TRANSFORMING THE BASIC SCIENCE CLASSROOM THROUGH MATCHING OF APPROPRIATE INSTRUCTIONAL STRATEGIES WITH STUDENTS LEARNING STYLES: EMPIRICAL EVIDENCE FROM UPPER BASIC SCHOOLS IN JALINGO, TARABA STATE

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ABSTRACT

This study investigated transforming the basic science classroom through matching of appropriate instructional strategies with students learning styles using the empirical evidence from upper basic schools in Jalingo, Taraba State. Two research questions and two hypotheses guided the study. This study adopted the experimental research design with two experimental groups and two control groups. A sample of 238 Upper Basic Two students from eight Upper Basic School in Jalingo, Taraba State was used. The Experimental group I was taught Basic Science using video demonstration instructional strategy and the control group I was taught using the conventional discussion method. The Experimental group II was taught Basic Science using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy. A pretest was administered to the subjects before the commencement of treatment. Treatment lasted for three weeks and thereafter a post-test was administered to all the groups. Data were collected using two instruments, namely the Learning Style Preference Questionnaire (LSPQ) and the Basic Science Performance Test (BSPT). The LSPQ was used mainly to identify the students preferred learning styles and assigned them to groups. The BSPT was used to measure students' academic performance in Basic Science. The data collected were analyzed using mean and standard deviation to answer the research questions while the hypotheses were tested using ANCOVA. The results indicated that matching instructional strategy with students learning styles enhanced academic performance. Based on the findings of this study, the

researchers concluded that matching of appropriate instructional strategies with students learning styles enhanced academic performance. In accordance with the findings of this study the researchers recommended that Basic Science teachers should identify students learning styles and accordingly match instructional strategy with students learning styles to enhance academic performance and that Upper Basic School administrators to classify students according to their learning styles. Students with same or similarly learning styles should be classified in one class and teachers should be informed to use instructional strategies that aligned with the students learning styles.

Introduction

It is an established fact that students learn in varyingly styles which are termed learning styles. Every student has at least one preferred learning style. Knowing the way students think and how they learn are critical during the design and application of classroom instruction in order to get the best students' academic performance. A student's learning style refers to the preferential way in which the student absorbs, processes, comprehends and retains information. Ossai (2012) sees learning style as the method that an individual has come to get used to for acquiring, processing and storing new information and skills. In other words, learning style represents the approach of the individual to the learning process and the individual's general attitude. In the view of MacKeracher (2004), learning styles is a characteristic cognitive, effective, and psychosocial behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Brown (2000) defines learning styles as the manner in which individuals perceive and process information in learning situations. Brown further argues that learning style preference is one aspect of learning style, and refers to the choice of one learning situation or condition over another. What determines style in this process is the unique style of perception of the individual and interaction with the learning mediums.

Scientists and psychologists have developed different models to understand the different ways that humans learn best. For instance, the visual, auditory, reading-writing and kinesthetic (VARK) model identifies four primary types of learning styles**: visual, auditory, reading/writing, and kinesthetic**. Each learning style responds best to a different method of teaching (*Leite, Svinicki &*

Shi, 2010). All learning styles theories and classifications postulate that learners will respond better to a teaching style that is aligned with their learning style. The visual learners learn best by looking at graphics, watching a demonstration, or reading. For them, it's easy to look at charts and graphs, but they may have difficulty focusing while listening to an explanation. The auditory learners would rather listen to things being explained than read about them. Reciting information out loud and having music in the background may be a common study method. Other noises may become a distraction resulting in a need for a relatively quiet place. Reading and writing learners prefer to take in information displayed as words. Learning materials that are primarily text-based are strongly preferred by these learners. The kinesthetic learners on the other hand process information best through a "hands-on" experience. Actually doing an activity can be the easiest way for them to learn. Sitting still while studying may be difficult, but writing or drawing things down makes it easier for them to understand. According to Murat (2013), common learning styles such as diverging, assimilating, converging and accommodating could also fall under visual, auditory and kinesthetic or tactile learners.

So it is important for teachers to understand the differences in their students' learning styles so that they can implement best practice strategies in their instruction to enhance students' academic performance and classroom participation. According to Zapalska and Dabb (2002), an understanding of the way students learn improves the selection of teaching strategies best suited to student learning. Felder and Silverman (1988) claim that student learning is determined by the student's ability, the student's background and the match between the student's learning style and the teacher's instructional strategies. Felder and Silverman (1988) further concluded that teachers can do nothing about students' given characteristics such as ability, background and learning styles. Therefore, in order to maximize students' academic performance, teachers should adjust their instructional strategies to fit students' learning styles. Waks (1995) takes into consideration the match between learning styles and instructional strategy as part of the model for curriculum design. Waks (1995) raises numerous questions concerning the instructional strategy-learning styles match. The question whether good matching indeed improves the learning process is the subject of this research.

The idea of matching students' learning styles with teachers' instructional strategies is known as the 'Matching Hypothesis'. The Matching hypothesis is the belief that the closer the congruence between the students' learning style preference and the teachers' teaching strategy (style), the higher the level of student achievement. People find it easier when they receive information or data the way they process it. Individualizing instruction to meet learning styles preferences is an idea first put forth in the 1960s by Cronbach and Snow (1977) and has since been widely used by many educational theorists. Specifically, Massa and Mayer, (2006) posited that a student will learn best if taught in a method that matches his or her learning style preference. All students have their own learning style(s), learning strengths, and learning weaknesses, and a mismatch between teaching and learning styles could lead to learning failure, frustration, and demotivation. Furthermore, matching learning styles with teaching strategies can lead to decreased anxiety and increased satisfaction for both teachers and students.

In order to understand students' learning styles, a teacher must understand how students approach a learning experience, how they process information from that experience, how they evaluate the experience, and how they use the information and the skills gained from the experience in real-life situations. As described above, many researchers and educational theorists argue that tailoring lessons to match students' learning styles improves student outcomes (Filiz & Sevine, 2016). Creating lesson plans that appeal to students' learning style preferences holds their interest and allows them to see the relevance of the lesson to their everyday lives (Babadogan, 2000). Matching students' learning styles with learning activities can also improve classroom management. Furthermore, helping students understand their learning styles allows them to identity strategies that they can use to improve their own learning and reduces student anxiety. It is essential to return the focus to teaching students and helping them become successful the art of instruction, trusted to develop and use their skill and intuition, and encouraged to implement strategies that meet the children's needs (Martin, 2010). In order words, matching instructional strategy with learning styles is one way of teaching students in accordance with their individual differences and needs.

However, there is dearth of empirical evidence in support of the hypothesis that matching instructional strategy with students' learning styles enhances

students' academic performance especially in Taraba State. Thus it has become necessary to conduct an empirical study to further test the efficacy of the "matching hypothesis with the hope that if it prove to enhance students' academic performance, then the Basic science classroom would be transformed to one that teachers match instructional strategy with students' learning styles.

Statement of the Problem

The study of learning styles has received significant attention in recent years, and in a time when academic performance is under scrutiny, it is vital that educators know and utilize the best possible methods for helping students learn successfully and improve academic performance in Basic Science. One of such measure to help improve students' academic performance is by matching instructional strategy with students' learning styles. It has been hypothesized that students' performance can be enhanced if teachers match instructional strategy with students' learning styles. However, despite the knowledge of learning styles and the advantages of the matching hypothesis, Basic Science teachers in Taraba State seem not to apply this in their teaching of Basic Science. In one classroom, there may be students who are visual, auditory, reading-writing and kinesthetic learners. The needs of these students are different based on their learning styles but they are taught under same conditions using the same teaching method. This may likely affect the academic performance of the students.

Also, while the support for the matching hypothesis has been reported in many studies (Bhatti & Bart, 2013; Gokhan & Beyhan, 2013 and Tulbure, 2012), criticisms are still leveled at the hypothesis. Critics such as Rogowsky, Calhoun and Tallal (2014); Pashler, McDaniel, Rohrer and Bjork (2008) argue that there is limited empirical evidence to support the matching hypothesis because few studies in this area utilize appropriate experimental designs. In addition, critics argue that learning should be holistic in nature and not focus on one or two learning style preferences. Matching teaching strategies to an individual's learning style preference plays to their strengths and does not encourage them to improve in their areas of weakness. Thus, it become imperative to investigate whether matching instructional strategies with students' learning styles would transform the Basic science classroom into one that would produce students' higher academic performance.

Objectives of the Study

This study focus on transforming the basic science classroom through matching of appropriate instructional strategies with students learning styles. The specific objectives are to:

1. Determine the mean difference between students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method.
2. Determine the mean difference between students with auditory learning styles taught Basic Science using audio supported zig-saw strategy and those with the auditory learning styles taught using the demonstration strategy.

Research Questions

This study was guided by two research questions

1. What is the difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method?
2. What is the difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported zig-saw strategy and those with the auditory learning styles taught using the demonstration strategy?

Research Hypotheses

The following hypotheses were tested at 0.05 level of significance

1. There is no significant difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method.
2. There is no significant difference between the mean performance scores of students with auditory learning styles taught Basic Science

using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy.

Research Methods

This study adopted the experimental research design with two experimental groups and two control groups. A sample of 238 Upper Basic Two students from eight Upper Basic School in Jalingo, Taraba State was used. The eight schools were selected using random sampling technique while the students were selected using purposive sampling technique after administering the Learning Style Preference Questionnaire (LSPQ). The learning Style Questionnaire was administered to intact classes in the selected schools. After identifying students learning styles through the LSPQ, 43 students with visual learning style were assigned to experimental group I while 41 visual learners in another school were assigned to control group I. Also 79 students with auditory learning style in one school were assigned to experimental group II while 75 students with auditory learning style were assigned to control group II. The Experimental group I was taught Basic Science using video demonstration instructional strategy and the control group I was taught using the conventional discussion method. The Experimental group II was taught Basic Science using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy. A pretest was administered to the subjects before the commencement of treatment. Treatment lasted for three weeks and thereafter a post-test was administered to all the groups.

Data were collected using two instruments, namely the Learning Style Preference Questionnaire (LSPQ) and the Basic Science Performance Test (BSPT). The LSPQ was used mainly to identify the students preferred learning styles and assigned them to groups. The BSPT was used to measure students' academic performance in Basic Science. The data collected were analyzed using mean and standard deviation to answer the research questions while the hypotheses were tested using ANCOVA.

Results

The results are presented according to the research questions and hypotheses.

Research Question One

What is the difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration

instructional strategy and those with visual learning style taught using the conventional discussion method?

Analysis of data to answer research question one is presented in Table 1.

Table 1: Mean Performance Scores of Students with Visual Learning Styles taught Basic Science using Video Demonstration Instructional Strategy and Conventional Discussion Method.

Group	N	Pre-test Mean	SD	Post-test mean	SD	Mean gain
Experimental Group I	43	35.10	9.20	62.00	13.39	26.9
Control Group I	41	34.00	9.01	48.98	13.85	14.98
Mean Difference		1.10		18.45		11.92

Result in Table 1 reveals that students in experimental group I have a mean performance score of 35.00 in pretest and 62.00 in post-test and standard deviation of 9.01 in pretest and 13.85 in post-test while those in the control group I have a mean performance score of 34.00 in pretest and 48.98 in posttest and standard deviation of 9.20 in pretest and 13.39 in posttest. The mean gain for students in the experimental group I was 26.9 while that of the students in the control group I was 14.98. The mean difference was 18.45 in favour of the experimental group I. Therefore, the difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method was 18.45.

Research Question Two

What is the difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported zig-saw strategy and those with the auditory learning styles taught using the demonstration strategy?

Analysis of data to answer research question two is presented in Table 2.

Table 2: Mean and Standard Deviation Scores of Students with Auditory Learning Styles taught Basic Science Using Audio Supported Zig-Saw Strategy and Demonstration Strategy

Group	N	Pre-test Mean	SD	Post-test mean	SD	Mean gain
Experimental Group II	79	34.29	11.03	54.25	15.03	19.96
Control Group II	75	33.84	11.34	40.80	15.34	6.96
Mean Difference		0.45		13.45		13.00

Result in Table 2 reveals that students in the experimental group II have a mean performance score of 34.29 in the pre-test and 54.25 in the post test with standard deviation of 11.03 in the pretest and 15.03 in the post test while those in the control group II have a mean performance score of 33.84 in the pretest and 40.80 in the post test with standard deviation of 11.34 in pretest and 15.34 in the post test. The experimental group II have a mean gain of 19.96 while the control group II have a mean gain of 6.96. There was a mean difference of 13.00 in favour of the experimental group II. Therefore, the difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported zig-saw strategy and those with the auditory learning styles taught using the demonstration strategy was 13.00.

Research Hypothesis One

There is no significant difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method.

Data to test hypothesis three are presented in Table 3.

Table 3: ANCOVA Result of Visual Learning Styles Students taught Basic Science using Video Demonstration Instructional Strategy and those with Visual Learning Style taught using the Conventional Discussion Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13590.24	2	6795.12	106.51	.000
Intercept	12057.20	1	12057.20	188.99	.000
Perftest	10159.47	1	10159.47	159.25	.000
method	347.95	1	347.9	5.45	.022
Error	5167.50	81	63.79		

Total	265975.00	84
Corrected Total	48012.136	83

Table 3 reveals that F(1,63.79)=5.45 with p-value of 0.02 which is less than 0.05 level of significant set for this study. The hypothesis is therefore rejected. This implies that there is a significant difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method.

Research Hypothesis Two

There is no significant difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy.

Table 4: ANCOVA Result of Students Mean Scores of Auditory Learning Styles Students taught Basic Science using Audio Supported Jig-Saw Strategy and Demonstration Strategy

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	26633.15	2	13316.58	94.06	.000
Intercept	27202.78	1	27202.78	192.13	.000
perftest	13635.96	1	13635.96	96.31	.000
method	7316.14	1	7316.14	51.67	.000
Error	21378.99	151	141.58		
Total	371947.00	154			
Corrected Total	48012.136	153			

Table 4 reveals that F(1,151) = 51.67 with p-value of 0.00 which is less than 0.05 level of significant set for this study. The hypothesis is therefore rejected. This implies that there is a significant difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy

Discussion of Findings

This study investigated the possibility of transforming the Basic Science classroom through matching of appropriate instructional strategies with students learning styles using empirical evidence from Upper Basic schools in Jalingo, Taraba State. The findings indicated that there is a significant difference between the mean performance scores of students with visual learning styles taught Basic Science using video demonstration instructional strategy and those with visual learning style taught using the conventional discussion method. Also there is a significant difference between the mean performance scores of students with auditory learning styles taught Basic Science using audio supported jig-saw strategy and those with the auditory learning styles taught using the demonstration strategy. The two findings of this study clearly show that matching instructional strategy with students learning styles enhances academic performance. This finding collaborate with that of Bhatti and Bart (2013), Gokhan and Beyhan, (2013) and Tulbure, (2012) who also found that matching of instructional strategy with students learning styles enhanced students' academic performance criticisms are still leveled at the hypothesis. The findings however disagreed with that of Rogowsky, Calhoun and Tallal (2014) and Pashler, McDaniel, Rohrer and Bjork (2008) who found that matching of instructional strategy with students learning styles do not enhanced students' academic performance. The finding that matching instructional strategy with students learning styles enhance academic performance is possible because a student will learn best if taught in a method that matches his or her learning style preference. These findings further support the matching hypothesis. The Matching hypothesis is the belief that the closer the congruence between the students' learning style preference and the teachers' teaching strategy (style), the higher the level of student achievement.

Conclusion

Based on the findings of this study, the researchers concluded that matching of appropriate instructional strategies with students learning styles enhanced academic performance.

Recommendations

In accordance with the findings of this study the researchers recommended that:

i. Basic Science teachers should identify students learning styles and accordingly match instructional strategy with students learning styles to enhance academic performance.

ii. Upper Basic School administrators to classify students according to their learning styles. Students with same or similarly learning styles should be classified in one class and teachers should be informed to use instructional strategies that aligned with the students learning styles.

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