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Influence of Gender and Cognitive Styles on Students' Achievement in Biology

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Abstract

The study investigated the influence of gender and cognitive styles on students' achievement in biology in senior secondary schools in Anambra State. One research question and one null hypothesis tested at 0.05 level of significance guided the study. A causal comparative research design and a population of 12,000 (SSII) biology students in sixty-four government - owned secondary schools in Awka Education zone. The sample of the study consisted of 265 SSII biology students (141 males and 124 girls) drawn from four government owned schools comprising of two (2) boys and two (2) girls' school in Awka education zone. The sample was drawn using disproportionate stratified random sampling technique. Two instruments were employed for data collection namely: Group Embedded Figure Test (GEFT) and Biology Achievement Test (BAT). GEFT was used to access the cognitive styles of students as either field -dependent or field independent. It is a standardized instrument with a reliability of 0.89 on a test re-test method. BA T content validity was ensured by a test blueprint while face validity was ensured by two biology educators and one expert in measurement and Evaluation from

the science Education Department, University of Nigeria, Nsukka. The reliability coefficient of BAT was established using Cronbach Alpha which gave 0.86. Mean and standard deviation was used to answer the research question while one-way Analysis of variance (ANOVA) was used to test the null hypothesis. Result showed among others: that gender and cognitive styles has no significant, influence on achievement scores of students in biology. Recommendations and conclusion were highlighted.

Key words: Gender, Cognitive styles, Achievement, Biology

Introduction

The very important nature and relevance of biology made it a subject offered by both science and arts students at the secondary school level. Unfortunately, students perform poorly in biology examinations, Research had failed to identify reasons for poor performance and processes underlying individual differences in learning (Mclaughlin, 1999). As a result, there was increased focus on cognitive and perceptual functioning, which resulted in the identification of several learning styles of cognitive and perceptual processing.

Cognitive styles are psychological constructs which describe individual's mode of information perception, organization and representation (Hall, 2000). It also reflects an individual's preferred way of actively processing and transforming information, categorizing new knowledge and integrating it within the memory structure (Luk, 1998). There are different dimensions of cognitive styles. The cognitive styles variable considered in this study is that of field Dependence (ED) and Field Independence ((FI). Study by Witkin, Moore, Good Enough and Cox (1977) revealed that students who are field-dependent learning styles tend 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 learners prefer more direct instruction or definition of the material in situations that involve restructuring abilities. They also seem to be incidental learners in social content and have difficulty using initiation. Conversely, students that are field - independent learning styles tend to be more analytic, solve complex problem and isolate facts. They can separate relevant elements from a distracting or confusing background. They prefer working alone, are flexible in learning situations, self - reliant, reflective, task-oriented and are concerned with mastery of concepts. Some of the results of related studies (Achor, 2001; Anyigbo, 2004; Okwo and Tartiyus, 2006) showed that field independent learners are more superior than their field dependent counterparts in academic achievements. However there is paucity of research on the influence of cognitive styles on achievements in biology. Most of the studies in Nigeria that are directly concerned with biology achievements investigated the influence of other factors than cognitive styles. One of such factors is gender.

Gender is a socially ascribed attribute which differentiate feminine from masculine. The difference in biology achievement due to gender has caused a lot of concern to educationist. Adegboye (1998) explained that many parent do not want to spend as much on female education as that of maie children because of their social or cultural environment. This affects gender stereotype in schools. Hence, the need to study the differential influence of gender and cognitive styles on students' achievement in biology. Gender-related studies on secondary school students' achievement in biology contains contradictory results. While some studies (Ndirika, 2013; Aniodoh & Eze, 2014) reported that boys did better, other studies (Nwaiwu and Audu, 2005; Lorchugh, 2006) did not find either performing better. These inconsistencies arose probably because these studies were conducted with students of different classes such as (SS 1, SS 11 and SS 111), on different biology content areas and under different testing conditions, (such as objective essay, or practical). Also, the design of these studies, either as experimental, quasi-experimental or causal - comparative, and the use of immediate post-test or retention test may have contributed to this state of affairs. The need arises for new studies to take these variables into consideration in an attempt to build a body of more consistent evidence on the influence of gender and cognitive styles on students' achievements in biology.

Biology is the most natural popular science subject that is concerned with the study of life and their basic structures, functions, growth and so on, Therefore, the field-dependent-independent cognitive styles has been identified as one of the of those psychological constructs that may mediate treatment and achievement in biology. The poor claimed achievement in biology need further investigation to ascertain how gender and cognitive styles may influence achievement in biology, since teachers have not been paying much attention to students' processing cognitive styles. Therefore, this study investigates the influence of cognitive states on students' achievement in biology.

Research Question

One research question guided the study;

1. *What is the influence of cognitive styles on the mean achievement scores of male and female students in biology*

Hypothesis

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

Ho: Cognitive styles have no significant influence on the mean achievement scores of male and female students in biology.

Research Method

The study was a causal comparative research design. The study was carried out in Awka Education zone of Anambra State. The population consisted of all Senior Secondary two (SSII) biology students numbering (12,000) twelve thousand biology students in sixty-four government - owned secondary schools in Awka education zone. The sample of the study consisted of 265 SSII biology students (141 males and 124 girls) drawn from four government owned schools comprising of two (2) boys' and two (2) girls' schools in Awka 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 Achievement Test (BAT).

GEFT is a non- verbal speed test, published by Witkin, Ottman, Raskin and Karp (1971). 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 Inter-mediate (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, INT) and 13-18 as field independent (FI). GEFT is a standard instrument and according to Witkin et al (1971), it has a satisfactory reliability of 0.89 on test-re-test over a three year period.

BAT is a forty multiple-choice objective test developed by the researcher. Each item has 5-option lettered A-E. The test was based on the units of study in SSII biology curriculum used for the study. BAT was used to assess the students' achievement in biology. The content validity of BAT 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 BAT was determined by administering it on 30 SSII biology students of a secondary school in Enugu. The Cronbach Alpha method was used to analyze the scores and the result gave a reliability of 0.86 indicating that BAT is 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. The GEFT instrument was first administered to the students. The students were made to understand the instructions very well before working through the instrument. BAT was administered last. The scripts from each students were collected, marked and the scores used for analysis. The research question 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. GEFT and gender were entered as independent variables while BAT scores were used as dependent variables.

Results

The findings of the study were presented sequentially, according to the research question and hypothesis.

Table 1: Mean achievement scores and standard deviation of male and female students cognitive in biology.

COGSTYLE	N	X	Standard	Deviation
Male	141	25.12	6.51	
Female	124	24.05	6.19	
Total	265	24.62	6.51	

Table 1 shows that the mean achievement scores of male cognitive style students is 25.12, while the female cognitive style students has a mean achievement scores of 24.05. This indicates that male cognitive styles in biology achievement is slightly higher than the female achievement scores.

Table 2: One - way Analysis of Variance of male and female cognitive styles in biology mean achievement scores.

SOURCE OF Variance	df	sum of squares	Mean square	F	Sig	Decision
Between Groups	1	74.7090	74.7090	1.7638	.185	
Within Groups	263	111139.5552	42.3557			
Total	264	11214.2642				

Table 2 shows that the mean achievement scores of male and female cognitive styles of students in biology did not differ significantly in their achievements. This is indicated by the calculated F-value of 1.7638, which is significant at .1853, but not significant at 0.05

level of probability. Therefore, the null hypothesis of no significant influence of cognitive styles on the mean achievement scores of male and female students in biology is accepted. This implies that there is no significant influence of cognitive styles and gender on the mean achievement scores of students in biology.

Discussion of Results

The null hypothesis of no significant influence of cognitive styles on the mean achievement scores of male and female students in biology is accepted. Calculated F-value of 1.7638, which is significant at .1853, but not significant at 0.05 level of probability. This suggests that there is no significant influence of gender and cognitive styles on the mean achievement scores of students in biology. The finding that there is no significant influence of gender and cognitive styles on mean achievement scores of students in biology is in agreement with the findings of (Nwaiwu and Audu, 2005; Lorchugh, 2006) who's studies did not find either performing better. The result of some studies (Ndirika, 2013; Aniodoh and Eze; 2014) are in disagreement with the finding of this study. They reported that boys did better than girls. The relative effectiveness of cognitive style influencing mean achievement scores in biology may be due to the personality characteristics associated with field-dependent (FD), field-intermediate (F, Int) and field independent (FI) that are quite different. Cognitive style is an individual characteristic mode of perceiving, organizing information and using the acquired knowledge (Brenner, 1997). Therefore, the fact that there is no significant influence of gender and cognitive styles in biology achievement is not misleading.

Recommendations

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

- *Teacher education in the country should include the use of cognitive styles in teaching and in identifying learners learning problem in order to popularize their effectiveness in teaching biology.*
- *In service training workshops and symposia should be organized and made compulsory for practicing teachers to embrace the skills of cognitive styles for effective implementation in teaching and learning process.*

Conclusion

The results of this study reveal that cognitive styles of field dependence-independence and gender has no significant influence on achievement scores of students in biology.

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