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Whole Brain Teaching Strategy in Learning Waves

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Abstract:
This study aims to determine the effectiveness of Whole Brain Teaching Strategy in learning Wave topics among grade 7 students. The pre-test-post-test quasi-experimental design utilizing Solomon Four Groups was used to carry out this study. The results revealed that the level of performance of the control group and experimental group in the pre-test were the same. There was no significant difference between the pre-test results of the control and experimental group. There were better improvements in the post-test performance of the students in the experimental groups. There was a significant difference between the performance in the pre-test and post-test results of the two groups of respondents. Experimental group showed a better performance than the control group. There was a significant difference among the performance of the four groups in the post-test. There was significant difference between Control Group (CG) 1 and Experimental Group (EG) 1, Control Group (CG) 2 and Experimental Group (EG) 2, Experimental Group (EG) 1 and Control Group (CG) 2, Control Group (CG) 1 and Experimental Group (EG) 2. The study concludes that WBTS is more effective to improve students' performance. It also implies that WBTS is superior as compared to the Lecture-Laboratory Method in helping the students perform in class.

Keywords: Whole Brain Teaching Strategy (WBTS), Waves, Effectiveness, Level of Performance, Control group, Experimental group, Pre-test, Post-test

I. INTRODUCTION

A self-directed learning process is arguably the most powerful model for facilitating and inspiring individual. It is to empower people to guide themselves through their personal learning and development journey. Palasigue (2009) said that in today's post-modern society, it is getting harder and harder to get the students get engaged in classroom instruction and learning. Thus, Ferrari et al., (2009) stated that there are many innovations in the field which are all geared towards the improvement of education. However, in spite of the new trends and techniques in teaching, no single techniques on a method is said to be better than other. The teacher is tasked to the responsibility to select, organize and implement the lesson in a manner tailored to the needs in the students. Based from American Psychological Association, the brain begins to mature even before birth. Although it continues to mature throughout most of life, the brain does not mature at the same rate in each individual. The bodies grow at different rates. Human reach puberty at different ages and emotional maturity at different times as well. Thus, it is important for teachers to understand that maturation of the brain influences learning readiness. In addition, Amass (2018) stated that it is important for the teachers to understand how the brain works in designing lessons and selecting which strategies to use. According to Battle (2010), the methods you use can make your classroom experience enormously rewarding, or enormously stressful, often both at the same time. However, there are ways to approach your interaction with your classes that can make the experience both more fun and less stressful for you, and your students at the same time. This approach is called Whole Brain Teaching Strategy (WBTS). Battle elaborated that whole brain teaching provides teachers with a method that integrates both effective, fun, low stress classroom management and exciting teaching methods that produce enhanced retention and comprehension of content. There are countless ways in which schools affect students' brain, for example stress, exercise, nutrition, and social conditions and also brain-based issues like attention, classroom attendance and memory. The brain is involved in everything we do at school and to ignore it would be irresponsible (Jensen, 2005). Hence in 1999 a new method of teaching based on brain research was established by college philosophy instructor Chris Biffle, in Southern California known as the Whole Brain Teaching Strategy (WBTS).This strategy is also called Power Teaching. This strategy could be used by teachers in any subject and any grade level (Biffle, 2010). According to Biffle (2013), in order to make students engaged in learning, whole brain teaching method is surrounded by seven fun-filled techniques known as The Big Seven namely: Class-Yes, Five Classroom Rules, Teach-Okay, Mirror, Switch, Hands and Eyes and Scoreboard. With these techniques, eight areas of the brain may activate. The eight areas of the brain are: motor cortex, visual cortex, amygdala, hippocampus, pre-frontal cortex, Broca's area, Wernicke's area, and limbic system. In addition, Biffle claims that whole brain teaching is a form of brain-based learning and involves many different teaching strategies including direct instruction and cooperative learning. WBT is beneficial for both teachers and students if implemented. With its engaging and motivating classroom environment, student-centered learning model and positive behavior reinforcement, WBT has proven to be successful within various classroom settings. Torio and Cabrillas (2016) states that the Philippine Educational system has several issues and concerns that needs to be addressed for educational reform. These educational issues include international, national and local concerns. International and national concerns revolve around poor performance in achievement examinations. Classroom issues are focused on teaching and learning. Major teaching issues revolve around the use of effective teaching strategies.

Learning issues include concerns such as motivation, academic performance, and development of essential skills. In addition, in the Philippines, there is a big challenge of handling large classes while addressing issues on quality of education. De la Cruz (2017) pointed out that the last time the Philippines participated in the Trends in International Mathematics and Science Study in 2003, it obtained a score of 378 which placed on 34th rank out of 38 countries (HS II math) and 43rd of 46 (HS II science). In addition, Orleans (2015) said that in the different science subject areas, achievements in physics of Filipino students appeared below the international standards (US Department of Education National Center for Education Statistics 2000, International Association for the Evaluation of Educational Achievement 2004). The Philippines ranked third and fourth to the last in the list of nations in the 1999 and 2003 TIMSS respectively. Furthermore, the DepEd reports that the NAT mean percentage score (MPS) for high school in school year 2012-2013 was 51.41 percent, or 23.59 percentage points away from the MPS target which is 75%. The MPS in Science was 41.35 percent.Umil (2017) said that the key issues and problems contributing to the dilemma are absenteeism, child labor, drop-outs, economic status, behavior and non-readers. It is also very alarming to know that in the Division of Sorsogon the NAT results in Science from SY 2011-2012 to SY 2014-2015 were very low. It did not reach the DepED target MPS of 75%. Based on the record of the Division Office of Sorsogon, the MPS from SY 2011-2012 is 36.81 percent, SY 2012-2013 is 42.12 percent and from SY 2014-2015, the MPS is 49.52 percent. In addition, it is reported that from SY 2014-2015, Gubat National High School, one of the biggest schools in the Division of Sorsogon has a MPS of 39.24 percent and ranked 72 out of 99 secondary schools in the Division of Sorsogon. Based from the researcher's experiences and observations, in most classroom discussion of the lessons in Science specifically in Physics, the teachers encountered problems on how to get the attention of the students effectively, how to engage the students in the lessons and retention of knowledge. With these international, national and local educational issues and concerns, the researcher was motivated to try the use of Whole Brain Teaching Strategy (WBTS) on the topic Waves. Based from Khan Academy (2010), waves are extremely important part of physics. An understanding of waves is essential to understand a wide range of physical phenomena including light and the wave properties of matter including electrons and atoms. It is in these lights that the researcher would like to try out Whole Brain Teaching Strategy (WBTS) in Gubat National High School as intervention in teaching Science that can motivate and arouse the interest of the students and eventually improve their academic performance and lead to a better performance in NAT.

II. FRAMEWORK

The concept of the study was shown in figure 1. This is composed of the Pre-test, two control groups, two experimental groups and the post-test. The 40-item pre-test was administered to control group 1 and experimental group 1. After which, the two control groups were taught using the lecture-laboratory method while the two experimental groups were taught with lecture-laboratory method using Whole Brain Teaching Strategy. The WBTS includes five techniques such as Class-Yes, Five Classroom Rules, Teach-Okay, Switch, Mirror, Hands and Eyes and Scoreboard. After all identified topics for the study were learned, post-test was administered to all four groups to quantify or evaluate the level of performance of both groups.

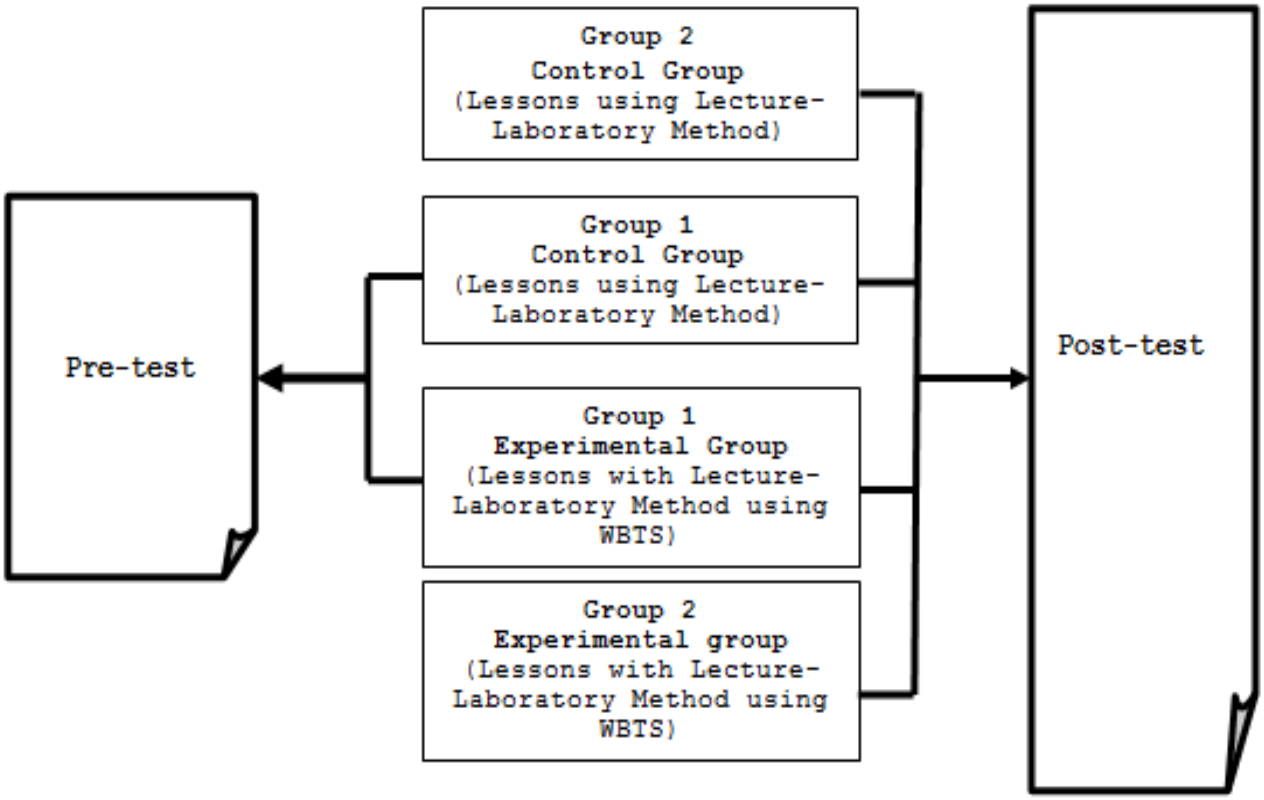

Figure 1. Conceptual Framework

OBJECTIVES OF THE STUDY

Themain purpose of the study is to determine the effectiveness of Whole Brain Teaching Strategy in learning Wave topics among grade 7 students. Specifically, the study sought to determine the**:** 1) level of performance of the control group and experimental group in the pre-test; 2) the difference between the pre-test results of the control group and experimental group; 3) the level of performance of the four groups in the post-test; 4) the difference between the pre-test and post-test results of the two groups of respondents; and 5) the difference among the performance of the four groups in the post-test.

III. MATERIALS AND METHODS

Research Design

The study used the pre-test-post-test quasi experimental design utilizing Solomon Four-Groups. According to Frey (2018), the Solomon four-group design was devised to overcome the problem of pretest sensitization. Pretest sensitization occurs when participants' scores on a post-test are influenced as a result of a pre-test being administered. The respondents were 120 grade 7 students of Gubat National High School. There were 30 students in every group. The respondents were composed of two control groups and two experimental groups that were determined through draw lots. Experimental groups received the lessons on waves in Physics 7 using the lecture-laboratory method using WBTS. On the other hand, control groups were taught using lecture-laboratory method. The methodology used in this study was the test administration using 40-item pre-test and post-test.The study used percentage, mean, t-test, one-way ANOVA and Scheffe's test as statistical tools to analyze the data samples of this study.

Research Site

The study was conducted at Gubat National High School, located at Gubat, Sorsogon. It is one of the biggest authonomost schools in the province of Sorsogon. It admits 3,330 students from Grade 7 to Grade 10 and 1,534 students from Senior High School. Further, it offers the following educational strands: General Academic Strand (GAS), Science, Technology, Engineering and Mathematics (STEM), Humanities and Social Sciences (HUMSS), Accountancy and Business Management (ABM), Technological Vocational and Livelihood (TVL).

Participants

The researcher conducted the experiment among grade 7 students of Gubat National High School, Gubat, Sorsogon consisting of 120 students coming from four regular grade 7 sections. The respondents were composed of two control groups and two experimental groups that were determined through draw lots.The 30 students in every group were determined by getting the middle 30's. The researcher got the grades of every group for first and second quarter for their respective adviser and got their average grades. Then, arranged their average grades from highest to lowest and removed the outliers to come up with final 30 sample size in each group.

Instrumentation

The instruments used in this study were the following: Table of Specification (TOS) which shows equal distribution of items per skill/learning competency in the test. The teacher-made lesson plans which incorporated the WBTS were validated by some experts. The lesson plans were developed in order to facilitate the WBT lessons that incorporated the 7 E's model such as Elicit, Engage, Explore, Explain, Elaborate, Extend and Evaluate. The WBTS was used in all parts of the 7 E's model. These focused on cognitive, psychomotor and affective needs of grade 7 students to increase their academic performance.

Validation of Instrument

The experts who validated the instruments were two master teachers, two school heads, and two Physics professors. For the developed lesson plans, majority commented and suggested on the parallelism of the lesson objectives to the activities and evaluation. For the teacher-made test, experts commented and suggested more on the parallelism of the test items to the learning competencies. Before the finalization, the researcher consulted again the experts, panelists and adviser about the revision he made.The researcher requested permission from the school head to conduct a dry-run. A dry-run of the pre-test was conducted on October 1, 2018 to 37 grade 8 students who are not respondents of the study. After the dry-run, the researcher conducted an item analysis to find out the number of items that need to be discarded and revised. After item analysis, out of 80-item test on Physics 7, forty items were removed from the test questions resulting to the final 40-item test.The final 40-item test was administered again on October 4, 2018 to 48 students to determine the reliability of the test using the Kuder-Richardson Formula 20 (KR20). The computed reliability was 0.737. This means that the test questions were acceptable based on the scale adopted from the study of Ricafort (2018).

Data Collection

The researcher asked permission from the school head/principal, Assistant principal and Science department head through formal letter to administer the test to gather the data and information significant to the study. After the approval was granted, the researcher personally conducted the pre-test on November 7, 2018 to the control group 1 and experimental group 1. The respondents were given instructions on the manner of answering the test. They were given one hour to answer the forty-item multiple choice test. The test papers and answer sheets were retrieved by the researcher right after the examination and the results were recorded and made available for statistical interpretation. In the first session was the orientation, the two experimental groups were oriented about the seven strategies of whole Brain Teaching which are the class-yes, teach-okay, switch, hands and eyes, mirror, classroom rules and scoreboard. They mastered their responses/gestures for every strategy. The control groups were taught of lessons with common method of instruction (Lecture-Laboratory Method). The control and experimental groups were taught by the same researcher with the same subject matter.The identified topics learned by the respondents on waves were the following: Waves, Sound and Light. These topics were got from the K to 12 curriculum guide. After discussing all identified topics in waves, post-test was administered on December 5, 2018 to control group 1 and experimental group 1, December 6, 2018 to control group 2, and December 7, 2018 to experimental group 2.

Data Analysis: The students' test results in the pre and post tests were checked, tallied, analyzed and interpreted. The mean, frequency count and percentage were used to determine the level of performance in the pre-test and post-test of control and experimental groups. The researcher adopted the scale from DepEd Order No.8, s. 2015 to determine the performance level and description of the students in the pre-test and post-test. To test the difference between the pre-test results of the control and experimental group, the t-test for independent samples was used. On the other hand, the t-test for correlated samples was used to test the difference between the pre-test and post-test results of the two groups of respondents. The F-test one-way ANOVA was used to determine the difference among the performance of the four groups in the post-test. The Scheffe's test is a test to compare and further determine where the difference lies among the post-test results of the four groups.

IV. RESULTS AND DISCUSSION

Table 1.Level of Performance of the Control Group 1 and Experimental Group 1 in the Pre-Test

Topics	Control Group 1		Experimental Group 1	
	Rating	Description	Rating	Description
Waves	25.95%	Did Not Meet the Expectations	30.71%	Did Not Meet the Expectations
Sound	26.44%	Did Not Meet the Expectations	24.89%	Did Not Meet the Expectations
Light	27.27%	Did Not Meet the Expectations	23.94%	Did Not Meet the Expectations

Table 1 shows the level of performance of the control group and experimental group in the pre-test along the three topics in Physics 7 such as Waves, Sound and Light. It implies that the students scored low in the pre-test in both groups. This may be attributed to the progression of topics under K to 12 Curriculum in which basic concepts on types of waves, characteristics of waves and wave velocity were not yet introduced in their previous grade levels. However, the only background of the students prior to these lessons is the basic concepts of waves which were taught in grade 6. This may not be sufficient to fully understand the characteristics of waves as it requires integration of the concepts in the new topics. Thus, it is imperative for teachers to provide students with the opportunity to recall the previous lessons so that it will facilitate the learning of Waves at the next level. The performance of the students can be ascribed to their readiness for the new lessons. The absence of pre-requisite concepts may be a big factor for learning. Gandhi (2010) discussed Thorndike's Law of Readiness or the law of action tendency and the law of set or attitude and its educational implications. Law of Readiness or the law of action tendency means that learning takes place when an action tendency is aroused through preparatory adjustment, set or attitude. Pre-test results of the present study is consistent with the said law, since in the absence of the pre-requisite knowledge of the students in Waves may have impact on their performance in the post-test. According to Hailikari et al., (2008), students' prior knowledge should be taken into consideration in instructional design and curriculum planning. Furthermore, the results of prior-knowledge assessments may be used as a tool for student support in addressing areas of deficiency.

Table 2. Difference between the Pre-Test Results of the Control Group and Experimental Group

Statistical Basis	Statistical Analyses
Level of Significance	0.05
Degrees of Freedom	58
Critical Value	2.0017
Computed t-value	-0.0906
Decision on HoDo not Reject	
Conclusion	Not Significant

Table 2 presents the difference between the pre-test results of the control group and experimental group. The pre-test results mean that the two groups of respondents have similar ideas about the topics presented in Physics 7. This may beattributed to the spiral progression approach wherein the scope and sequence of the content were developed such that concepts and skills revisited at each level with increasing depth. Since the learners have no basic knowledge yet on some wave topics in lower grade levels, both control group and experimental group have low level of performance in the pre-test. Ramos (2018) pointed out that in the spiral progression approach, the students had a hard time in remembering the concepts and skills they have learned in the lower level, since these acted as pre-requisites in the current lessons.

In the spiral progression approach in Science, WBTS could help students enhance their retention of the concepts and skills they have learned and mastery of subject matter in difficult science concepts as well. Alaniz(2015) stated that the learning methods used in Whole Brain Teaching create active learners and effective long-term learning.

Table .3. Level of Performance of the Four Groups in the Post-Test

Topics	Control Group 1		Control Group 2		Experimental Group 1		Experimental Group 2	
	Rating	Description	Rating	Description	Rating	Description	Rating	Description
Waves	74.52%	Did Not Meet the Expectations	77.14%	Fairly Satisfactory	82.38%	Satisfactory	81.19%	Satisfactory
Sound	72.89%	Did Not Meet the Expectations	67.78%	Did Not Meet the Expectations	77.56%	Fairly Satisfactory	78.89%	Fairly Satisfactory
Light	68.79%	Did Not Meet the Expectations	66.97%	Did Not Meet the Expectations	85.45%	Very Satisfactory	81.82%	Satisfactory

Table 3 reflects the level of performance of the four groups in the post-test. As compared to the performance in the pre-test of the experimental group 1 (see Table 2), it can be observed that there is a significant increase in their ratings. The improvements of the ratings may be attributed to the use of WBTS where the students were actively engaged in teaching and learning process compared to that of the control group. To support these findings, Calhoun (2012) claimed that WBTS keeps students actively engaged in the learning process. Likewise, Palasigue (2009) concluded that WBTS makes students become more engaged in every lesson on a day to day basis. It also reveals that there were improvements in the post-test performance of the students on the three topics in Physics 7. These findings mean that Whole Brain Teaching Strategy facilitated in the improvements of the level of performance of the experimental groups on the three topics in Physics 7. This is evident during the conduct of lessons that whole brain teaching strategy enhanced better the students' motivation as they are actively engaged in learning. Likewise, retention of knowledge and academic performance of the students are reinforced. Biffle (2013) states that Whole Brain Teaching recognizes that students learn the most when they are engaged in lessons that involve seeing, hearing, doing, speaking and feeling.

It transforms students from passive receivers of information to dynamic creators of high energy lessons. It's simple, effective and powerful.In addition, Bawaneh (2012)) cited that whole brain teaching method improved students' motivation and academic performance towards science learning. WBTM stresses on experiments and activities in the classroom, which enhances positive interaction and participation during lessons, thus improving the motivation for learning. Further, Duman (2006), declares that brain-based instruction increased the students' academic achievement and motivation as well.

Table .4. Difference between the Pre-Test and Post-Test Results of the Control Group 1 and Experimental Group 1

Statistical Bases	Statistical Analysis	
	Control Group 1	Experimental Group 1
Level of Significance	0.05	0.05
Degrees of Freedom	29	29
Critical t-value	2.045	2.045
Computed t-value	22.3537	21.84
Decision Ho	Reject Ho	Reject Ho
Conclusion	Significant	Significant

Table 4 reflects the difference between the level of performance in the pre-test and post-test of the control group and experimental group.

This result implies that the academic performance of the students in the experimental group is more improved with the use of whole brain teaching strategies. It shows that WBTS helped students to better understand and retain the information in three topics in Physics 7 such as waves, sound and light. Torio and Cabrillas (2016) revealed that from the use of whole brain teaching as teaching strategy, students' academic performance and motivation are increased. In addition, Arnold (2015) states that WBTS help create a positive learning environment where students can actively participate in learning and hence create effective long term learning.

Table 5. Difference among the Performance of the Four Groups in the Post-Test

Sources of Variations	Sum of Squares	df	Mean Squares	Computed F	Tabular F(0.05)	Decision	Interpretation
Between Column	429.29	3	143.097	12.092	2.683	Reject Ho	Significant
Within Column	1372.702	116	11.834				
Total	1801.992	119					

Table 5 presents the difference among the performance of the four groups in the post-test.The post-test performances of both experimental and controlled groups have significant difference. This shows that students obtained varying scores in the post-test. Further, result may be also attributed to the exposure of the students on the WBTS as it allowed them to be active learners. Since there was a significant difference among the performance of the four groups of respondents in the post-test, the Scheffes' test was used to further compare the F-values of the four groups' post-test performance.

Table 6. Comparison of the F-values of the Four Groups' Post-Test Performance

Between (k-1) (2.683)(3) =8.049	F-value	F.05	Statistical Analysis
CG 1 vs. EG 1	16.77	8.049	Significant
CG 1 vs. CG 2	0.46	8.049	Not Significant
CG 1 vs. EG 2	13.54	8.049	Significant
EG 1 vs. EG 2	0.0062	8.049	Not Significant
EG 1 vs. CG 2	22.76	8.049	Significant
CG 2 vs. EG 2	18.96	8.049	Significant

Table 6 below shows the comparison of the F-values of the four groups' post-test performance. The table presents that the two experimental groups of respondents had better performances with the use of Whole Brain Teaching Strategy. It means that WBTS is more effective to improve students' performance. It also implies that WBTS is superior as compared to the lecture-laboratory method in helping the students perform in class. Alaniz (2015) declares that the method used in WBTS increase students' motivation, engagement, and collaboration during direct instruction, and critical thinking. In addition, Tufekci and Demirel (2009) claimed that brain-based learning like the WBTS is more effective in empowering academic achievement, motivation and retention of gained knowledge.

V. CONCLUSION

The control group and experimental group performed very low in the pre-test along the lessons on waves, sound and ligth. Both groups did not attain the minimum grade requirement of 75% as per DepEd Order No.8, s. 2015. The two groups of respondents equally performed low in the pre-test. The experimental groups showed a higher performance in the post-test than the control groups along the lessons on waves, sound and light. The two groups of respondents perform differently in the pre-test and post-test. The four groups performed differently in the post-test. The two experimental groups who were taught with the lecture-laboratory method using the WBTS performed better than the two control groups taught using the lecture-laboratory method. Hence, WBTS is effective in teaching waves.

TRANSLATIONAL RESEARCH: Findings of the study can be translated to the seminars and training workshops intended for any grade level teachers teaching any subjects especially when it is related to classroom management and teaching approaches and strategies. School administrators may encourage to organize teachers' seminars and training workshops about this strategy, where teachers provided chances to be familiarized, acquainted and created their own Whole Brain Teaching classroom that would motivate and arouse the interest of the students and eventually improve their academic performance and lead to a better performance in NAT.

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