

Effects of Cognitive Styles on academic performance of Senior Secondary School Biology Students in Science Process Skills in Jigawa State, Nigeria

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Abstract

The purpose of the study is to determine the relationships between cognitive styles, and achievement in science process skill among senior secondary school biology students in Jigawa State. Three objectives of the study and three hypotheses were stated. Correlation survey was employed as the design for the study. Two instruments were used for data collection. Group embedded figure test (GEFT) and the biology Science process skills achievement test BSPSAT). 216 students selected by proportionate random sampling were used as subjects for the study. The findings revealed that, cognitive styles of field dependence, field-independence and field Neutral were significantly related to achievement in science process skills. The study recommends that, efforts should be made to improved secondary schools students cognition by teachers employing variety of learning content presentation methods.

Key Words: *Cognitive Styles, Academic Performance, Biology Students, and Science Process Skills*

Background of the Study

Science process skills are the mental and physical skills which scientists use to carry out the process of doing science. (Nwosu and Okeke, 1995). They include: observation, inferences, measurement, classification, experimentation, interpreting data, using numbers, controlling

variables, formulating hypotheses, predictions and formulating models. Also, Colvill and parrie, (2003) state that, science process skill are inextricably linked to acquisition of new scientific knowledge.

Cognitive styles are psychological constructs which describes individuals mode of information perception, organization and representation (within and moore, 1991). Also Emmanuel (2003) stated that cognitive style is a continuum and there is actually no low or high end of it, however, at the extreme ends there are field-dependent and field-independent individuals. Good-enough and Cox (1991) revealed that students who preferred a field-dependant learning style tend to perceive the world globally, found it difficult to solve – problems, tend to favour the “Specter approach to learning and would adopt the organization of information to be learned. While students who preferred a field-independent learning style tended to view the world analytically, found it easier to solve-problem and were more likely to favour inquiry and independent study. And, they tend to provide their own structure to facilitate learning. The students cognitive styles as it relate to gender and achievement in science process skills is of interest in this study as senior secondary schools students by piglets categorization are expected to be formal thinkers within the age range of 11 – 19 years.

Statement of the Problem

Past and recent studies conducted on cognitive achievement and science process skills were focused on acquisition and students competency in skills at different levels of education. They include Akinmade (1991) on Primary School Science; Akale (1993) on Junior Secondary School Integrated Schience; Okebukola (1985) and Nwosu (1995) on Senior Secondary Students and Zayun (2010) on University undergraduates. However, an aspect that is under researched in this field is how the students cognitive styles relates with their achievement in science process skills and gender. Mc. Laughlin (1991) clearly stated that, there was less attention on research that identify processes underlying individual differences in learning. It is in light of the above, that this study is set to investigate the students cognitive styles (field-dependence/field independence) and see how it relate with gender and achievement in science process skills among senior secondary school biology students.

Objectives of the study

1. Determine significant relationship between senior secondary school biology students field dependency cognitive style and achievement in science process skill test
2. Determine significant relationship between senior secondary school biology students field independency cognitive style and achievement in science process skill test
3. Determine significant relationship between senior secondary school biology students field neutral cognitive style and achievement in science process skill test

Null Hypotheses

HO₂- there is no significant relationship between the SSS biology student's field-dependency cognitive style and achievement in science process skills test.

HO₂ – there is no significant relationship between the SSS biology students' field-independency cognitive style and achievement in science process skills test.

HO₃ – There is no significant relationship between SSS biology students field-neutral cognitive style and achievement in science process skills test

Methodology

The study uses ex post-facto quasi experimental design. According to Yakasai (1991) Ex-post – facto design is a situation where by an explanation is offered about a given phenomena after it had taken place. Here dependant variable is related to an independent variable and non of the variables has been manipulated by the researchers. The population of the study comprises all the senior secondary biology students in Dutse education zone, Jigawa state- Nigeria. The students were estimated to be six thousand in number and this constituted the population of this study which was conducted in four secondary schools in the zone.

The samples for the study consist of a projected estimate of 216 students selected by proportionate random sampling and balloting. Four senior secondary schools in three zonal education areas in Jigawa state were selected. Almost the same number of male 108 and female students were sampled.

Two instruments were used for data collection. They are: Group Embedded Figure Test (GEFT) and Biology Science Process Skills Achievement Test (BSPSAT). The Group Embedded figure test was developed by Witkin et al (1971) was use to measure the students filed dependency and field-independency cognitive styles. It consists of three sections with 25 items.

The first part contains seven items for practice, the second and the third sections consist of 9 items each for scoring.

The biology science process skill Achievement test consist of 50 objective items from the four selected science process skill of predicating, classification inferring and experimenting. The choice of skills to be tested was conceive after a study conducted by the Research, monitoring and evaluation Department of WAEC in 2004 on identification and Appraisal of some Biological Science process skills needed for Good performance at SSCE (WAEC) in Nigeria secondary schools. The items were adapted from WAEC (SSCE) questions from SSII and I scheme of work of Biology.

The two instruments were administered to the subjects by the researcher. First the group Embedded figures test was administered followed by the science process skill Achievement Test. Based on the GEET manual, Students who scored 0 – 8 were defined as field-dependents, those with 9 – 14 were field-neutral, those with 15 – 18 were field independent. The science process skill achievement test was scored accordingly. The scores of the three groups in (GEET were compared with the score of the (BSPSAT) and the data was analyzed by simple descriptive statistics, person correlation depending on the issue addressed by the research questions and hypotheses.

Results

Null Hypothesis 1,2, and 3 were tested at 0.05 level of significance with tailed t test. Hypothesis 1 state that: there is no significant relationship between the SSS biology students' field-dependency cognitive style and achievement in science process skills test. Pearson correlation analysis was applied to the relevant data in order to find the strength of the relationship between the two variables, which were measured in interval and ratio scales.

Table 1: Summary of Analysis for Null Hypothesis 1

N	X	Y	df	t-cal	t-cri	r	Level
216	10.80	17.28	200	3.58	1.97	0.9	0.05

From Table 1 the t-value calculated is greater than the t-value critical. This calls for the rejection of the null hypothesis 1 because it is not significant. This means that there is significant

relationship between the senior secondary school biology student field dependant cognitive styles and achievements in science process skills test.

Null Hypothesis 2

In response to answer Hypothesis 2 which says there is in no significant relationship between field-independency (cognitive style) and achievement in science process skills test. Person correlation analysis was applied to the relevant data followed by a T- test

The result in Table 2 shows that t calculated for field-independency is 2.98, which is greater than the critical value of 1.97. r is 0.58, therefore the relationship between field-independency and achievement science process skills test is also significant. H_{02} is also rejected.

Table 2. Summary of analysis for Null Hypothesis 2

N	X	Y	df	t-cal	t-cri	r	Level
216	34.56	36.72	200	2.981	1.97	0.58	0.05

Null Hypothesis 3 – There is no significant relationship between SSS biology students’ field-neutral cognitive style and achievement in science process skills test.

Table 3: Summary of Analysis for Null Hypothesis 3

N	X	Y	df	t-cal	t-cri	r	Level
216	68.0	40.0	200	2.981	1.97	0.50	0.05

The result in Table 3 indicated that there is significant relationship between senior secondary school, biology student’s field neutral cognitive styles and achievement in science process skill test. This is because the t-value calculated (2.98) is greater than the t-value critical (1.97) and thus the product moment correlation coefficient r is (0.50) which shows strong relationship. The null hypothesis is therefore rejected.

Discussion of Findings

The findings from this study indicated that, cognitive styles of field-dependent and field-independent are singly and jointly significantly related to senior secondary school biology student’s achievement in science process skills. For the cognitive style test (Group embedded

figure test) the field-independent learners perform better than the field-dependent learners. This is in line with Bomide (1986) and Otubah (2007) that cognitive style is positively related to achievement in science. Since those students who performed better in the group embedded figured test also did better in the science process skills test. Analysis of the entire sample indicated that majority of the secondary school biology students that participated in the study were field-dependent learners (41% were field-dependent learners) only 35% were field-independent learners the remaining 29% were field-neutral learners. Since the mean score of field-independent learners in science process skills test is higher than those of the field-dependent learners as indicated by Table 2.

With regard to achievement in science process skills test and gender, the findings indicated that, achievement in science process skills test is not gender related this does support the findings of Emmanuel (2003) that achievement in higher order physics, the results indicated that, cognitive style of field-dependent and field-independent are positively related to gender, especially the field-independency (cognitive style) as given in table 14.17.5% of the participants were male field-dependent while 15% were female field independents. This is also in agreement with findings of Okwo and Otubah (2007) that the joint influence of field-dependence/field-independence and gender on students achievement in physics is significant.

Conclusion

From the results and observations from the study it was concluded that, about half of the participants were field-dependent learners. Gender is not a significant factor in determining achievement in science process skills. Gender is however, a significant factor in determining the confluence the student's performance in science generally and biology in particularly.

Recommendations

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

1. There should be proper placement of students in relation to school courses.
2. School authorities should Endeavour to know the learning styles of each student so that proper placement can be made.
3. Field dependency student should be placed to art courses while field independency should be placed to the science courses.

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