Influence of Cognitive Styles and School Location on Academic Achievement of Students Interest in Biology

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ABSTRACT

The study investigated the influence of cognitive styles and school location on academic achievement of students' interest in Biology. The study was carried out in Onitsha education zone of Anambra State. Two research questions and two null hypotheses tested at 0.05 level of significance guided the study. An ex-post facto research design and a population of 10,000 (SSII) Biology students in the thirty-two government owned secondary schools in Onitsha education zone. A samples size of 540 Biology students (265 males and 275 females) drawn from four schools, two (2) schools from urban areas and two (2) schools from rural areas in Onitsha education zone. The schools were sampled using disproportional stratified random sampling technique. Two instruments were used for data collection namely: Group Embedded Figure Test (GEFT) and Biology Interest Inventory Scale (BIIS). GEFT was adopted used to access students' cognitive styles. it is a standardized instrument with a reliability of 0.89 on a test-re-test method. BIIS was a multiple-choice questions developed by the researchers. BIIS content validity was ensured by a test blue print while face validity was ensured by two biology educators and expert in measurement and one Evaluation from Science Education Department, University of Nigeria, Nsukka. The reliability coefficient of BIIS was established using Cronbach Alpha which gave 0.86. Mean and standard deviation was used to answer research questions, while one-way Analysis of variance (ANOVA) was used to test the null hypotheses. Result showed among others: that cognitive styles and school location had a significant influence on students' interest mean achievement in Biology. Recommendations and conclusion were highlighted.

Keywords: *Cognitive Styles, School Location, Achievement of Students' Interest, Biology*

INTRODUCTION

The overall sustainable development of any nation depends on the level of scientific and technological literacy of her citizens. The level of scientific and technological development of a nation depends on a qualitative and functional science, technology and mathematic (stm) education. It is through qualitative and functional STM education that appropriate scientific, technological and technical skills are transmitted to students, [1].

Nevertheless, Biology as one of the STM education prepares students for future careers such as: nursing, pharmacy, medicine, dentistry fisheries etc. Biology is the fulcrum on which all sciences and technology disciplines and careers are hinged for national development [2]. This is because biology is a branch of science that deals with the study of life ie living things and non-living things. Biology undoubtedly improved the quality of our lives. Some important achievements of applied biological research include: (a) Organ transplant, (b) development of vaccines and drugs for preventing and curing many serious diseases. (c) In-vitro fertilizations (IVF) which helps infertile couple to have children and (d) production of hybrid crop plants and farm animals with desirable qualities [3].

Despite, the several importance of biology to national development and careers available for people with qualifications in Biology, students still perform poorly in biology at secondary school level, [4]. The West African Examination Council (WAEC) Chief examiner's report has shown that results released in the year 2016, revealed that students had a raw mean score and a standard deviation of 13.89 in biology 2 (Essay). This indicates that the achievement of candidates was

poorer than that of May/June certificate Examination (WASSCE) result, with a mean score of 32 and a standard deviation of 18.39. In response to the poor achievement of students in biology, several efforts have been made by biology educators [5], [6] to improve secondary school students' interest and performance in biology. Some of such efforts include; recommendation of the use of discovery and demonstration strategies in the teaching and learning of biology in secondary schools. The factors that could cause poor performance and lack of interest in biology may be students' cognitive styles of processing biology information and school location.

Cognitive styles are psychological constructs which describe individuals' mode of information perception, organization and representation [7]. It is strategies determining a person's typical modes of perceiving, remembering, thinking and problem-solving [8].

Cognitive styles have been studied in four perspectives namely: reflective-impulsive, field-dependence, field, independence, holistic-sevialist and deep-level surface level processing. Two cognitive styles of field-dependence (FD) and field-independence (FI) were studied in this paper. The two styles were studied because they are the commonest and frequently used styles for categorizing students' mental ability into FD and FI with the use of Group embedded Figure Test (GEFT) [9]. Study by [10] revealed that students who are field-dependent (FD) learners tends to be global in the analysis of learning situations and have difficulty in breaking information into isolated parts; perceive an item as discrete from its background; nor can they impose structure when it is lacking in content. Field-dependent (FD) learners may prefer more direct instruction or definition of the material in situations that involve restructuring abilities. They also seem to be incidental learners in social contexts and have difficulty using initiation.

Conversely, students that are field independent learners tend to be more analytic, solve complex problem and isolated facts. They can separate relevant elements from a distracting or confusing background. They prefer working alone, flexible in learning situations and self-reliant, reflective, task-oriented and concerned with mastery of concepts.

Some of the results of related studies showed that field independent learners are generally more superior than their field dependent counter-parts in Biology academic achievements [11]. [12] revealed that cognitive styles of dependence-independence students' significantly influenced achievements in biology. [13] found out that field independent students performed better than the field dependent students in practical biology. Cognitive styles are students' preferred ways of thinking about learning task. It is the way students think and perceive information. It can influence students' interest in a learning task and achievement. Thus, the idea of individual differences in mode of processing information has spurred up the feeling that cognitive style could influence students' interest in biology.

Interest is a feeling or emotion that causes attention to be focused on an object, event or process [14]. Individual interest is a drive, a motive or a force that propels ones action in a certain way and cannot be dissociated from cognitive styles. Individual interest could be influenced by field independence cognitive learning style, while situational interest could be influenced by field dependence cognitive learning styles. [15] are of the view that individual interest is characterized with an intrinsic desire to understand a particular topic that persist over time, while situational interest, is assumed to be transitory, environmentally activated and context specific. Situational interest for example influence students' engagement with the learning task and the willingness to persist in the task (e.g. attention, effort, persistence and acquisition of knowledge, [6]. Thus, interest could influence students' engagement, willingness and persistence in learning task.

Some environmental factors, models laboratory apparatus and equipment could help to trigger and sustain interest when students are involved in practical activities that help them to learn Biology.

Hence, school location could influence a child's interest and learning opportunities. School location refers to a community in which the school is located such as village, hamlet or rural areas, a city, town or urban area [9]. Weeks (2010) opined that urban area is the transformation of the natural and agricultural environment into a built environment characterized with places like: power stations, water co-operations, pharmaceutical industries, zoological garden, amusement centres, and stadia etc, while schools in rural areas tends to have natural and agricultural environments: like bushes, farms and local industries such as: black-smith workshops, clay pot pottery workshops, local basket and mat makers etc. [3], stated that urban schools are more favoured than rural schools in terms of number of teachers, basic infrastructures and instructional materials. School location in this study are categorized into urban and rural school respectively. [1], revealed that ethno-scientific teaching approach has

significantly affected attitude of students to sciences while, [3],stated that method of field trip had significant influence on cognitive achievement and interest mean sources of pupils with different school location in environment concepts in primary school. The concern about potential urban-rural differences in educational outcomes is not limited to one country; rather it appears to be a global issue [12]. Hence, there is the need to investigate how cognitive styles and school location could influence students' interest in Biology.

Research Questions: Two research questions guided the study:

(1) What is the influence of cognitive learning styles on the interest mean achievement scores of students' in biology?

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(2) What is the influence of school location (urban or rural) on the interest mean achievement scores of students with different cognitive styles in biology?

HYPOTHESES

Two null hypothesis was formulated to guide the study and was tested at 0.05 level of significance.

HO_1: Cognitive Styles have no significant influence on the interest mean achievement scores of students' in biology.

HO_2: School location have no significant influence on the interest mean achievement scores of students with different cognitive styles in biology.

RESEARCH METHOD

This study was an ex-post facto research design. The study was carried out in Onitsha Education Zone of Anambra State. The population consisted of all the senior secondary two (SSII) Biology students numbering (10,000) ten thousand biology students in thirty-two government owned secondary schools in Onitsha education zone. The sample of the study consisted of 540 biology students (265 males and 275) females drawn from four government owned schools comprising of two (2) schools from urban areas and two (2) schools from rural areas in Onitsha education zone. The schools were randomly selected using disproportionate stratified random sampling technique, from the schools that satisfied the condition that their students were taught by qualified teachers over the

years. Two instruments were employed for data collection. The Group Embedded Figure Test (GEFT) and Biology interest Inventory Scale (BIIS).

GEFT is a non-verbal speed test, published by [11]. It is a test of student's ability to find a simple form where it is hidden within a complex pattern. Hence, it is used to assess the cognitive style of students as either field/dependent (FD), field intermediate (F, INT) and field independent (FI). GEFT has a score range of 0 to 18, a student that scores 0 to 6 is classified as field-dependent (FD) while 7 to 12 as field intermediate (F, I NT) and 13-18 as field Independent (FI). GEFT is a standardized instrument and according to [10] it has a satisfactory reliability of 0.89 on test-re-test over a three year period.

Biology Interest Inventory Scale (BIIS) is a thirty multiple-choice objective test developed by the researchers.

Each item has 5-option lettered A-E. The test was based on the units of the study in SSII biology curriculum used for the study. BIIS was used to asses the students' interest in Biology. The content validity of BIIS was ensured by constructing a test blueprint with items representing the areas and behaviours expected to be covered by SSII students. While it was also face validated by two biology educators and one experts in measurement and Evaluation from the science Education Department, University of Nigeria, Nsukka. The reliability of BIIS was determined by administering it on 30 SSII biology students of a secondary school in Enugu state. The Cronbach Alpha method, was used to analyze the scores and the result gave a reliability of 0.86 indicating that BIIS was reliable.

The method of administration of the instrument was on the spot administration with the help of two research assistance to ensure a 100% return. GEFT instrument was first administered to both urban and rural students.

The students were made to understand the instructions very well before working through the instrument. BIIS was administered last to both urban and rural students. The scripts from each students were collected, marked and the scores used for analysis. The research questions were analyzed using mean and standard deviation, while Analysis of variance (ANOVA) was used to test the null hypothesis at 0.05 level of significance.

RESULTS

The results of the study were presented sequentially, according to the research questions and hypotheses.

Research Question 1: What are the influence of cognitive learning styles on the interest mean achievement scores of students' in biology?

Table 1: Mean interest achievement scores and standard deviation of students with different cognitive styles in biology cognitive styles

Cognitive Styles	N	$\bar{\text{X}}$	SD
Field Independent (FI)	172	10213	10.75
Field Dependent (FD)	368	96.46	12.31
Mean Diff		5.67	

Table 1: Shows that the interest mean achievement scores of field independent cognitive styles students in biology was 102.13 with a standard deviation score of 10.75, whereas the mean scores of field dependent cognitive styles students in Biology was 96.75 with a standard deviation score of 12.31. The mean interest score difference between field independent cognitive styles students and field dependent cognitive .

style students was 5.67. This indicates that field independent cognitive styles students had higher interest. The higher standard deviation score of the field dependent students shows that their scores deviated more from the mean than that of the field independent cognitive students. This indicates that the observed higher mean score of the field independent may be real as it appears

Hypothesis 1: Cognitive Styles have no significant influence on the interest mean achievement scores of students in biology.

Table 2: Analysis of Variance (ANOVA) of interest mean achievement scores of students with different cognitive styles in biology.

Source of variance	Df	Sum of squares	Mean squares	F	Sig
Corrected model	7	5832.352	833.193	6.049	.00
Intercept	1	338916.302	3389616.302	4608.79	.00
Cognitive style	1	4281.411	4281.411	31.083	.00
Error	532	7327.713	137.740		
Total	540	293729.00			
Corrected total	539	7910.065			

Table 2 shows that an F-ratio of 31.083 with associated probability value of 0.00 was observed. This probability value of 0.00 was compared with 0.05 and it was found to be significant because 0.00 was less than 0.5 level of probability. The null hypothesis was therefore rejected and result drawn that cognitive styles have significant influence on students' interest mean achievement scores in Biology.

Research Question 2: What is the influence of school location (urban or rural) on the interest mean achievement scores of students with different cognitive styles in biology?

Table 3: Mean interest achievement scores and standard deviation of school location (urban or rural) on students with different cognitive styles in biology

Cognitive styles	N	$\overline{X}$	SD
Urban	404	196.71	21.48
Rural	368	204.31	25.77
Mean diff.		7.6	

Table 3 shows that the interest mean achievement scores of the urban school students was 196.71 with standard deviation score of 21.48 in biology, while the mean achievement scores of rural school students was 204.31 with standard deviation score of 26.77 in Biology. This indicates that the rural students had more interest in biology than the urban school students. The higher standard deviation of the rural school students shows that, the scores of the rural school students deviated more from the mean than that of the urban school students. This shows that the higher interest mean scores of the rural school students may not be real as it appears.

HO$_2$: School location have no significant influence on the interest mean achievement scores of students with different cognitive styles in Biology.

Table 4: Analysis of Variance (ANOVA) of school location influence on interest mean achievement scores of students with different cognitive styles in Biology.

Source of variance	df	Sum of squares	Mean squares	F	Sig
Corrected model	7	5832.352	833.193	6.049	.00
Intercept	1	338916.302	3389616.302	24608408.79	.00
Location	1	887.5641	887.564	6.444	0.1
Error	532	73277.713	137.7840		
Total	540	5293729.00			
Corrected total	539				

Table 4 shows that an F- ratio of 6.44 with associated probability value of 0.01 was obtained. This probability value of 0.01 was compared with 0.05 and it was found to be significant because 0.01 was less than 0.05 level probability. The null hypothesis was therefore rejected and inference drawn that school location has a significant influence on interest mean achievement scores of students with different cognitive styles in Biology.

DISCUSSION

The null hypothesis of no significant influence of cognitive styles on the interest mean achievement scores of students in biology was rejected. Calculated F-value of 31.083 is not significant at 0.00 but was significant at 0.05 level of probability. Therefore the null hypothesis was rejected and result drawn that cognitive styles have significant influence on students' interest mean achievement scores in Biology. The finding that cognitive styles have significant influence on students interest mean achievement scores in biology is in agreement with the findings of [5] who's studies revealed that cognitive styles of dependence independence students' significantly influenced achievements in biology

Also the null hypothesis of school location having no significant influence on the interest mean achievement scores of students in Biology was rejected. Calculated F-ratio value of 6.44 which was not significant at 0.01 but was significant at 0.05 level of probability. This was because 0.01 was less than 0.05 level of probability. Therefore, the null hypothesis was rejected and inference drawn that school location have a significance influence on interest mean achievement scores of students with different cognitive styles in Biology.

The finding that school location has a significant influence on interest mean achievement scores of students with different cognitive styles in biology is in agreement with finding of [4] who's study revealed that ethno-scientific teaching approach has significantly affected attitude of students in science. The finding of this study also is in line with the study of [7] who's study revealed that method of field trips had significant influence on cognitive achievement and interest mean scores of pupils of different school location in environmental concepts in primary schools. The relative effectiveness of cognitive styles influencing interest mean achievement scores in biology may be due to the personality characteristics associated with field-dependent and field independent that are quite different. Therefore, influence of cognitive styles and school location on interest mean, achievement scores of students in biology is not misleading.

CONCLUSION

The result of this study revealed that cognitive styles and school location had . a significant influence on students' interest mean achievement in Biology

RECOMMENDATIONS

Based on the findings of this study the following recommendations were made:

- Teacher education in the country should include the use of cognitive styles in teaching and in identifying learners learning problem n order to popularize t heir effectiveness in teaching biology.

- Government should endeavour to equip education sector with fund, staff and basic laboratory equipment to enable biology teachers to inculcate qualitative biology skills to students in both urban and rural areas of the country.

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