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EDITORIAL LIST

Editorial

The decision to float this journal was borne out of concern for quality scholarly writings in the areas of social psychology and applied psychological principles in education and in other areas. Apart from providing an outlet for publication or research findings, this journal offers opportunities for professionals and students to disseminate their views or positions on topical issues and emerging theories within the scope of the journal. In this regard, the journal welcomes articles from a diverse area of community life, clinical and developmental psychology, sociology and anthropology, religion and other humanities.

Policy

The IJAPHP aims at dissemination information on standard research and scholarship. Theories, articles (theoretical, empirical) are welcome from international communities. The Editorial Board is strongly committed to publishing contributions from all the regions of the world to make it truly international in nature and in content.

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Prospective authors should send articles through electronic mail using (a) MS Word generated 12 point fond by attachment to: ijaphp2000@yahoo.com. Specifications for hard copy submission:

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- The paper submitted must go through a blind review process and this may last for two months. Authors will be contacted of the outcome.
- Authors should note that articles that are not accepted for publication would not be sent back.
  Publication fees$150/£100.

CONTENTS

INTERACTION EFFECT OF BRAIN-BASED INSTRUCTIONAL STRATEGY AND COGNITIVE STYLE ON STUDENTS' ATTITUDE TO SENIOR SECONDARY SCHOOL MATHEMATICS

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Abstract

This study investigated the interactive effect of Brain-based instructional strategy and cognitive style on students' attitude to Senior Secondary School Mathematics. A pre-test, post-test, control group quasi-experimental design was adopted with a 2 x 3 x 2 factorial matrix. The sample was 522 Senior Secondary School II Students from nine randomly selected schools in Oyo State, Nigeria. Five schools were randomly assigned to the experimental (Brain-Based Instructional Strategy – BBIS), while four schools were assigned to the control group (Non-Brain-Based Instructional Strategy – NBBIS). The instruments were: Mathematics Attitude Questionnaire (r = 0.83), Cognitive Style Test (r = 0.81), Mathematics Anxiety Rating Scale (r = 0.81). Two research questions and one hypothesis guided the study. Data obtained from the research questions were analyzed using mean scores while the hypothesis was tested at 0.05 level of significance using the analysis of covariance (ANCOVA). Brain-based instructional strategy was more effective at improving students' attitude to Mathematics than the conventional method. Teachers of Mathematics could, therefore, adopt this strategy for teaching secondary school students.

Keywords: Brain-based instructional strategy, Cognitive style, Students' attitude to mathematics, Interaction effect

Introduction

Brain-Based Learning strategy is a learner-centred and teacher-facilitated strategy that utilizes learners' cognitive endowments. Sousa (2004) says a brain-based approach integrates the engagement of emotions, nutrition enriched environments, music, movement, meaning making and the absence of threat for maximum learner participation and achievement.

Proponents of brain-based instructional strategy (Sousa, 2004; Ryan and Abbot, 1999; Caine and Caine, 1998; Jensen, 1998) identified three instructional learning techniques of the strategy. These are:

1. Relaxed Alertness: It consists of low threat and high challenge. It is the technique employed to bring the brain to a state of optimal learning.
2. Orchestrated Immersion: This is a technique of trying to eliminate fear in learners, while maintaining a highly challenging environment.
3. Active Processing: This technique allows the learners to consolidate and internalize information by actively processing it.

Brain-Based learning strategy! What is it all about? To many, the term "brain-based" learning sounds redundant. Isn't all teaching and learning brain-based. Advocates of brain-based teaching insist that there is a difference between "brain-compatible" education and "brain-antagonistic" teaching practices and methods, which can actually impair learning.

Brain-based learning sometimes called Brain-compatible is an educational approach based on what current research in neuroscience suggests about how our brains naturally learn best (Lucas, 2004). The learning strategy derived from this research can easily be integrated into any learning environment, from a kindergarten classroom to a seminar for adult.

With new technologies that allow scientists to observe the brain functions as they occur, we are gaining insights into how the brain learns, assimilates, thinks and remembers. From these findings, an approach to education called the brain-based learning has evolved.

This instructional strategy is based on the structure and functions of the brain. Lucas (2004) asserts that as long as the brain is not prohibited

from fulfilling its normal processes, learning will occur since everyone is born with a brain that functions as an immensely powerful processor. Understanding how the brain learns and relating it to the educational field resulted in the concept known as brain-based learning. It is defined as any teaching strategy that utilizes information about the human brain to organize how lessons are constructed and facilitated with emphasis placed on how the brain learns naturally.

Research evidence suggests that the adoption of learner-centred strategy based on the structure and function of the brain can improve learners' academic performance (Sousa, 2008; Adebayo, 2005; Lucas, 2004; Lacknewy, 2003).

The theory of the brain-based learning is based on the structure and function of the brain. As long as the brain is not prohibited from fulfilling its normal processes learning will take place (Lucas, 2004). Brain-based learning requires a more systematic way of conceptualizing how learning takes place and how to facilitate it. In essence, the present study is based on the core principles of brain-based learning by implication these core principles are offered as a general theoretical foundation for brain based learning. These principles are simple and neurologically sound. Applied to education, however, they help us to reconceptualize teaching by taking us out of traditional frames of reference and guiding us in defining and selecting appropriate programs and methodologies.

Student's cognitive styles have been found to mediate learning (Ige, 2001). Most of the differences encountered in students' learning could be described in terms of different manners in which students perceive and analyze a stimulus configuration (i.e. their cognitive styles). Each individual responds differently when exposed to a stimulus world. Some act on first impulse, some examine isolated components of what is presented to them before responding while others respond on the basis of contextual or holistic manner (Olajengbesi, 2006). This calls for its better understanding by the teacher in his/her choice and usage of teaching strategies. The present study investigated through quasi-experimental design, the interactive effect of brain-based instructional strategy and Cognitive Style on students' attitude to Senior Secondary School Mathematics in Oyo State, Nigeria.

Method

Research Design

The design consisted of two treatment groups (Brain-Based Instructional Strategy and Conventional Instructional Strategy), Moderator Variables of Mathematics Anxiety at three levels (low, medium and high) and Cognitive Style at two levels (analytic and non-analytic).

The division of intact classes to different treatments (instructional strategy) was employed because they are believed to consist of natural clusters, having similar age, height, academic background and other attributes. In using this design, two intact groups of participants were randomly assigned to experimental group and control group respectively.

Two intact groups were involved in the study viz: experimental group and control group. Participants in each group were pre-tested on the dependent variables and thereafter exposed to different treatments.

The experimental group was exposed to the Brain-Based Instructional Strategy while the control group was exposed to the Conventional Method. The participants in both groups were post-tested after the application of treatments. The target population was all senior secondary school class two Mathematics students in Oyo State, Nigeria.

Sample and Sampling Procedure

Five hundred and twenty-two senior secondary two (SS II) students were involved in this study. Three zones were randomly selected from the four zones that make up the Oyo North Senatorial District of Oyo State. Stratified random sampling procedure was used in selecting nine schools: five schools from urban and four from rural areas of the three zones selected for the study. Five of the schools were randomly assigned to experimental groups and four as control groups. In each of the nine sampled schools, only two randomly selected intact classes (SS II) were involved in the study.

Research Instrument

The following three instruments were used for data collection and they are:

- Mathematics Attitude Questionnaire (MAQ)
- Cognitive Style Test (CST

Mathematics Attitude Questionnaire (MAQ)

This is an instrument of twenty items that elicits information from the participants on their attitude towards Mathematics. The instrument is made up of two sections. A and B, section A is designed to elicit responses in relation to student's name, age, gender, class and name of school. Section B is made up of twenty items (ten positive and ten negative statements), requesting participants to indicate their attitude towards the study of mathematics based on a four-point Likert Scale. Each participant was requested to tick an appropriate option weighted as follows:

Strongly agreed (SA) – 4; Agree (A) – 3 Disagreed D = 2; Strongly disagreed = 1. This rating was meant to reflect how the participants felt about the particular statement.

Cognitive Style Test (CST)

This is a reasoning test used to measure how students choose and analyze set of pictures of common objects, animals, plants or artifacts for the purpose of classifying them. The language he or she uses in categorizing these phenomena presumably reflects each individual's style of categorization. The Cognitive Style Test (CST) is a modified version of the Cognitive Style Test developed by Sigel (1967). The modification and validation were done by Onyejiaku (1980) to reflect Nigerian environment as cited by Afuwape (2002).

The CST consists of twenty cards numbered 1 to 20. Each card contains three pictures in black and white, two of which could have one thing or the other in common or could go together in some ways. The CST was used to classify the students into 'analytic' and 'non-analytic' styles on the basis of their statements regarding the way they perceive the pictures. The students were asked to respond to each set of three pictures by noting how any two of the three pictures in the set go together or are related in any way. The statements made by the students regarding the way they perceived the pictures and classified any two together could be categorized into three thus:

- Analytic Descriptive (AD);
- Categorical Inferential (CI) and;
- Relational Contextual (RC)

Analytic Descriptive Responses

Students here place together objects based on their shared or common characteristics, which are directly discernible. Example, in a card containing a man, a bed and a chair, participants here place together bed and chair because "they are made of wood".

Categorical Inferential Responses

Participants here, place together objects on the basis of super ordinate features, which are not directly discernible (abstract), but are inferred. Example, participants here will place a bed and chair together because "they are for relaxation".

Relational Contextual Responses

Participants here, place together objects or events on the basis of features establishing a relational link between them. The two stimuli or objects here are independent conceptionally, rather each derives meaning from the other. Hence, this style is sometimes called global or holistic or contextual mode of categorization. Example, participants here will place together "the man and the bed" or "the man and the chair" on the ground that, "the man can sit on the chair" or "sleep on the bed".

In this study, analytic style participants were those who scored above the median on Analytic Descriptive and Categorical Inferential responses and below the median on Relational Contextual responses. Non-analytic style participants were those who scored above the median on Relational Contextual responses and below the median on Analytic Descriptive and Categorical Inferential responses.

Table 1: Table of Specification for CST

S/n	Content Area	Responses	Number of Items
1.	Analytic Descriptive Responses	Placing objects of common characteristics together	7
2.	Categorical Inferential Responses	Placing objects together on the basis of super ordinate features which are not directly discernable but are inferred	7
3.	Relational Contextual Responses	Placing objects/events together on the basis of features establishing a relational link between them.	6
	TOTAL		**20**

Source: Afuwape (2002); Sigel (1967)

Coding For Cognitive Style Test

Analytic Descriptive (AD)	-	1 point
Categorical Inferential (CI)	-	2 points
Relational Contextual (RC)	-	3 points

- Participants whose total score was above the median on AD and CI responses and below the median on RC responses were categorized as Analytic students.
- Participants, whose total score was above the median on RC responses and below the median on AD and CI responses were categorized as Non-Analytic students (Median = 10.05).

Research Questions:

1. What is the pretest and posttest mean scores of attitude to Mathematics scores of students exposed to Brain-Based Learning and Conventional Strategies?
2. What is the pretest and posttest mean scores of attitude to Mathematics scores of (i) low, (ii) medium and (iii) high mathematics anxiety groups?

Hypothesis

Based on the stated problem, the following hypothesis was generated and tested at 0.05 alpha levels of significance.

HO_1: There is no significant interaction effect of treatment and cognitive style on students' attitude towards Mathematics

Procedure

Pre-Experimental Activities

Training of Research Assistants: The researcher appointed and trained twelve research assistants; they were trained on the nature and purpose of the Brain-based Instructional Materials. Essentially, the research assistants were needed in the areas of administration of pre-test and post-test, organization and arrangement of research materials.

Pre-Test Administration

The following instruments were administered as pre-test in that order before the commencement of treatment

(i) Cognitive Style Test (CST)
(ii) Mathematics Attitude Questionnaire (MAQ)

The research questions were answered using mean scores and standard deviations to explain and compare pretest scores of the experimental and control groups in all the criteria measured.

Data Analysis

Data collected were analyzed using descriptive and inferential statistics. Inferential Statistics of Analysis of Covariance (ANCOVA) was used to test the hypothesis and estimate the effects of various factors on the dependent variables. The Multiple Classification Analysis (MCA) was used to determine the mean scores of students in various groups. Scheffe post-hoc test was used to determine the source of the significance and see the direction and the amount of variations due to each independent variable.

Results

Research Question 1: What is the pretest and posttest mean scores attitude to Mathematics scores of students exposed to Brain-Based Learning and Conventional Strategies?

Table 2: Attitude mean scores of students exposed to Brain-based learning and Conventional strategies

Treatment		ATTITUDE	
		X	**SD**
Experimental	Pretest	52.47	10.66
	Posttest	57.36	13.59
Control	Pretest	54.81	15.96
	Posttest	56.13	14.87

Table 2 showed that the pretest and post-test mathematics attitude scores of students in the experimental group were 52.47 and 57.35 with corresponding standard deviations of 10.66 and 13.59 while that of the control group were 54.81 and 56.13 with corresponding standard deviations of 15.96 and 14.87 respectively. The results revealed that there was an improvement in the posttest means scores of the students in the experimental group. This indicated that treatment actually had influence on students' attitude to Mathematics in the experimental group.

Research Question 2: What is the pretest and posttest mean scores of attitude to Mathematics scores of (i) low, (ii) medium and (iii) high mathematics anxiety groups?

Table 3: Attitude mean scores of low, medium and high Mathematics anxiety groups

Mathematics Anxiety Group		Attitude	
		X	**SD**
Low	Pretest	54.86	11.15
	Posttest	59.11	11.47
Medium	Pretest	53.48	12.84
	Posttest	55.30	15.03
High	Pretest	48.25	21.63
	Posttest	53.83	18.83

Table 3 showed that the pretest and posttest mathematics attitude mean scores of students in low, medium and high mathematics anxiety groups were 54.86 and 59.11; 53.48 and 55.30; and 48.25 and 53.83 respectively. The result indicated that students with low mathematics anxiety recorded the highest score on test attitude, followed by the medium mathematics anxiety while high Mathematics anxiety group obtained the lowest attitude scores in Mathematics. The Brain-Based Learning Strategy was more effective in promoting the attitude of the low and medium mathematics anxiety groups while the attitude of the high mathematics anxiety groups was best improved through the conventional method.

Table 4: Summary of 2 × 3 × 2 ANCOVA of Post-Attitude Mean Scores of Students by Treatment, Cognitive Style and Anxiety Test Score

Source of Variance		Experimental Method				
		Sum of Squares	df	Mean Square	F	Sig. F
Covariates	Pre-Attitude Score	4075.624	1	4075.624	24.41107	0.000
Main Effects	(Combined)	1536.373	4	384.093	2.300537	0.062
	Treatment	293.966	1	293.960	1.760682	0.189
	Cognitive Style	73.383	1	73.383	0.43953	0.512
2–Way Interactions	(Combined)	2177.479	2	435.496	2.608416	0.027
	Treatment × Cognitive Style	13.320	1	13.320	0.079781	0.780
Residual		86818.015	520	170.231		
Total		**94718.245**	**522**	**181.453**		

*Significant at $p < 0.05$

$H_0$1: There is no significant interaction effect of treatment and cognitive style on students' attitude towards mathematics.

Table 4 showed that there was no significant interaction effect of treatment and cognitive style on students' attitude towards mathematics ($F_{(1,510)} = 0.078$; $p>0.05$). Therefore, the null hypothesis one was not rejected.

Discussion and Recommendations

Findings showed that there was no significant interaction effect of treatment and cognitive style on students' attitude towards Mathematics. However, this interaction was significant on students' achievement in Mathematics. This later result confirms the assertion of researchers (Olajengbesi, 2006; Afuwape 2002) that the personal variable of cognitive style interacts with instruction to produce results. This result implies that the treatment is sensitive to students' cognitive style on attitude to mathematics. In other words, understanding and utilizing the core principles of Brain-Based Instructional Strategy to teach students of

different cognitive styles in order to show the desired learning outcomes becomes inevitable. Also, analytic cognitive style students more than non-analytic are very critical in their reasoning and are able to distinguish figures as discrete from their background and this may have enhanced their attitude towards Mathematics.

Recommendations

Based on the findings of this study, the following recommendations are made;

- To improve students' attitude in Mathematics, innovative strategy such as Brain-Based Instructional Strategy should be adopted in secondary schools.
- The findings of the study revealed that students' cognitive style was important in determining their attitude in Mathematics, teachers of Mathematics should therefore endeavour to design lesson plans capable of enhancing the performance(s) of students with varied cognitive style levels.
- Teachers of Mathematics should endeavour to take cognizance of "prime times" during any teaching-learning process. For example, in a 40-minute period, students' attention is strongest for the first 20 minutes, then the brain needs "down times" for approximately 10 minutes (Brain's downshifting is like a camera that has a reduced focus). The next ten minutes is the next best teaching time. Teachers of Mathematics should adopt the strategy because:

(i) Analytic Cognitive Style students derive maximum benefits from the application of the strategy.

(ii) To boost students' attention, encoding and retrieval process, teachers of Mathematics, should encourage "peer teaching" and "elaborate rehearsal" among students. Studies have shown that learners will remember content more if it is moved from "short-term memory" to "long-term memory".

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