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Learners' Critical Thinking and Motivation as Significant Standpoint in Whole Brain Teaching in Science

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Abstract

The study was conducted to investigate learners' critical thinking and motivation as significant standpoints in whole-brain teaching. Furthermore, it aimed to determine the difference in the results of test scores as to critical thinking skills and determine the motivational level of the students after being exposed to whole-brain teaching techniques. Two groups of posttest design were used. Sixty (60) Grade 8 students clustered into two (2) groups were selected as respondents in San Pablo City Science Integrated High School during the academic year 2021-2022. Survey questionnaires and test questions were utilized to obtain the data. The motivation questionnaire results indicate that the respondents showed a high level of motivation after exposure to whole-brain teaching techniques in both groups and results revealed that there was no significant difference between the students' mean test scores exposed to attention-getter whole-brain teaching techniques and brain-engager whole-brain teaching techniques. This suggests that whenever the students are exposed to any of the two sets of whole-brain teaching techniques, their critical thinking skills performance will be consistent.

Keywords – Whole Brain Teaching, Critical Thinking Skills, Motivation, Mean Scores, Science Curriculum

Introduction

The central feature of the K to 12 Enhanced Basic Education Curriculum is the development of learners to become productive members of society, equipping them with the essential competencies, skills, and values for both lifelong learning and employment (Luistro, 2012).

The 21st-century workforce requires higher-order thinking skills which are conspicuously significant whereas the information age requires individuals who are flexible, dynamic, active, and versatile. Preparing students for what is ahead requires the teachers to utilize a lot of innovativeness and imagination in planning and actualizing exercises that address the dual challenge of providing the basics and building up the capacity to think and reason (Pelligrini, 2018).

Several teaching strategies were initially introduced to the teaching and learning practice to address the Philippines' poor performance in both national and international examinations, particularly in the areas of mathematics and science (Torio et al., 2016).

Learning is a process that guides learners through a planned, implemented, and systematically evaluated process that allows them to achieve learning objectives effectively and efficiently. Teachers should understand that the demands of professionalism of teachers are not only able to develop material but also must be able to perform engaging and meaningful learning. To achieve it, teachers need to understand how the brain works as a system of human intelligence in machine learning (Corebima, 2017).

School responsibility and high-stakes testing often shift classroom focus from the utilization of engaging learning activities that promote critical thinking and creativity to straightforward test arrangement rehearses. Utilizing brain research as a guide, teachers might have the option to improve test scores, while yet giving reasonable instruction that promotes critical thinking (Paul, R., 2015).

Scientific cognition and process skills are the key trends that are given much discussion inside a science classroom. K to 12 educators is pushed to teach the necessities as dictated by the standardized evaluations to catch up with the competencies as mandated by the curriculum. As a result, many students leave the K–12 education system lacking critical thinking skills that are required for success in higher education or the workplace (Smith & Szymanski, 2013).

Critical thinking is considered a major intellectual and practical skill, particularly in science education. This supports the major understanding of the learners toward the environment and society. But this skill lacks not only in function but also in understanding what the concept is. It requires not just learning effort but maximum exertion of intellectual capability and personal reflection (Rowles et al., 2013).

Brain-based teaching strategies have proven significant contributions to learning gains and one strategy under brain-based is considered in this study and is referred to as Whole Brain Teaching Techniques (WBT). WBT addresses the four learning areas of the brain. Addressing the four areas of the brain means targeting the holistic development of individual learners. The failure to address one area will mean failure to completely contribute to the growth of individual learners (Torio et al., 2016).

The whole brain teaching technique is a research-based instruction that gives more importance to interaction between teachers and students and between students to students. It also delivers information to students in small doses. Whole-brain teaching calls for students to be actively engaged in learning, and for teachers to assign gestures to concepts to help students remember them (Hoss, 2013; McCollum, 2013).

Research evidence from previous research that whole-brain teaching is an effective method that helps to generate a highly active classroom, effective classroom management, and has a positive learning outcome but even though it was started in 1999, whole-brain teaching has not reached the masses as much as other best practices around the nation (Tipton, 2016). Even though there is a lack of research to support whole-brain teaching techniques, the idea of making learning fun by combining classroom management and active learning and teaching is very interesting (Tipton, 2016). There is a lack of prior research on whole-brain teaching (Clark, 2016). This limitation is a reminder that further research regarding whole-brain teaching is necessary.

The study of Learners' Critical Thinking and Motivation as a Significant Standpoint in Whole Brain Teaching in Science was conducted in San Pablo City Science Integrated High School with grade 8 students as respondents. Figure 1 shows the conceptual framework, which includes the independent and dependent variables of the study.

Objectives of the Study

The study was conducted to determine if there is a significant difference between the test scores in critical thinking skills and motivational level of the two groups of students after being exposed to Whole

Brain Teaching Techniques at San Pablo City Science Integrated High School during the third quarter of the School Year 2021-2022.

Methodology

The study utilized a two-group posttest design to determine whether there is a significant difference exists between the test scores of the respondents in critical thinking skills after being exposed to Whole Brain Teaching Techniques. The test was given after the implementation of Whole Brain Teaching Techniques such as Attention-Getter (behavior-focused) and Brain-Engager (cognitive-focused) whole brain teaching techniques. Related samples t-test was used to determine if there is a significant difference between the test mean scores of the participants at a 5% level of significance.

The respondents were sixty (60) Grade 8 students who are currently enrolled in San Pablo City Science Integrated High School during the school year 2021-2022. The respondents were exposed to whole-brain teaching techniques.

The study utilized cluster sampling. Cluster sampling is a technique in which clusters of participants that represent the population are identified and included in the sample. This involves the identification of the cluster of participants and their inclusion (Crossman, 2017).

The researcher utilized a researcher-constructed questionnaire in the collection of data. The questions were based on the most essential learning competencies for Grade 8 Science quarter three. There were two (2) learning competencies. This is composed of forty item-test which covers the topics: of the particle nature of matter and physical changes in terms of the arrangement and motion of atoms and molecules. The table of specifications (TOS) was also prepared to ensure the proper budgeting of competencies that were taught each day.

Teacher-made lesson exemplars that show the flow of each lesson with the implementation of whole-brain teaching strategies were prepared. Two (2) sets of whole-brain teaching techniques in the context of whole-brain teaching were utilized in the student-focused activities.

The said instruments were validated by six (6) science teachers who all have master's degree major in Science and Technology coming from different public High Schools in the Division of San Pablo City.

Results and Discussion

1. Performance of the Students after being Exposed to Whole Brain Teaching

1.1. In terms of Defining

Table 1
Performance of the Respondents Using Whole Brain Teaching Techniques in terms of Defining

Scoring Scale	Attention-Getter		Brain-Engager		VI
	f	%	F	%	
9-10	9	30.0	11	36.7	Excellent
7-8	18	60.0	16	53.3	Good
5-6	3	10.0	3	10.0	Average
3-4	0	0	0	0	Fair
1-2	0	0	0	0	Poor
Total	**30**	**100.0**	**30**	**100.0**	

Table 1 shows the scores of the respondents in *Defining* as exposed to attention-getter and brain-engager whole-brain teaching techniques. In terms of attention-getter, the majority of the students which is eighteen (18) or 60% gained 7-8 scores interpreted as *Good*. While in terms of the brain-engager majority of the students which is sixteen (16) or 53.3 % gained 7-8 scores were also interpreted as *Good*. Based on the result, in terms of *Defining* it can suggest that the scores of the students can be improved to an Excellent level or have scores between 9-10. On the other hand, it is worth to mention that no students gained scores that are lower than 5 or 50% of the overall scores in Defining.

The result implies that using the whole brain teaching techniques, whichever of the two sets, the students were able to answer the Defining test questions which include the following skills: The students can be able to find unique characteristics, gather facts, recognize tasks, and problems, and move from general to the specific concept about the topic Particle Nature of Matter.

1.2. In terms of Classifying

Table 2
Performance of the Respondents Using Whole Brain Teaching Techniques in terms of Classifying

Scoring Scale	Attention-Getter		Brain-Engager		VI
	f	%	F	%	
9-10	15	50.0	21	70.0	Excellent
7-8	14	46.7	7	23.3	Good
5-6	1	3.3	2	6.7	Average
3-4	0	0	0	0	Fair
1-2	0	0	0	0	Poor
Total	**30**	**100.0**	**30**	**100.0**	

The distribution scores of the respondents in classifying after being exposed to attention-getter and brain-engager whole-brain teaching techniques are presented in Table 2. As to attention-getter, the majority of the students which is equal to fifteen (15) or 50% gained 9-10 scores interpreted as *Excellent*. While in terms of the brain-engager majority of the students which is equal to twenty-one (21) or 70 % gained *Excellent* or 9-10 scores also. Notice also that based on the results, no students gained a score between 3-4 interpreted as *Fair* and 1-2 or *Poor*.

These levels indicate that learners already have sufficient skills to demonstrate their ability to distinguish similarities and differences, grouping and categorizing, comparing, and making either/or distinctions of concepts about the Particle Nature of Matter.

1.3. In terms of Finding Relationship

The table on the preceding page shows the scores of the respondents in the *Finding Relationship* subskill as exposed to attention-getter and brain-engager whole-brain teaching techniques.

In terms of attention-getter, the majority of the students which is equal to eleven (11) or 36.7% gained between 9-10 scores interpreted as *Excellent*. While in terms of brain-engager majority of the students which is equal to twelve (12) or 40 % gained *Excellent* or 9-10 scores also. It is noteworthy that in both groups the greatest number of respondents scored *Excellent* or got 9-10 scores. It is also observed that no students got poor or 1-2 scores.

Table 3
Performance of the Respondents Using Whole Brain Teaching Techniques in terms of Finding Relationship

Scoring Scale	Attention-Getter		Brain-Engager		VI
	f	%	F	%	
9-10	11	36.7	12	40.0	Excellent
7-8	9	30.0	9	30.0	Good
5-6	7	23.3	7	23.3	Average
3-4	3	10.0	2	6.7	Fair
1-2	0	0	0	0	Poor
Total	**30**	**100.0**	**30**	**100.0**	

In Finding Relationships, the data paint quite a different picture. The results are more scattered in the different levels compared to the other three subskills. Nevertheless, the majority of the respondents between the two groups obtained scores between 9-10 interpreted as *Excellent*.

This implies that most of the students between the two groups after being exposed to whole brain teaching techniques have excellent abilities in answering the posttest questions that deal with relating concept parts and whole, analyzing, seeing patterns, synthesizing, and using deductive and inductive reasoning about the topic which are the skills in Finding relationship critical thinking subskill questions.

1.4. In terms of Drawing Conclusion

Table 4
Performance of the Respondents Using Whole Brain Teaching Techniques in terms of Drawing Conclusion

Scoring Scale	Attention-Getter		Brain-Engager		VI
	f	%	F	%	
9-10	20	66.7	18	60.0	Excellent
7-8	4	13.3	8	26.7	Good
5-6	3	10.0	3	10.0	Average
3-4	2	6.7	0	0	Fair
1-2	1	3.3	1	3.3	Poor
Total	**30**	**100.0**	**30**	**100.0**	

Table 4 above shows the scores of the respondents in *Drawing Conclusion* as exposed to attention-getter and brain-engager whole-brain teaching techniques.

In terms of attention-getter, the majority of the students which is equal to twenty (20) or 66.7% gained 9-10 scores interpreted as *Excellent*. While in terms of the brain-engager majority of the students which is equal to eighteen (18) or 60% gained *Excellent* or 9-10 scores also. It is noteworthy that in both groups the greatest number of respondents scored excellent or got 9-10 scores. Meanwhile, it is also observed that only in the *Drawing Conclusion* had a student obtained a *Poor* or 1-2 score, based on the given rubric it means that the students answer is partially aligned to the concept of the topic and provided one (1) piece of evidence to support the answer to the question.

On the other hand, the results imply that most of the students already have sufficient skills to demonstrate their ability to identify cause and effect, making distinctions, inferring, and evaluating which are the skills involve in Drawing Conclusion.

2. Test of Difference Between Groups in terms of Mean Test Scores

Table 5
Test of Difference between Groups in terms of Mean Test Scores as to Critical Thinking Skills

Critical Thinking Skills	Attention-Getter		Brain-Engager		t	df	Sig. (2-tailed)
	M	SD	M	SD			
Defining	7.93	1.08	8.03	1.33	-.320	58.000	.750
Classifying	8.57	1.14	8.90	1.32	-1.048	58.000	.299
Finding Relationship	7.27	1.95	7.57	1.76	-.627	58.000	.533
Drawing Conclusion	8.23	2.50	8.50	2.19	-.439	58.000	.662
Total Scores	32.00	4.00	33.00	4.32	-.930	58.000	.356

$p < 0.05$ significant; (s) $p \geq 0.05$ not significant (ns)

Table 5 shows the results of the independent sample t-test comparing the test scores of the two groups. In the last column, notice that all the p- values are more than .05, it is shown that there is no significant difference between the mean posttest scores of the two groups in all the subskills of critical thinking. Meaning, whenever the students are exposed to any of the two whole-brain teaching techniques, their critical thinking skills performance will be consistent.

In terms of attention-getter, the subskill that gained the highest average score of 8.57 (SD=1.14) is the *Classifying.* It is also true in terms of brain engager which obtained the highest mean score of 8.90 (SD=1.32). It implies that in both groups of respondents after being exposed to whole-brain teaching techniques, most of the students were able to demonstrate their ability to distinguish similarities and differences, grouping and categorizing, comparing, and making either/or distinctions of concepts.

Both groups of the respondents gained the lowest average scores in finding relationship subskill. In terms of the respondents exposed to attention-getter gained 7.27 (SD=1.95) while respondents exposed to brain-engager obtained 7.57 (SD=1.76). These are still positive results; this may be attributed to the nature of whole-brain teaching techniques and how it affected the respondents' critical thinking skills.

Based on the practitioners of Whole Brain Teaching it was found out that WTB made a huge difference in the way students remember and retain information, students are more engaged, their critical thinking is increased, and students are actively participating inside the classrooms (Kharsati, P. D & Prakasha, G. S., 2017).

Based on the study of Bucayong et al (2020), Whole Brain Teaching (WBT) stresses providing equal learning opportunities for different learners, where each of the four brain compartments will be exercised during the whole period of class. It is also designed to keep students engaged in learning and makes classrooms easier to manage by combining auditory, verbal, and visual elements of teaching instruction (Biffle, 2014).

3. Test of Difference Between Groups of Students in terms of Motivational Level

Table 6 shows the test of the difference between the motivational level of the respondents as to attention-getter and brain-engager whole-brain teaching techniques. The obtained t-values have p-values that are higher than 0.5, it is shown that the motivational level in each set of whole brain teaching techniques (Attention-getter and Brain-engager) had no significant difference.

Table 6
Test of Difference Between Groups of the Students in terms of Motivational Level as to Whole Brain Teaching Techniques

Motivation Scale	Attention-Getter		Brain-Engager		t	df	Sig. (2-tailed)
	M	SD	M	SD			
Self-Efficacy	4.04	0.76	4.05	0.59	-.027	58	.979
Active Learning Strategy	4.30	0.76	4.25	0.68	0.291	58	.772
Science Learning Value	4.54	0.96	4.49	0.70	.214	58	.831
Performance Goal	4.48	0.89	4.42	0.79	.268	58	.789
Achievement Goal	4.47	0.96	4.63	0.58	-.750	58	.456
Learning Environment Simulation	4.39	0.72	4.28	0.77	.547	58	.586

$p < 0.05$ significant; (s) $p \geq 0.05$ not significant (ns)

In terms of attention-getter whole brain teaching techniques, the Science Learning Value scale gained the highest average value of 4.54 (SD=0.96), This implies that the majority of the respondents in this group got motivated when they feel the value of science learning such as acquire problem-solving competency, experience the inquiry activity, stimulate their thinking, and find the relevance of science with daily life this was evident during the group activity, increasing rigor and complex thinking happened in this phase of the learning. Students can collaborate to complete higher-order thinking tasks. While in brain engager the Achievement Goal scale obtained the highest average value of 4.63 (0.58). This implies that most of the students in this group got motivated when they feel satisfied as they increase their competence and achievement during science learning.

Whole brain teaching focuses on making learning fun, Biffle and his team believe that students learn best when educational activities are fun. In addition to students' learning, such an environment helps to decrease challenging behaviors inside the classroom (Biffle, 2013).

Macias (2013) discussed whole-brain teaching's benefits for teachers and students. Teachers benefit from positive behavior reinforcement, memory retention, and student engagement. Students' benefits include motivation, student-centered learning, and application of their learning.

This implies that no matter what sets of whole-brain teaching techniques were used, the students' motivational level towards science learning will be consistent in terms of self-efficacy, active learning strategy, science learning value, performance goal, achievement goal, and learning environment stimulation. Furthermore, based on the overall results of the two sets of whole brain teaching techniques whether it is attention-getter (behavior-focused) or brain-engager (cognitive-focused) students' motivational level fall between Agree and Strongly Agree which implies the students are motivated in learning science.

Conclusions

Based on the findings the following conclusions were drawn:

1. There is no significant difference between attention-getter whole-brain teaching techniques and brain-engager whole-brain teaching techniques in terms of mean test scores as to critical thinking skills. Therefore, the null hypothesis posited in the study is sustained.
2. There is no significant difference between attention-getter whole-brain teaching techniques and brain-engager whole-brain teaching techniques in terms of the motivational level of the respondents. Therefore, the null hypothesis posited in the study is sustained.

Recommendations

Based on the findings of the study and the conclusions are drawn, the following are hereby recommended:

1. Since it was found out that in both groups that were subjected to whole brain teaching techniques most of the respondents got "excellent" level in critical thinking subskills such as Classifying, Finding Relationships, and Drawing Conclusions, teachers are encouraged to apply these techniques in their science class and continue in teaching with the employment of these techniques.
2. Since the study revealed that the use of whole brain teaching techniques in teaching science stimulates students' thinking in science and satisfies their own curiosity, teachers may apply these techniques in other science classes such as Biology, Physics, and Environmental Science, since the techniques were conducted only in chemistry subject.
3. Since the study revealed that in both groups most of the respondents were willing to participate in the science course because the teacher does not put a lot of pressure on them in using the whole-brain teaching techniques, teachers may consider using whole-brain teaching techniques on other age groups to determine the effects of the two sets of techniques.
4. Since the study revealed that most of the respondents in both groups did not meet the "excellent" level in defining skills, teachers may use or look for other teaching techniques that can fully enhance all the critical thinking skills.
5. Future researchers may explore a similar study in enhancing students' critical thinking skills utilizing a different teaching technique to discover further which techniques can fully target and develop all critical thinking skills.

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