, improving their behavior, and increasing their engagement and motivation. It was supported by the study of Armijo (2009), as cited in Lockhart (2016). Research proves that these factors have direct correlation with student achievement which may be an indicative that WBT has a positive effect on student achievement.

Several researches proved that academic self-concept is directly related to academic performance in mathematics (Ghazvini, 2011). As to the effect of WBT in students' self-concept, no evidence was found that it affects students' overall academic self-concept (Clark, 2016).

In terms of determining the effects of WBT techniques to the academic performance of students in mathematics, a positive effect was found in the study of Armijo (2009), cited in Lockhart (2016) which was done by analyzing the Academic Performance index of the school before and after the implementation of WBT. On the other hand, a negative effect was found on the study of Lockhart (2009), cited in Lockhart (2016) which was done by analyzing the students' grades before and after the use of WBT. This indicates that further studies must be conducted. Moreover, the designs of their researches were not experimental. In the Philippines, Torio & Cabrillas-Torio (2015) revealed a 20% learning gain to the academic performance of Physics students which can be derived from the use of WBT. The study made use of Quasi-experimental design but was done in the field of Science.

The fact that there are only a number of recorded studies on Whole brain teaching implies that this teaching pedagogy has not yet captured much attention. With these the researcher sees the solution with the utilization of WBT techniques as revealed by various studies.

2. Methodology

2.1 Research Design

The quasi-experimental research design which compares two treatment groups (White & Sabarwal, 2014) was utilized in this study. Specifically, pretest-posttest design with a control group. This design was preferred because the experimental and control groups were naturally assembled groups as intact classes. Matched-subject design was employed to increase the probability that the two groups are equivalent. Thirty (30) pairs of individuals in each group were selected as respondents who were mechanically matched using their general weighted average in mathematics 7. After the matching was completed, the choice of which group will be the control and which will be the experimental was done randomly.

2.2 Setting, Population, Sampling, and Respondents of the Study

This study took place at General Emilio Aguinaldo National High School where the researcher is currently teaching. It is located at LTO Compound Palico IV, Imus City in Cavite Philippines and was founded on 1996. The school has the largest students' population among the five DepEd managed urban junior high schools in Imus City, with eight thousand eight hundred thirty (8,830) grade 7 to 10 and special education students. The school's National Achievement Test (NAT) results in Mathematics showed 30.74% in SY 2011-2012, 31.45% in SY 2012-2013, 34.56% in SY 2013-2014 and 29.77% on SY 2014-2015. The percentage scores are far behind the set goal of the Department of Education which is 75%.

The population of the study was consisted of grade 8 students of the said school with a total of two thousand two hundred forty-three (2,243) students from thirty-eight (38) sections. The researcher handles four (4) heterogeneous classes. Out of these four (4) classes, two (2) classes were randomly selected using the fishbowl method as well as in determining which will represent the control group and the experimental group. The respondents were sections 8-A and 8-B. Section 8-A has sixty-four (64) students while section 8-B has sixty-two (62) students. However, to increase the probability that the two classes are of equivalent performance prior to the conduct of the study, only thirty (30) students in each class were selected through matched-pairing using their general weighted average in the previous grade level. Each respondent in the control group has a corresponding respondent in the experimental group with the same general weighted average in mathematics 7. Students who were part of the study were treated equally as the other students who were not included in the study.

2.3 Research Instrument

Pretest and posttest were used in measuring the academic performance of the students. First, the researcher constructed a Table of Specifications and a 60-item multiple choice type of test. The test is about Algebra which covers the topics Factors of Polynomials and Rational Algebraic Expressions. Experts' opinions were sought for the validity of the test. Then, it was administered to one section of Grade 9 with fifty (50) students who had their Mathematics 8 in the previous year for pilot testing. The test was subjected to item analysis to determine the 40 items that will be considered in the final draft. Kuder-Richardson's formula 20 was used to determine the internal consistency and a reliability coefficient of 0.82 was obtained. The same tool was administered as pretest at the start and posttest at the end of the treatment but the items were disarranged to avoid the effect of practice.

The researcher also developed two sets of detailed lesson plans, one for the experimental group with integration of WBT techniques and one for the control group using Conventional teaching techniques. The developed detailed lesson plans were showed to experts for face and content validation in terms of the following criteria: (a) Curriculum standard; (b) Content; (c) Organization, language and style; and (d) Instructional strategies and learning environment. The overall rating of the validators for the detailed lesson plans is 4.41 or Strongly Acceptable.

2.4 Data-Gathering Procedure

The researcher asked permission from the Division Superintendent and the principal of the school through a letter of request. The permission of parents and student-participants were sought through letters of consent and assent. Then, pretest was administered to both control and experimental groups. After which, they underwent their respective treatments.

The experimental group was taught using the seven core teaching techniques of Whole brain teaching pedagogy. All these seven techniques were used on the entire duration of the study. The Class-Yes was introduced on the first day. It serves as the main attention-getter and the most used WBT technique. The Five Classroom Rules was also introduced on the first day and rehearsed in the class over and over again with corresponding gestures. It revolves on five specific rules that are critical on the effective development and implementation of WBT classroom management. The Teach-Okay and Switch were introduced on second day and were used to maximize learning. In these techniques, the students were paired and swap roles in teaching each other what they just learned from the teacher using energetic gestures. The Scoreboard was introduced on the third day and used as a motivation tool where the teacher tallies the positive and negative attitude manifested by the class. At the end of the lesson, the students receive a reward if there are more positive points than negative or a punishment if it is the other way around. Another technique is the Hands and Eyes which was introduced on the fourth day. It was used at any point during the lesson when the teacher wanted the students to pay full attention to the lesson. The last technique is Mirror which was introduced on the fifth day. It was used when the teacher wanted to teach a concept through words and gestures and the students mimic the words and actions of the teacher.

The control group, on the other hand, was taught using conventional teaching techniques. Conventional teaching, also known as traditional teaching, is a teacher-centered instruction (Abida & Muhammad, 2012; cited by Lee & Sulayman, 2018) where the students passively receive the information from the teacher (Liu, 2014; cited by Lee & Sulayman, 2018). In this

study, conventional teaching refers to classroom instruction used by the teacher without the implementation of WBT techniques. The students in the control group underwent the same pacing and lesson content as the students in the experimental group but did not experience the use of WBT techniques.

After all the topics have been discussed, posttest with the same questions as the pretest was administered.

2.5 Statistical Treatment of Data

The data gathered was subjected to statistical analysis using mean, standard deviation, t-test for dependent means, and t-test for independent means. Level of significance was set at 0.05 alpha which is a liberal estimate for educational researches. Mean reflects the academic performance of the two groups. To describe the academic performances of the students, the pretest and posttest scores were interpreted based on Deped Order No. 8, s. 2015 (Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program). First, the score was converted to percentage score by dividing the score by the highest possible score then the quotient was multiplied by 100%. Second, the percentage score was transmuted to grade using a transmutation table. Lastly, the grade was described as follows:

Table 1: *Grading Scale and its Equivalent Description*

Grading Scale	Description
90-100	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

3. Results and Discussion

3.1 Results on the academic performance in Algebra as reflected in the pretest and posttest mean scores of the students taught using:

- Whole brain teaching techniques; and

- Conventional teaching techniques.

Table 2: *Pretest and Posttest Scores of Experimental Group*

Score	Pretest	Posttest	Description
34 – 40	0	4	Outstanding
31 – 33	0	2	Very Satisfactory
28 – 30	0	7	Satisfactory

24 – 27	0	9	Fairly Satisfactory
0 – 23	30	8	Did Not Meet Expectations
Mean	**14.77**	**27.53**	

The data indicates that the pretest scores of all the 30 respondents from the experimental group range from 0 to 23 which can be described as Did Not Meet Expectations. The pretest mean score which is 14.77 can also be described as Did Not Meet Expectations. This can be due to the fact that the learning competencies are new to them and were not covered in mathematics 7. But after subjecting them to Whole brain teaching techniques, the posttest scores show that there were 4 respondents with scores of 34 to 40 which can be described as Outstanding; 2 respondents with scores of 31 to 33 which can be describes as Very Satisfactory; 7 respondents with scores of 28 to 30 which can be described as Satisfactory; 9 respondents with scores of 24 to 27 which can be described as Fairly Satisfactory; and 8 respondents with scores of 0 to 23 which can be described as Did Not Meet Expectations. The mean posttest score of the experimental group which is 27.53 can be described as Satisfactory.

Table 3: *Pretest and Posttest Scores of Control Group*

Score	Pretest	Posttest	Description
34 – 40	0	1	Outstanding
31 – 33	0	1	Very Satisfactory
28 – 30	0	5	Satisfactory
24 – 27	0	10	Fairly Satisfactory
0 – 23	30	13	Did Not Meet Expectations
Mean	**14.90**	**24.27**	

It can be gleaned from the table that the pretest scores of all the 30 respondents from the control group range from 0 to 23 which can be described as Did Not Meet Expectations. The pretest mean score which is 14.90 can also be described as Did Not Meet Expectations. But after subjecting them to conventional teaching techniques, the posttest scores show that there was 1 respondent with a score of 34 to 40 which can be described as Outstanding; 1 respondent with a score of 31 to 33 which can be described as Very Satisfactory; 5 respondents with scores of 28 to 30 which can be describes as Satisfactory; 10 respondents with scores of 24 to 27 which can be described as Fairly Satisfactory; and 13 respondents with scores of 0 to 23 which can be described as Did Not Meet Expectations. The mean posttest score of the control group which is 24.29 can be described as Fairly Satisfactory.

It was evident that the scores of the students in both groups increased after subjecting them to Whole brain teaching techniques and conventional teaching techniques but the increase is higher in the experimental group which can be derived from the use of WBT techniques. This can be attributed to the study of Armijo (2009), as cited in Lockhart (2016), that there is a positive correlation between the use of Whole brain teaching and students' achievement as this method increased students' motivation and engagement that leads to improved academic performance.

3.2 Results on the significant difference between the academic performance in grade 8 Algebra as indicated by pretest and posttest mean scores of the students taught using:

- Whole brain teaching techniques; and
- Conventional teaching techniques.

Table 4: *Comparative Analysis of the Pretest Mean Scores of the Experimental and the Control Groups*

	Experimental	Control
Mean	14. 77	14.90
Mean Difference	0.13	
Computed t-value	-0.176	
Critical value (α = 0.05, 2T, 58 df)	2.002	
Decision	Ho: Not Rejected	
Significance	Not Significant	

The t-test for independent means revealed that there is no significant difference in the pretest mean scores of the experimental and control groups since the computed t-value of -0.176 in absolute value is less than the critical value of 2.002. This means that the two groups have the same baseline knowledge on Algebra at the beginning of the study.

Table 5: *Pretest and Posttest Mean Scores of Experimental and Control Groups*

Group	Mean		Difference	Computed t-value*	Significance
	Pretest	**Posttest**			
Experimental	14.77	27.53	12.76	-17.784	Significant
Control	14.90	24.27	9.37	-15.273	Significant
*critical value (α = 0.05, 2T, 29 df) = 2.045					

The t-test for dependent means showed that there is a significant difference between the pretest and posttest mean scores of the experimental group since the computed value of -17.924 in absolute value is greater than the critical value of 2.045. Similarly, there is a significant

difference between the pretest and posttest mean scores of the control group since the computed t-value of -15.373 in absolute value is also greater than the critical value of 2.045. It was clear that the scores of the students increased after subjecting them to Whole brain teaching techniques which matches the findings of Armijo (2009), cited in Lockhart (2016); and Torio & Cabrillas-Torio (2015) that WBT has a positive impact on students' achievement but contradicts to Lockhart's (2009), cited in Lockhart (2016) findings that Whole brain teaching has a negative effects on students' academic achievement. Likewise, students who were taught using conventional teaching techniques performed positively good as well.

Table 6: *Comparative Analysis of the Posttest Mean Scores of the Experimental and the Control Groups*

	Experimental Group	**Control Group**
Mean	27.53	24.27
Mean Difference	3.26	
Computed t-value	2.857	
Critical value (α = 0.05, 2T, 58 df)	2.002	
Decision	Ho: Rejected	
Significance	Significant	

The t-test for independent means revealed that there is a significant difference in the posttest mean scores of the two groups since the computed t-value of 2.857 in absolute value is greater than the critical value of 2.002. Therefore, the null hypothesis that there is no significant difference between the academic performance in grade 8 Algebra as indicated by pretest and posttest mean scores of the students taught using Whole brain teaching and conventional teaching techniques is rejected. It implies that the use of Whole brain teaching techniques is more effective in increasing the academic performance of the grade 8 students in mathematics than the use of conventional teaching techniques. The result supports the studies of Awolola (2011); Rehman, etal. (2012); and Elsayed (2015) that the use of Brain based learning strategies does increase the academic performance of the students in mathematics more than the conventional way of teaching.

3.3 Results on the impact of WBT-based instruction in Grade 8 Algebra?

Our brain is involved in everything we do. Therefore, it is essential that schools provide positive experiences to every student for effective learning to take place (Jensen, 2008, cited in Kharsati & Prakasha, 2017). Research indicates that incorporating Brain based learning strategy has significant contributions in improving the academic performance of students and one strategy under brain-based is Whole brain teaching. WBT has proven to be successful in numerous

classroom settings in terms of capturing students' interest, sustaining their attention, improving their behavior, increasing their engagement, motivation and achievement as revealed by various studies. In this study, it was revealed that incorporating Whole brain teaching techniques in teaching and learning process can increase students' mathematics achievement significantly. This could be due to the fact that multiple areas of the brain are activated when using WBT techniques throughout the lessons. It was evident during the course of the study as the researcher observed that the students get excited and participative when the Class-Yes was used. They immediately response when called as compared to the students taught using conventional teaching techniques. It was supported by the study of Kelso (2009) that positive students' response increased when WBT attention getters like Class-Yes were used in the classroom. The Five Classroom Rules combined with the use of Scoreboard were helpful in establishing the discipline in the class as the students are motivated to behave accordingly and participate in discussion to avoid getting frowny faces and accumulate smiley faces. Thus, the students are focused on the entire duration of the lesson. Cape Gazette staff, cited in Kharsati & Prakasha, (2017) stated that WBT enhanced students' focus and attention in class. The Teach-Okay and Switch, when first introduced, were challenging. Not everyone was participating, but as the days went by, the students get acquainted with the method and everyone was engaged and cooperative. The researcher also observed that the students in the experimental group understand the lesson more easily and few questions were raised during the discussion as compared to the students in the control group. According to Biffle (2013), students learn the most when they are teaching each other. Hand and Eyes were useful in getting the maximum attention from the students, which creates maximized instruction time. The Mirror technique helped to represent various concepts and facilitate retention of the material through gestures. Though it was difficult to look for appropriate gestures for abstract concepts, it was highly observed that the students tend to retain the concept better when it is presented using gestures. Research proves that words when accompanied with gestures yields better memory retention (Howard-Jones, 2014). Whole brain teaching method reach diverse learners because of the memorable learning experiences which engage the students in learning, and in turn, increase their academic performance. This study proved that Whole brain teaching has a positive impact on the academic performance of grade 8 students in Algebra.

4. Conclusion

The academic performances of the students in both groups are almost the same at the beginning of the study and can both be described as Did Not Meet Expectations. But after subjecting them to their respective treatments, the academic performance of the experimental group which can be described as Satisfactory is higher than the control group which can be described as Fairly Satisfactory. The study revealed that the academic performance of both groups increased and the increase is higher in the experimental group which can be derived from the use of Whole brain teaching techniques.

The students' academic performance increased significantly after subjecting them to Whole brain teaching techniques and conventional teaching techniques. Hence, Whole brain teaching techniques and conventional teaching techniques are both effective in improving the academic performance of grade 8 students in Algebra. Results of the posttest comparison of both groups showed that students in the experimental group learned better than those in the control group. It can be concluded that there was a greater retention of the topics learned when taught using Whole brain teaching techniques than conventional teaching techniques. Thus, Whole brain teaching has a positive impact on the academic performance of grade 8 students in Algebra.

5. Recommendations

Conventional teaching method can be used regularly with integration of Whole brain teaching techniques as these methods are both effective in increasing the academic performance of the students in grade 8 Algebra. Grade 8 mathematics teachers are encouraged to adapt and use as reference the Compendium of WBT-based lesson plans developed by the researcher as it may inspire them to use and apply the seven core teaching techniques of WBT in their Algebra class. It may also help them acquire the necessary skills to reach diverse learners in the classroom successfully and make Algebra a fun subject to learn.

School administrators should provide faculty development seminars that would venture on the discovery of an innovative and effective teaching pedagogy like Whole brain teaching that could enhance teaching and learning and help the school in achieving its vision, mission, goals and objectives.

The study was carried out for one quarter. Therefore, the longitudinal impact of WBT on students' academic performance must be examined. Since the students will be exposed to WBT techniques for a longer timeframe, they will have a better understanding of which techniques

help them learn and which ones are effective in improving learning. Practicing the use of these techniques may lead to a natural way of learning which in turn, improved their test scores.

The current research involved 60 respondents only using quasi-experimental research. Therefore, the results of this study could not be generalized to a broader scope. An in-depth study with a larger number of respondents can be done to further conclude the impact of Whole brain teaching method in students' academic performance in Algebra.

Whole brain teaching does not center solely on Big Seven. Teachers can venture on other WBT techniques to actively engage the students with different learning styles by incorporating many different teaching techniques into one lesson. Moreover, similar studies can be conducted in the elementary and tertiary levels, in other subjects, as well as in other parameters to further prove the usefulness of Whole brain teaching method.

References

Alpacion, N. D., Camañan, C. T., Gregorio, A. L., Panlaan, J. R. & Tudy, R. A. (2014). Attitude, Self-Efficacy and Students' Academic Performance in Mathematics. IAMURE International Journal of Social Sciences. https://doi.org/10.7718/ijss.v12i1.920

Al-Tarawneh, M. (2016). The Impact of a Teaching-Learning Program Based on a Brain-Based Learning on the Achievement of the Female Students of 9th Grade in Chemistry. Higher Education Studies, 6(2), 162. https://doi.org/10.5539/hes.v6n2p162

Andaya, O. F. (2014). Factors that Affect Mathematics Achievement of Students of Philippine Normal University- Isabela Campus. International Refereed Research Journal, 5(4).

Awolola, S. A. (2011). Effect of Brain Based Learning Strategy on Students' Achievement in Senior Secondary School Mathematics in Oyo State, Nigeria. Cypriot Journal of Education Science, 2, 91-106.

Bawaneh, A. K. A., Md Zain, A. N & Saleh, S. (2011). The Effect of Herrmann Whole Brain Teaching Method on Students' Understanding of Simple Electric Circuits. European Journal of Physics Education, 2(2).

Biffle, C. (2013). Whole Brain Teaching for Challenging Kids (and the rest of your class, too!). Yucaipa, CA: Whole Brain Teaching LLC.

Capate, R. N. A., & Lapinid, M. R. C. (2015, March). Assessing the Mathematics Performance of Grade 8 Students as Basis for Enhancing Instruction and Aligning with K to 12

Curriculum. In Proceedings of the De La Salle University (DLSU) Research Congress (Vol. 3).

Clark, H. S. (2016). Effect of Whole-Brain Teaching on Student Self-Concept (Doctoral dissertation). Walden University. Retrieved from http://scholarworks.waldenu.edu/dissertations/2146/

Egodawatte, G. (2011). Secondary School Students' Misconceptions in Algebra, Unpublished Ph. D. Thesis, University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/29712/1/EgodawatteArachchigeDon_Gunawardena_201106_PhD_thesis.pdf.pdf

Elsayed, A. M. (2015). The Effect of using a Strategy Based on Brain-Compatible Learning Theory in the Development of Numerical Sense Skills of the Basic Education Students in Oman. European Journal of Social Sciences, 47(2), 183-195.

Fernandez, A. F. (2013). Standards-Based Assessment: DepEd's Perspective. NETRC, DepEd. Retrieved July 7, 2018 from http://ceap.org.ph/upload/download/20136/31131995_1.pdf

Ghazvini, S. D. (2011). Relationships between Academic Self-concept and Academic Performance in High School Students. Procedia- Social and Behavioral Sciences, 15, 1034-1039. https://doi.org/10.1016/j.sbspro.2011.03.235

Hakim, L., Cahya, E., Nurlaelah, E., & Lestari, Z. (2015). The Application EQ and SQ in Learning Mathematics with Brain-Based Learning Approach to Improve Students' Mathematical Connection and Self-Efficacy in Senior High School. PEOPLE: International Journal of Social Sciences, 1(1), 542-557.

Herrmann-Nehdi, A. (2002). Training With The Brain In Mind: The Application of brain dominance technology to teaching and learning. Session Number 509.

Herrmann-Nehdi, A. (2009). The Best of Both Worlds-Making Blended Learning Really Work By Engaging the Whole Brain®. Lake Laurie, NC: Herrmann International.

Howard-Jones, P. (2014). Neuroscience and education: A review of educational interventions and approaches informed by neuroscience. Education Endowment Foundation, Millbank, UK.

Inocian, R. B. (2015). Integrated Arts-based Teaching (IAT) Model for Brain-based Learning. Journal of Curriculum and Teaching, 4(2). https://doi.org/10.5430/jct.v4n2p130

Kharsati, P. D & Prakasha, G. S. (2017). Whole Brain Teaching. IOSR Journal of Humanitiesa and Social Science, 22(6), 76-83. https://doi.org/10.9790/0837-2206027683

Kelso, A. (2009). Power teaching: "How Powerful Is It?". Fifth Grade Intern Park Forest Elementary Luisiana. Retrieved from https://ed.psu.edu/pds/teacher-inquiry/2009/kelsoa.pdf

Lee, M & Sulaiman, F. (2018). The Effectiveness Of Practical Work In Physics To Improve Students' Academic Performances. People: International Journal of Social Sciences, 3(3), 1404-1419. https://doi.org/10.20319/pijss.2018.33.14041419

Lockhart, E. (2016). English as a Foreign Language through Whole Brain Teaching in Primary School (Doctoral dissertation, Rovira i Virgili University).

Magno, C. (2011, October 9). Analysis of the Basic Education of the Philippines: Implications for the K to 12 Education Program. Retrieved from https://www.academia.edu/3814475/Analysis_of_the_Basic_Education_of_the_Philippines_

Rehman, A. U., Malik, M. A., Shafqat, S., Zafar, I.,; Muhammad, R. (2012). Effectiveness of Brain-Based Learning Theory on Secondary Level Students of Urban Areas. Journal of Managerial Sciences, 6(1).

Richardson, J. J. (2011). Increasing Left and Right Brain Communication to Improve Learning for Tenth Grade Students in a Public School (Doctoral Dissertation). Retrieved from ProQuest Dissertations Publishing (UMI No. 3468506)

Sanchez, H. (2017). The Education Revolution: How to Apply Brain Science to Improve Instruction and School Climate. Thousand Oaks, California: Corwin, a Sage Company.

Sesmiarni, Z. (2015). Brain Based Teaching Model as Transformation of Learning Paradigm in Higher Education. Al-Ta lim Journal, 22(3), 266-275. https://doi.org/10.15548/jt.v22i3.141

Torio, V. A. G., & Cabrillas-Torio, M. Z. (2016). Whole Brain Teaching in the Philippines: Teaching Strategy for Addressing Motivation and Academic Performance. International Journal of Research Studies in Education, 5(3), 59-70.

White H, Sabarwal S (2014). Quasi-experimental Design and Methods, Methodological Briefs: Impact Evaluation 8, UNICEF Office of Research, Florence.

Worden, J. M., Hinton, C., & Fischer, K. W. (2011). What Does the Brain Have to Do with Learning?. Phi Delta Kappan, 92(8), 8-13. https://doi.org/10.1177/003172171109200803