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Original Paper

Effects of Brain-Based Learning Strategies on Secondary School Students' Attitude to Learning in Federal Capital Territory, Abuja, Nigeria

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Abstract

The study was carried out to find out whether Brain-Based Learning Strategies had any effect senior secondary school students' attitude to learning in the Federal Capital Territory, Abuja. A pre-test post-test Quasi Experimental Research design was used with a sample size of 142 Senior Secondary School Students (S.S.S 1) drawn from two Senior Secondary Schools in the Abuja Municipal Area Council. Two intact classes were used; one class drawn from each of the schools, the classes were assigned to Groups using a Lucky Dip. With 70 students constituted in the Experimental Group and 72 in the Control Group. The Student Attitude Scale (SAS) was used to collect data for the study. All hypotheses were tested at a significant level of 0.05 using t-test. Findings revealed a significant difference in Students Attitude to learning with a mean difference of 0.59 in favor of the Experimental Group. However, no significant difference was observed in Students Attitude to learning in the Experimental Group based on gender. It was recommended that teachers should adopt the Brain-based learning strategies in teaching Economics in Senior Secondary Schools. In addition, since the teaching pedagogy is Gender-fair, it should be implemented in all schools irrespective of learners' gender.

Keywords

brain-based learning strategies, attitude, instructional strategy, conventional teaching methods

1. Introduction

Learning is a principal function of the brain. Neuroscience and cognitive science have provided vital information that indicates that learning changes the physical structure of the brain. These structural changes alter the functional organization of the brain; in other words, learning organizes and

reorganizes the brain (Fields, 2013). Thus, developmental processes involve interactions between the environment and interpersonal information (Jensen, 2011). The learning process is so complex that, despite the array of attempted theories: behaviourist, cognitive and affective, it is still an unexplored field of study. Learning is promoted and regulated by the learner's surroundings and prior knowledge, as such, instructional strategies, which enable learners to feel secure in the learning situation, to enrich teaching and support the learning process should be applied and encouraged.

The existing methods of instruction in education are based on expectations that certain learning goals should be achieved by a certain age. However, since learners have different intellectual capabilities, the outcome of these methods will not be the same for all the students; there must be variability. With findings of researches in neuroscience which investigated the relationship between the brain, the neural system and our cognitive behaviours, educators and neuroscientists advocated for a brain compatible education. Otherwise referred to as the brain-based learning, a student-centred instructional strategy.

Using the latest neural research findings, instructional techniques that are brain friendly such as brain-based learning provided a biologically driven framework for creating effective instruction. Caine and Caine cited in Jack and Kyado (2017) explained that, brain-based learning involves accepting the rules of how the brain processes and then organizing these rules/principles in mind to achieve meaningful learning. These principles have been redesigned over the years and are still being used in books and educational programs as a guide to natural learning (Chipongian, 2004; D'Costa, 2010; Jensen, 2011; Jack & Kyado, 2017).

Once the brain processes an outside stimulus as threatening, a rush of adrenaline goes to the brain Desautels (2016). Desautels (2016) further added that, all unnecessary stimuli are put away so the brain can focus on the things at hand that pose an immediate threat. These facts are important because in establishing positive learning environments educators must put students' safety and comfort as high priorities. This is explained in line with the three conditions for learning put forward by Caine and Caine (2001) thus: relaxed alertness, orchestrated immersion and active processing. Relax alertness entails eliminating fears in learner, while maintaining a highly challenging learning environment. Orchestrated immersion involves getting learners to concentrate on the learning process and the concepts learnt while active processing is the process of connecting the new knowledge to existing knowledge to form meaning.

Adunola (2011) believe that, the choice of teaching method used depends largely on the information or concept taught, in addition to the attitude and enthusiasm of the learner. Adunola (2011) explained further that, many learners developed a negative attitude towards a given subject not because of its content but due to certain inadequacies related to how it is taught. Attitudes emerge as a result of personal experience, observation and influence of social norms. Some of these attitudes are inimical to the goal of learning.

Attitude refers to a set of emotions, beliefs, and behaviours toward a particular object, person, thing, or event. Students' attitude could be positive or negative. Positive attitude would enhance learning

outcomes while a negative attitude would discourage learning (Perloff, 2016). Lourdes, Vera and Francisco (2012) described attitudes as psychological orientations developed from one's experiences, which influence a person's view of situations, objects or people and how to respond to them positively, negatively, favourably or unfavourably. From the psychological perspective, attitudes is a learned tendency to evaluate things in a certain way (Vogel, Bohner, & Wanke, 2014).

Attitudes can guide encoding information, attention and behaviours, even if the individual is pursuing unrelated goals (Kahle & Valette-Florence, 2012). According to Awang, Jindal-Snape, and Barber (2013) there is a strong association between individuals' attitudes towards education and their academic performance and commitment. Evidence from literatures (Das, Mishra, & Halder, 2014; Seyihoglu & Kaptan, 2012; Mohammed & Waheed, 2011) reveals that student's attitude to learning is positively related to the instructional strategy adopted by the teacher. Kubiatko in Venesovaa and Malaa, (2016) posits that, if attitudes towards a subject and school are positive, the academic achievement of students gets better.

Many teachers, as is apparent from the study of Venesovaa and Malaa (2016) associate academic achievement with the positive attitude of students towards school that may not be necessarily reflected in excellent achievements, although reflected in producing the best individual performance in relation to a student's disposition. According to Awang, Jindal-Snape, and Barber (2013) there is a strong association between individuals' attitudes towards education and their academic performance and commitment. They stressed further that, students who have negative attitudes towards educational activities are found to exhibit challenging behaviour including anti-social and off-task behaviour. Das, Mishra, and Halder (2014) opined that, attitude is the most influencing factor for both teachers and students of their behaviour in the classroom. If attitude is the individual's feelings towards education; once teachers are able to develop positive attitude in their students through motivation, the teaching-learning process will be more effective. Das et al. (2014) further lamented that, school's environment and curriculum are the important factors for children to decide whether they would like the school or not. In the light of the above, to grow students' positive attitude, school environment and curriculum must be attractive. Fraser and Kahle (2007) in their research showed that, learning environments at home, at school and with peer group accounted for a significant amount of variance in student attitudes.

Several factors could influence attitude such as anxiety, learning environment, and teaching method. In essence, the way a teacher designs the learning process and materials could influence the attitude of learners to learning, either positively or negatively (Lourdes, Vera, & Francisco, 2012). Comfortable learning environments will create a good attitude and reduce the bad attitudes (Azizi, Halimah, & Faizah, 2011). In addition, Mohammed and Waheed (2011) when reviewing literature aimed at understanding attitudes and influences on their development identified factors such as: anxiety, self-efficacy, self-concept, motivation and school experiences. Students should be exposed to an interesting and stimulating environment in class in order to enhance learning. Hence, the teacher needs

to understand the students and thus adopt pedagogies that will ensure effective learning.

Attitude is very vital in learning. Kubiatko in Venesovaa and Malaa (2016) argues that, if attitudes towards a subject and school are positive, the academic achievement of students gets better. Many teachers, as is apparent from the study of Venesovaa and Malaa (2016) associate academic achievement with a positive attitude of a student towards school, that may not be necessarily reflected in excellent achievements, although it will be reflected in producing the best individual performance in relation to a student's dispositions. This study is directed towards examination of learning systems that are effective in promoting positive attitudes towards learning.

The conventional lecture method of teaching which has become a norm in the Nigerian classrooms could be said to exhibit some of the following weaknesses: it generates surface knowledge, entails rote memorization of facts, promotes one-way communication, and lacks interaction between students and teachers therefore making learners passive observers in the classroom and restricted. However, the challenges that educators face in the 21st century are so diverse that using better and appropriate teaching methods is more crucial now than ever before.

Although, the lecture method is effective in delivering knowledge to a large number of students and covering a wide range of topics within a stipulated time. Most teachers using lecture method only lump information on students rather than facilitate a learning process that would help learners acquire, assimilate and exhibit good knowledge of the subject as the method involves students receiving information mainly through input given by teachers in the classrooms. This however hinders students' innate learning potentials and ignores students' individual differences leading to negative attitudes towards learning and its attendant poor academic performance.

Advocates of brain-based learning insist that there is a difference between "brain-compatible" education, and "brain-antagonistic" instructional practices and methods which can actually prevent effective learning. It is argued that teaching without an awareness of how the brain learns is like designing a glove with no sense of what a hand looks like its shape and how it moves. It is apparent that if classrooms are to be places of learning, then the brain as the organ of learning must be understood.

Brain-based learning strategy differs from conventional teaching strategy. A typical feature of conventional lecture method according to Broughton (2007) is the "teacher-dominated interaction". Aziz-Ur-Rehman (2011), on the other hand describe the brain-based learning as a student-centred method which engages the brain in the learning process by considering the natural functioning of its various parts. Conventional teaching method however, promotes rote memorization of facts. Conventional methods such as lectures may not be the best way to convey information even if it is a popular teaching technique. According to Sousa (2006), students on average retain only five percent of information delivered through lecture twenty-four hours later. Lessons therefore, should be designed to promote critical divergent thinking and equip students with information relevant to the real world and the ability to use such information as provided via brain-based learning strategy.

One of the core principles of brain-based learning is that emotions (attitudes inclusive) and learning are mutually correlated. Brain scans indicate that the hippocampus, where emotions are housed, is activated when learning occurs (Burton, 2009). The moods, biases, prejudices, feelings, self-esteem, social interactions and psychological needs generate emotions to function accordingly, thereby determining the depth of understanding and mastery. Teachers should present information to students in a way that encourages a positive emotional connection to the material. This will help to retain the information. Some of the emotional states that is useful to learning include; anticipation, curiosity, confusion and suspicion.

Teachers can implement a brain-based education by designing the classroom and presenting lesson to suit the knowledge of how the brain function while considering the three conditions of learning as illustrated in Figure 1.

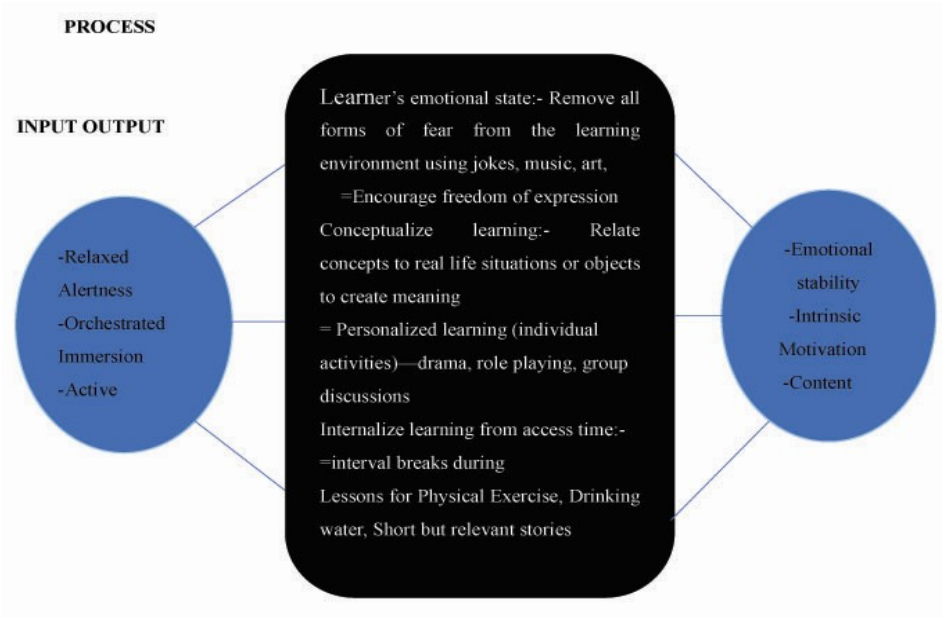

Figure 1: Brain-Based Learning Input-Process-Output Chart

The Brain-Based Learning Input-Process-Output (BBLIPO) chart illustrate the pathway to enhance brain function. Effective learning is achievable when the learners are not just present in the classroom but emotionally active and relevant to the learning process. The brain-based learning strategies, hinged on the three conditions for learning as proposed by Caine and Caine (2000), that is, the Relaxed Alertness, Orchestrated Immersion and Active Processing which requires the introduction of activities (input) that enhance brain function in order to achieve effective learning (output).

A relevant theory in this study is Constructivism as a learning theory propounded by John Dewey, it explains how people might acquire knowledge and learn. The theory states that, 'humans construct knowledge and meaning from their experiences'. It suggests that individuals construct reality based on actively gained knowledge, and meaning is then interpreted by the individual. The learning theory is

based on the interaction between the brain and the environment. The learner is an information constructor as he/she experiences an environment first-hand goes on to form and test new information, and thereby develops reliable and trust-worthy knowledge.

In constructivism, knowledge is constructed based on personal experiences and hypotheses of the environment. Learners continuously test these hypotheses through social negotiation. The theory is not so much concerned with what (product) students learn as much as how (process) they learn it. Each learner has different interpretation and construction of knowledge process. Brain-based learning agrees with constructivism that individual differences may exist both in the construction and interpretation of knowledge. Brain-based and constructivism learning approaches have emanated from two different fields but have strong similarities in their implications for education.

Teachers should design lessons and learning environment in such a way that will encourage learners to actively participate and take charge of their learning in order to make learning contextual, as learners will make learning personal and emotional: two factors that enhance mastery of knowledge constructed.

Several studies have asserted the effectiveness of brain-based instructional strategy on the attitudes of learners. Denton (2010) in a study stated that, teachers acknowledged that due to the brain-based sessions, students viewed their teaching differently and their attitudes toward education had changed and/or improved. Seyihoglu and Kaptan (2012) in the same vein found that teaching geography through brain-based learning approach had a positive effect on the students' attitude towards the course. In a study conducted in Turkey by Akyürek and Afacan (2013), to examine the effect of brain-based learning approach on attitudes and motivation levels in 8th grade students' science classes confirmed the positive effect of brain-based learning approach on students' attitude.

Jack and Kyado (2017) in a quasi-experimental research examined the "effect of brain-based learning strategy on students' academic achievement, attitude, motivation and knowledge retention in Electrochemistry". The result of the study affirmed the positive effect of BBL on students' attitude towards learning.

Brain-based and constructivism learning approaches have emanated from two different fields but have strong similarities in their implications for education. Teachers can adopt innovative and interactive instructional techniques that support best practices and also take the role of facilitator in the learning process rather than master and disseminator of knowledge. Teachers should as well design lessons and learning environment in such a way that will encourage learners to actively participate and take charge of their learning in order to make learning personal and contextual.

In spite of the findings of brain-based learning and its relevance in improving academic achievement of students, a review of available empirical studies on BBL and students' academic achievement reveals that no study has been conducted in the Federal Capital Territory and majority of the existing studies have concentrated on the sciences and languages.

1.1 Statement of the Problem

There is concern among parents, teachers and the public at large about the lackadaisical attitude of students towards learning in Nigeria and the lack of learners' commitment to the learning process, with the resultant effect evident in the poor academic achievement of students in national examinations such as WASSCE, UTME, NECO and others. Several studies have ascribed the blame to the inefficiency of the present instructional methods adopted by teachers which seem deficient in achieving the desired learning outcomes. The pedagogy adopted influence learners' interest, commitment and involvement in a lesson. Hence, the need to investigate the effectiveness of the brain-based learning strategies in improving learners' attitude to learning.

The specific objectives of this research are, to find out if:

(i) there is any difference in students' attitude towards learning of Economics between the experimental and control group at pre-test;

(ii) there is any difference in students' attitude towards learning of Economics between the experimental and control group at post-test; and

(iii) there is any difference in attitude towards learning of Economics between male and female students in the experimental group at post-test.

This study was guided by the following research questions:

1) What is the difference in students' attitude towards learning of Economics between the experimental group and the control group at pre-test?

2) What is the difference in students' attitude towards learning of Economics between the experimental group and the control group at post-test?

3) What is the difference in attitude towards learning of Economics between male and female students in the experimental group?

The following null hypotheses were tested at 0.05 level of significance.

H_{01}- There is no significant difference in students' attitude towards learning of Economics between the experimental group and the control group at pre-test.

H_{02}- There is no significant difference in students' attitude towards learning of Economics between the experimental group and the control group at post-test.

H_{03}-There is no significant difference in attitude towards learning of Economics between male and female students in the experimental group.

2. Method

The research design for the study is the pre-test post-test, control group design in a quasi-experimental setting. The quasi-experimental design is considered appropriate because the experimental and control groups were naturally assembled groups as intact classes so that the normal school setting is not disrupted. For this research, the researcher used two classes, one class for each of the two selected schools; each class representing a group. One class represented the experimental group (denoted as

Group E) while the other class represented the control group (denoted as Group C).

The target population for this study comprised 16,894 students in Senior Secondary I in all the public Senior Secondary Schools in Abuja Municipal Area Council of the Federal Capital Territory that are offering Economics as a subject. The sample size for the study comprised 142 senior secondary one (S.S.1) students from two selected senior secondary schools. Two co-educational senior secondary schools were selected using simple random sampling technique. The two selected schools were randomly assigned to the experimental group and the control group using lucky dip. The experimental group has seventy (70) students while the control group had seventy-two (72) students.

The instrument used in the study is the Students' Attitude Scale (SAS) is designed along a four-point Likert type scale with 17 items modified, and four options namely; Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). The Students' Attitude Scale (SAS) items were adapted by researcher from other existing attitude scale namely, Biology Attitude Scale by National Association of Biology Teachers (2011). Students' Attitude Scale (SAS) was used to determine students' attitude to learning.

To determine validity of the Students' Attitude Scale (SAS), experts in the field of education were consulted. The rating by the experts after observation, corrections and final consideration served as logical validity of the instruments. For reliability of the instrument, the SAS was subjected to pilot test by the researchers with 31 students of a secondary school from the study area. Reliability of SAS was determined using Cronbach's alpha reliability coefficient; the value of Cronbach's alpha reliability coefficient normally ranges from 0 and 1. With the value of 0.73, the items on the SAS scale were judged to have a good internal consistency.

Experimental Procedure

The procedure began with a pre-test where a version of the instrument was administered to the participants to establish their initial status before the commencement of treatment.

The treatment tool for the experiment is the lesson plan designed using the 12 principles of brain-based learning strategies and the three conditions of learning (relaxed alertness, orchestrated immersion and active processing) developed by Caine & Caine (2001) and the lesson plan for the conventional lecture method. The lesson plan for the two groups was prepared by the researcher for consistency in lesson presentation for the groups. The researcher drafted a teacher's guideline for the study based on the principles of Brain-based learning strategies (BBLS).

2.2 Teacher's Guideline on Teaching Economics using Brain-Based Learning Strategies

1) A balance diet chart was displayed in the classroom and teacher informs learners before the lessons about the importance of nutrition and hydration to their brain development and function.

2) Teacher encouraged students to come with drinking water in their water bottles, which students took during the lessons to maintain body hydration and reduce stress.

3) Teacher, during the first lesson enlighten students on the importance of food intake to their physical development and the consumption of water for good brain health and function in accordance with Hans

(2012) and Wilson (2013).

4) Diagrams used in learning some concepts and most group assignments were displayed in the classroom.

5) Students were encouraged to reflect on previous knowledge.

6) Teacher created a stimulating environment to take care of students' emotion using means such as: playing soft or classical music on few occasions, cheerful environment through brain energizers and sarcasm free jokes.

7) Students are motivated using praise or positive adjectives chosen by each student as a prefix to their name for example Intelligent Henry, Smart Adamu, Charming Sochi, etc.; this really boosted students' self-esteem.

8) Concepts were broken down to manageable parts to enable students internalise them easily and form meaning.

9) Class was broken into groups using various formats such as birth months, first alphabet of name, number of siblings, etc. This is to encourage peer interaction and learning. The groups engaged in group discussions, projects, role playing; thereafter students were allowed to evaluate themselves across groups without criticism.

10) Teacher encouraged students to freely express their fears, confusions and ideas as regards each module of topic taken.

11) Teacher generated friendly environment by encouraging smiles and laughter, through teacher's friendly attitude towards students and physical exercise.

12) Students were encouraged to form their own patterns as they learn; the teacher can do this by posing questions that will inspire curiosity in students or allowing time for reflection on new information. This promoted critical thinking and subsequently presentation of meaningful contents by merging new ideas into existing ones.

13) Students were also encouraged to perform individual task of their choice as it relates to learning concepts.

14) Innovations were appreciated and ambiguities acknowledged.

The experimental group was taught by the researchers led by a team member who is an Economics teacher while the control group was taught by the school Economics teacher with the researcher as an observer based on the school management arrangement. The post-test version of Students' Attitude Scale (SAS) was administered to the two groups at the ten (10) weeks of study to assess the basic knowledge of Economics attained after treatment.

The administration of the Students' Attitude Scale lasted for a period of 30 minutes. The items on the SAS questionnaire were scored on a 1, 2, 3 and 4 range as follows: Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points, Strongly Disagree (SD) = 1 point. The negative questions were scored on the reverse as follows: Strongly Agree (SA) = 1 points, Agree (A) = 2 points, Disagree (D) = 3 points, Strongly Disagree (SD) = 4 point. A weighted score points of 2.5 was the

benchmark, any score from 2.5 and above was recorded as agreement while score below 2.5 was rated as disagreement. The 2.5 benchmark represents the average of the four scales, that is. 4+3+2+1=10 /4 = 2.5

The data collected were analysed using both descriptive and inferential tools of statistical analysis. Descriptive statistical tools mainly; mean, and standard deviation were used to answer the research questions. On the other hand, an inferential statistical tool such as independent sample t-test was used to analyze data. Statistical Package for Social Sciences (SPSS) computer software (version 23) was used to compute the data collected.

3. Result

Research Question One: What is the difference in students' attitude towards learning of Economics between the experimental group and the control group at pre-test?

Table 1. Pre-test Mean Scores of Students Attitude towards Learning for Experimental and Control Group

S/No.	Statement	Control			Experimental		
		Mean	Std. Dev.	Decision	Mean	Std. Dev.	Decision
1	The Economics lesson was stress free and enlightening; it helped me learn	2.64	1.12	Agree	2.60	1.04	Agree
2	better.	3.38	0.66	Agree	3.19	0.87	Agree
3	I enjoy studying Economics even after the lessons in class.	2.76	0.82	Agree	2.99	0.85	Agree
4	I do not care about my performance in Economics.	2.83	0.89	Agree	3.49	0.61	Agree
5	I feel disturbed when I cannot complete a task.	3.43	1.01	Agree	3.03	1.06	Agree
6	I am looking forward to being the best student in Economics.	3.43	0.75	Agree	3.54	0.69	Agree
7	I feel satisfied when I work hard enough and take charge of my learning.	3.32	0.76	Agree	3.67	0.58	Agree
8	With the class activities, I can relate Economics concepts to our everyday	2.90	0.83	Agree	3.23	0.76	Agree
9	activities.	2.76	0.64	Agree	2.99	1.09	Agree
10	I only study when I have an examination or test to write.	3.26	0.95	Agree	2.63	1.04	Agree

11	I don't study material that is not likely to be part of the examination.	3.24	0.75	Agree	3.64	0.50	Agree
12	Being involve in my own learning make me understand the concept better.	2.67	0.87	Agree	3.13	0.98	Agree
13	I believe offering Economics will bring the best in me.	2.99	0.98	Agree	2.46	0.98	Disagree
14	I only offer Economics to improve my overall grades.	2.50	0.91	Agree	3.33	0.63	Agree
15	I feel safe and confidence with my performance in Economics.	3.21	0.99	Agree	2.50	1.08	Agree
	I don't like my classmates assessing my performance.						
16	I stay focused throughout the Economics lesson because the teacher involves every student in the learning	3.07	0.93	Agree	3.26	0.83	Agree
17	process.	3.29	0.91	Agree	3.33	0.70	Agree
	I easily recall information from the lessons because I relate and learn from every student in the class	**3.05**		**Agree**	**3.11**		**Agree**
	The teaching method use by the teacher, encourage cooperation among students.						
	Overall Mean						

Table 1 indicates that, with an overall mean score of 3.11 and 3.05, the learners in the experimental and control groups respectively have a similar attitude to learning Economics. Therefore, there is very minimal difference in attitude to learning Economics between the two groups with the difference in mean score of 0.06. It was observed that students in both the experimental and control group agreed to most of the items on the scale. Few variations could be noticed in items 6, 7 and 11 where the students in the experimental group show stronger support for statements such as "I feel satisfied when I work hard enough and take charge of my learning". "With the class activities, I can relate Economic concepts to our everyday activities". This imply that the two groups of students were relatively identical in their attitudes before the commencement of treatment using the two instructional strategies.

Research Question Two: What is the difference in students' attitude towards learning of Economics between the experimental group and the control group at post-test?

Table 2. Post-Test Mean Scores of Students on Attitude towards Learning for the Control group and Experimental Group

S/No.	Statement	Control			Experimental		
		Mean	Std. Dev.	Decision	Mean	Std. Dev.	Decision
1	The Economics lesson was stress free and enlightening; it helped me learn	3.18	0.87	Agree	3.44	0.60	Agree
2	better.	2.89	1.02	Agree	3.33	0.81	Agree
3	I enjoy studying Economics even after	2.78	1.08	Agree	3.65	0.47	Agree
4	the lessons in class.	2.96	1.09	Agree	3.56	0.60	Agree
5	I do not care about my performance in	3.28	0.72	Agree	3.57	0.62	Agree
6	Economics.	3.06	1,07	Agree	3.74	0.45	Agree
7	I feel disturbed when I cannot complete a task.	2.90	1.02	Agree	3.43	0.57	Agree
8	I am looking forward to being the best student in Economics.	2.93	1.12	Agree	3.63	0.48	Agree
9	I feel satisfied when I work hard enough and take charge of my learning.	2.67	1.07	Agree	3.43	0.69	Agree
10	With the class activities, I can relate Economics concepts to our everyday	2.94	1.01	Agree	3.50	0.67	Agree
11	activities.	3.04	1.09	Agree	3.60	0.49	Agree
12	I only study when I have an	2.61	1.01	Agree	3.49	0.58	Agree
13	examination or test to write.	2.88	1.01	Agree	3.61	0.57	Disagree
14	I don't study material that is not likely	2.63	0.98	Agree	3.37	0.76	Agree
15	to be part of the examination.	2.93	0.95	Agree	3.63	0.64	Agree
16	Being involve in my own learning make me understand the concept better.	3.01	1.05	Agree	3.46	0.65	Agree
17	I believe offering Economics will bring the best in me.	2.96	1.09	Agree	3.57	0.76	Agree
	I only offer Economics to improve my overall grades.	**2.94**		**Agree**	**3.53**		**Agree**
	I feel safe and confidence with my performance in Economics.						

I don't like my classmates assessing my performance.	
I stay focused throughout the Economics lesson because the teacher involves every student in the learning process.	
I easily recall information from the lessons because I relate and learn from every student in the class	
The teaching method use by the teacher, encourage cooperation among students.	
Overall Mean	

Table 2 indicates that, with an overall mean score of 3.53 and 2.94 the learners in the experimental and control groups respectively exhibit differences in their attitude towards learning of Economics. Therefore, there is a difference in attitude towards learning of Economics between the two groups with the difference in mean score of 0.59 in favour of the experimental group.

The overall mean of 3.53 and 2.94 for the experimental group and the control respectively, shows that the students in the experimental group show stronger assertion to the items on the attitude scale at post-test while the students in the control group showed less positive attitude.

Research Question Three: What is the difference in attitude towards learning of Economics between male and female students in the experimental group?

Table 3. Mean Score and Standard Deviation on Attitude towards Learning Economics by Male and Female Students in the Experimental Group

Gender	Total	Mean	Std. Dev.	Std. Error Mean
Male	37	3.31	0.90	0.148
Female	33	3.17	0.87	0.151

The result presented in Table 3 reveals a difference in the mean attitude of the male and female students in the experimental group. There was a lower mean score on attitude to learning Economics for female students with (mean = 3.17, SD = 0.87), compared to that of male students with (mean = 3.31, SD = 0.90). There is a mean difference of 0.14 in favour of the male students. This result implies that, the mean score of male students in the experimental group on attitude towards learning Economics is

slightly higher than that of the female students in the group after the group was taught Economics using Brain-based learning strategies.

H_{01}: There is no significant difference in students' attitude towards learning Economics between the experimental group and the control group at pre-test.

Table 4. Two-Tailed T-Test Result of Difference in Students' Attitude to Learning between the Control and Experimental Groups at Pre-Test

Group	N	Mean	Std. Dev.	df	t	p-value	Decision
Control	72	3.05	0.89	140	0.415	0.679	Accepted
Experimental	70	3.11	0.83				

Table 4 shows the result of the t-test analysis at 0.05 significant level. The results ($t_{(140)} = 0.415$, $p = 0.679 > 0.05$) indicate that there is no significant difference in the mean scores of the two groups on attitude towards learning of Economics before the treatment was administered on the groups. The null hypothesis was therefore accepted. This implies that there is no significant difference in attitude towards learning Economics between the experimental and control groups before the two instructional strategies were employed as treatment.

H_{02}: There is no significant difference in students' attitude towards learning of Economics between the experimental group and the control group at post-test.

The result from the t-Test analysis of the difference in students' attitude to learning

Table 5. Two-Tailed T-Test Result of Difference in Students' Attitude towards Learning of Economics between the Control and Experimental Groups at Post-Test

Group	N	Mean	Std. Dev.	df	t	p-value	Decision
Control	72	2.94	1.02	140	4.310	0.000	Rejected
Experimental	70	3.53	0.61				

The results on Table 5, ($t_{(140)} = 4.310$, $p = 0.000 < 0.05$) indicates that there is significant difference in the mean scores of the two groups on attitude towards learning of Economics after the treatment was administered on the groups. The null hypothesis (H_{05}) was therefore rejected. This implies that students who were taught Economics using brain-based learning strategies showed greater improvement in their attitudes towards the subject while those taught using the conventional lecture method showed less improvement. This result demonstrates that brain-based learning strategy is more effective in improving students' attitudes towards learning than the conventional teaching strategy.

H_{03}: There is no significant difference in mean scores on attitude towards learning of Economics between male and female students in the experimental group.

Table 6. Two-Tailed T-Test Result of Difference in Mean Scores on Attitude towards Learning of Economics between Male and Female Students in the Experimental Group

Group	N	Mean	Std. Dev.	df	t	p-value	Decision
Male	37	3.31	0.90	68	0.350	0.727	Accepted
Female	33	3.17	0.87				

From Table 6, the results ($t_{(68)}$ = 0.660 and P=0.512 > 0.05) indicates that there was no significant difference in the mean score on attitude towards learning between the male and female students in the experimental group. The null hypothesis was therefore accepted. This implies that improvements in students' attitudes toward learning of Economics due to intervention with brain-based learning strategy is not dependent on gender and can be adopted to improve learners' attitude to learning irrespective of gender.

4. Discussion

The first finding is this study relates to the attitudes of students towards learning Economics before the commencement of treatment. The students included those in the experimental and control groups. Students in both groups were in agreement on most items on the questionnaire on attitude. However, the experimental group recorded a slightly higher mean score on attitude to learning compared to that of the control group with mean of 3.11 and 3.05 respectively. This difference however was not statistically significant when tested at 0.05 significant level. With this result, the researchers established that the two groups did not exhibit significant differences in their attitudes toward learning of Economics before the treatment began. This finding implies that prior to treatment, the control and experiment were similar in attitudes towards the subject; any observed difference during the post treatment stage can thus be attributed to treatment effects.

Secondly, the study established that difference in post-test mean score on attitude towards learning by the two groups was statistically significant. The students in the experimental group recorded more improvement in mean score on attitude towards learning with mean difference of 0.6 in favour of the experimental group. This result revealed that the Brain-based learning strategies implemented in the experimental group has a positive effect on the students' attitude to learning Economics. This result confirms the assertions by Adebayo (2005), Tufekci (2005), Tufekci and Demirel (2009), Akyurek and Afacan (2013), Jack and Kyado (2017), and Mekarina and Ningsih (2017) that, students in the experimental group taught with Brain-based activities recorded statistically significant mean score on

attitude to learning. Adebayo confirms that students who were exposed to brain-based instructional strategy in Chemistry performed significantly higher in their attitude mean score than their counterparts who were exposed to the conventional lecture method. This is in tandem with Jack and Kyado (2017) who affirmed that brain-based learning had much more positive effect on students' achievement, attitude, motivation and retention because students were taught with brain-based working principles leading to these positive contributions.

Contrastingly, Aydin (2008), Samur (2009), and Yildirin (2010) observed that the brain-based learning approach did not reflect any influence on students' attitude towards learning and no significant changes in students' attitude were observed. On another note, Olaoluwa and Ayantoye (2017) reported a difference in mean score of the experimental group on attitude however the difference was not statistically significant. Olaoluwa and Ayantoye therefore suggested that, if Brain-based instructional strategy is adopted to teach Mathematics, learners could be better improved in terms of contextual thinking, creative reasoning, logical thinking, sequential learning, intuitive knowledge and insightful learning.

On gender interferences among students subject to treatment using brain-based learning strategy, this study revealed a greater improvement in attitude towards learning of Economics by male students compared to their female counterparts. However, a t-test analysis on the difference in attitude on the basis of gender showed no significant difference between male and female students in the experimental group. This result is in tandem with Inci (2010) who reports that no significant difference was observed in attitude of male and female students in the experimental group at post-test. However, the findings of Karnica and Vashishtha (2015), Akyurek and Afacan (2013) contradicts the result of this study as both studies reveal a difference in attitude by gender in favour of the female students. However, these works were majorly on science-oriented subjects rather than in the humanities or social science subject as in this present study.

4.1 Conclusion and Recommendations

This study examined the effects of Brain-based learning strategies on senior secondary school students' attitude to learning. It was found that students in the control and experimental groups were relatively similar in their attitudes towards learning before the commencement of the treatment. Noticeable changes therefore, were attributed to treatment effects during the experiment. The study found after the treatment that Brain-based learning strategy led to significant improvements in students' attitude towards learning Economics over the conventional strategy. Improvement in the attitudes of students towards learning using brain-based learning was noticed among male and female students. The study concluded further that brain-based learning is effective irrespective of students' gender. The findings show that, teachers can improve learning outcomes by providing an enriched learning environment, well-structured brain-friendly instructional activities; as this would eliminate fear and tension, hence encourage positive attitude amongst students towards learning.

The study recommends that:

1) Teachers should ensure to provide a relaxed environment with low threat and high challenging environment in order to ensure that learning environment is stress-free and would enhance students' attitude towards learning.

2) Economics teacher in the Federal Capital Territory should apply the Brain-based learning strategies because of its relevance in improving learners' attitude towards learning.

3) Teachers should also encourage and help learners to become aware of and properly manage their feeling and develop positive attitude to education and its components because the ability to learn is a function of learners' physical development, personal comfort and emotional state.

4) Teachers should encourage good nutrition, physical exercise, movement, sarcasm free jokes, art (music), drama, drinking of water before and during lessons to promote positive attitudes towards learning.

5) Brain-compatible strategies can be implemented in single sex and co-educational schools since there are mixed reports of its effect on gender.

References

Adunola, O. (2011). *An analysis of the relationship between class size and academic performance of students*. Ego Booster Books, Ogun State, Nigeria.

Akyurek, E., & Afacan, O. (2013). Effects of brain-based learning approach on students' motivation and attitudes levels in science class. *Mevlana International Journal of Education*, *3*(1), 104-119. https://doi.org/10.13054/mije.13.08.3.1

Amrai, P., Motlagh, S. E., Zalani, H. A., & Parhon, H. (2011). The relationship between academic motivation and academic achievement students. *Procedia Social and Behavioural Sciences*, *15*(2), 399-402. https://doi.org/10.1016/j.sbspro.2011.03.111

Awang, M. M., Jindal-Snape, D., & Barber, T. (2013). A documentary analysis of the government's circulars on positive behaviour enhancement strategies. *Asian Social Science*, *9*(5), 203-208. https://doi.org/10.5539/ass.v9n5p203

Azizi, Y., Halimah, M., & Faizah, I. (2011). Students' perception on aggressive behaviour in five secondary schools in urban areas of Johorbahru. *Journal of Educational Psychology and Counselling*, 1-24.

Burton, E. (2009). *21st Century Focus: Brain-based learning: Educating students as a whole and teaching the way the brain naturally learns best*. Retrieved 2nd August, 2020, from http://www.edutopia.org/Erika-burton

Caine, G., & Caine, R. (2001). *The brain, education, and the competitive edge*. Lanham, MD: Scarecrow Press

Chipongian, L. (2004). "*What is Brain-based learning*"? University of Wisconsin. Madison. Retrieved 2nd August, 2019, from http://brainconnection.brainhq.com/2004/03/26/what-is-brain-based-learning/

Das, S. K., Mishra, B., & Halder, U. K. (2014). *Study on relationship between attitude towards education and academic achievement in secondary level minority students*. Retrieved 20th August, 2019, https://www.researchgate.net/publication/280979820

D'Costa, C. (2010). *Brain based learning*. Retrieved May 12th, 2019, from http://www.Shutterstock.com/Rawpixel.com

Denton, V. (2010). *A case study on the professional development of elementary teachers related to brain research and the strategies used to help struggling readers* (Doctoral dissertation). Available from ProQuest Dissertations and Thesis database. (UMI No.3415926)

Desautels, L. (2016). *Brain based learning: Brains in pain cannot learn*! Retrieved May 14th, 2019, from http://www.Shutterstock.com/Rawpixel.com

Fields, R. D. (2013). Changes in brain structure during learning: fact or artifact? Reply to Thomas and Baker. *NeuroImage*, *73*, 260-267. https://doi.org/10.1016/j.neuroimage.2012.08.085

Fraser, B. J., & Kahle, J. B. (2007). Classroom, home and peer environment influences on student outcomes in science and mathematics: an analysis of systemic reform data. *International Journal of Science Education*, *29*(15), 1891-1909. Retrieved 21th May, 2019, from https://www.scimagojr.com/journalsearch.php?q...tip=sid https://doi.org/10.1080/09500690601167178

Jack, G. U., & Kyado, J. J. (2017). Effectiveness of brain-based learning strategy on students' academic achievement, attitude, motivation and knowledge retention in electrochemistry. *Journal of Education, Society and Behavioural Science*, *21*(3). https://doi.org/10.9734/JESBS/2017/34266

Jensen, E. (2000). Moving with the brain in mind. *Educational Leadership*, *5*(3), 34-38.

Jensen, E. (2011). *Brain-based learning: What is brain-based learning strategy*? Retrieved 10th February, 2019, from http://feaweb.org/brain-based-learning-strategy

Lourdes, M., Vera, M., & Francisco, P. (2012). Attitudes towards mathematics: Effects of individual, motivational, and social support factors. *Journal of Child Development Research*. http://dx.doi.org/10.1155/2012/876028

Mohamed, L., & Waheed, H. (2011). Secondary students' attitude towards mathematics in a selected school of Maldives. *International Journal of Humanities and Social Science*, *1*(15), 277-278.

Perloff, M. R. (2016). *The Dynamics of Persuasion: Communication and Attitudes in the Twenty-First Century*. Routledge. https://doi.org/10.4324/9781315657714

Seyihoglu, A., & Kaptan, S. Y. (2012). The effect of brain-based learning approach to elementary teacher candidates' attitude and achievement in geography lesson. *Hacettepe University Journal of Education*, *42*, 380-393.

Verešováa, M., & Maláa, D. (2016). Attitude toward school and learning and academic achievement of adolescents. In *The European proceedings of social and behavioural sciences* (pp. 870-876). http://dx.doi.org/10.15405/epsbs.2016.11.90

Vogel, T., Bohner, G., & Wanke, M. (2014). *Attitudes and attitude change*. Psychology Press. https://doi.org/10.4324/9781315784786