

# COGNITIVE STYLES, SECONDARY SCHOOL STUDENTS' ATTITUDE AND ACADEMIC PERFORMANCE IN CHEMISTRY IN AKWA IBOM STATE – NIGERIA.

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*This study sought to investigate the influence of cognitive styles and attitude on the academic performance of students in chemistry in Akwa Ibom State. Two hypotheses were formulated to guide the study. The Ex post facto research design was adopted for the study. Simple random sampling was done to select 200 senior secondary 3 students. A students' questionnaire containing three sections viz Siegels Cognitive Style Test, Chemistry Students Attitude Test and Chemistry Achievement Test was administered to the 200 randomly selected senior secondary three (3) students offering chemistry. The data collected were subjected to data analysis using Analysis Variance, Fishers LSD Multiple Comparison Test and Pearson Product Moment Correlational Analysis. Based on these analyses, the following results emerged. There is a significant difference in student academic performance in chemistry due to their cognitive styles; students with analytic cognitive styles performed significantly higher than relationals and inferentials. There is a significant positive relationship between students' attitude to chemistry and their performance in chemistry. Based on these results, it was recommended that chemistry teachers should show greater interest in the teaching of the subject using cognitive styles in a way of motivating students to learn the subject.*

## INTRODUCTION

Today, science is more important and frequently used as a means to understand the options associated with development of technology. The future of the nation still depends to a large extent on a continuity in the development of its human and material resources for science and technological advancements.

In recognizing the significance of (STM) Uche & Umoren (1989) stated that,

*In the contemporary world, science and technology has become an integral part of human culture countries that ignore this significant truism is risking the future of its youths. If today's youths are not properly equipped with the rudimentary knowledge of modern science, they will grow up only to discover that haphazard knowledge of science is not sufficient to understand the sophisticated operation of the present information age in science and technology (p.38).*

Having seen the role which science has to play in nation building educators are concerned about the need to improve students' academic achievement.

Research on students' academic achievement has generally taken the form of finding human or environmental variables which correlate with higher achievement and which can be used as predictors of achievement. Among the various variables identified is individual differences.

(Pitcher, 2002), Riding & Douglas (1993). Different researchers emphasized different dimension of individual differences which correlate with higher achievement and which hold out some hope for positive action for educational practice (Babalola, 1989 and Stephen, 2002) of these dimension, cognitive styles and students attitude are major ones.

Cognitive style is the control process or style which is self generated, transient, situationally determined conscious activity that a learner uses to organize and to regulate, receive and transmit information and ultimate behaviour. Studies on cognitive style have shown that individuals do not approach scientific tasks in the same manner (Babalola, 1989; Onwu & Asuzu, 1989). There are different cognitive strategies for processing information which in turn influence students academic achievement. Thornel (1994) therefore states that science education, strongly suggests the consideration of cognitive styles and students academic achievement as an important criteria in the development and implementation of both curricula and instructional performance.

Changes in learners' behaviour that can be possibly achieved through education cannot be solely attributed to "Cognitive style" but also to affective orientations (Emina, 1986:177). This is because attitude as an affective construct, has been described as the basis for both "intellectual preparedness" and motivation in learning. Akinmade (1992), has confirmed that students' attitude toward science are sine qua non for higher achievement in science. It is against this background that this study sought to investigate the influence of cognitive style and attitude on students' performance in chemistry.

## **OBJECTIVE OF THE STUDY**

The purpose of the study is to find out the extent to which students cognitive styles and attitude influence their academic performance in chemistry. Specifically, the study sought to determine: (i) If there is any significant influence of student cognitive styles on their performance in chemistry and (ii) if there is any relationship between students attitude and their performance in chemistry.

## **SIGNIFICANCE OF THE STUDY**

The consideration of cognitive styles and student academic achievement are important criteria in the development and implementation of both curricula and instructional performance.

This study would also help to provide some information for curriculum designers and classroom teachers in order to utilize relevant approaches to enhance meaningful learning of chemistry by students. Thus, the knowledge of students' cognitive style and attitude would be very useful in both academic and career counseling.

## **THEORETICAL FRAMEWORK**

Learning process requires adequate attention from the learners in order to assimilate and absorb what is being taught. People exhibit significant individual difference in the cognitive processing styles that they adopt in problems solving and other similar decision making activities. Accordingly, Glass and Riling (1993) defined cognitive style as a fairly fixed characteristic of an individual that are static and relatively in-built features of the individual. Nevertheless, Pitcher (2002) after research findings, defined cognitive style as the relatively stable strategies, preferences and attitudes that determine an individual's typical modes of perceiving, remembering and problem solving. Cognitive style can also be defined as the process which is self-generated, transient, situationally

determined conscious activity that a learner uses to organize and to regulate, receive and transmit information and ultimately behaviour (Messick ,1996)

Asuzu's (1984) three cognitive styles have been well established through research findings in relation to science learning and teaching.

These are:

- (i) Analytic
- (ii) Relational; and
- (iii) Inferential

### **Analytic style**

This style is also called field independent or descriptive cognitive style. According to Za'rour & Panaouri – Kilariotis (1997), individuals in analytic mode associate stimuli on the basis of their overt physical attributes like part or whole. Onwu & Asuzu (1989) looked at Analytic styles as the tendency to associate objects or events on the basis of common characteristics, which are directly discernible (e.g. a chair and a table are similar because both have four legs).

### **Relational Cognitive Style**

According to Za'rour & Panaouri – Kilariotis (1997) "individual with relational and contextual orientations group together stimuli that are interdependent or functionally related. Onwn & Asuzu (1986) defined relational style as a mode to associate objects or events on the basis of features establishing a relational link between them.

### **Inferential Cognitive Style**

Onwu & Asuzu (1989) defined inferential style as the tendency to associate objects or events on the basis of super ordinate features which are not directly discernible but are inferred. It is an imaginative tendency. For example, a car and a boat are similar because both are means of transportation.

## **METHODOLOGY**

### **Research Design**

The research design for this study was Ex-post Facto. In the research the independent variables (cognitive styles and attitude) had already occurred and no attempt was made to manipulate or control them. The researcher then studied the independent variable (s) in retrospect for the possible relation to and effect on the dependent variable (achievement in chemistry).

### **Population and Sample**

The population of this study comprised of senior secondary three students in Ibesikpo Asutan Local Government Area of Akwa Ibom State Nigeria.

The simple random sampling method by balloting was used to select 4 schools and 400 students. A breakdown of the figure showed that 100 students each were randomly selected from the schools in the study area.

## Instrumentation

The instrument used for this study was a questionnaire. The questionnaire consisted of 3 sections. Section A consisted of Siegel's cognitive style test. This cognitive style test was made up of 20 triads of familiar pictures (three in a set) which required the respondents to match any two pictures that go together in a triad stating the reason for their choice. A subject is classified as analytic, relational or inferential on the basis of the reason given.

Section B was a Chemistry Students Attitude Test (CSAT). CSAT was a four point Likert scale with 12 items. Subjects were required to tick (✓) the option they felt was most appealing to them. The option ranged from strongly agreed (4 to strongly disagree (1).

Section C consisted of a Chemistry Achievement Test (CAT). CAT was a fifty (50) item, multiple choice, 4 option objective test questions drawn from different topics in the senior secondary school 1-3 syllabus on chemistry. Respondent were required to choose the options that bears the correct answers to the questions.

## Data Collection

The questionnaire instrument was administered to 400 senior secondary three (SS3) students offering chemistry. At the time of the instrument administration session, exact procedures were followed. Subjects were read, verbatim the instructions provided in the questionnaire. Practiced problems provided in the administration questionnaire ensured comprehension of the directions. The subject first completed the cognitive style test, chemistry students attitude test and the Chemistry Achievement Test.

## Data Analysis

After the data were collected, the responses were scored to enable the researcher reduce the information into statistical form. The students' cognitive style scores together with their reasons were analysed to group the respondents as relationals, inferentials and analytics. The students achievement score in chemistry based on this categorization was analyzed using the One Way Analysis of Variance. Pearson Product Moment Correlation was also used to analyzed the relationship between attitude and achievement.

## FINDINGS

### Hypothesis 1

Cognitive styles do not have significant influence on students' academic performance in STM (Chemistry).

Cognitive styles	N	$\bar{x}$	SD
Relationals	94	40.77	15.82
Inferentials	182	42.11	11.83

Analytics	124	47.23	15.70
Total	400	43.38	15.92

**Table 1: Means and Standard Deviation of Students' Cognitive Styles on their academic performance in STM (Chemistry)**

Table 1 provides the means and standard deviation for the three cognitive styles (Relationals, Inferenceals and Analytics) grouped according to their performance in chemistry. Table 1 shows that students with analytic cognitive style have a higher mean performance in chemistry ( $\bar{x} = 47.23$ ) followed by Inferenceals ( $\bar{x} = 42.11$ ) and lastly by Relationals, ( $\bar{x} = 40.77$ ).

The One Way Analysis of Variance of cognitive styles based on students' academic performance in chemistry showed a significant F-value ( $F = 5.60$ ;  $p < .05$ ). The null hypothesis was rejected.

This is because the calculated F-value of 5.60 was found to be greater than the critical F-value of 2.62 at .05 level of significance with 2 and 397 degrees of freedom. This finding means that there is significant difference in students academic performance in chemistry due to their cognitive styles.

Given the significant F-value, a detailed multiple comparison analysis using Fishers Least Significant Difference (LSD) to determine which of the pair wise comparison was significant was done.

Sources of variance	SS	DF	MS	F
Between group	1384.955	2	692.48	5.60*
Within group	49082.162	397	123.63	
Total	50467.12	399		

Significant at .05; critical F = 2.62

**Table 2: Summary of One Way Analysis of Variance (ANOVA) of Influence of Cognitive Style on Students Achievement in Chemistry**

Cognitive style	Relationals (n= 94)	Inferenceals (n = 182)	Analytics (n = 124)
Relationals	40.77 <sup>a</sup>	-1.3 <sup>b</sup>	-6.46

Inferentials	0.47 <sup>c</sup>	42.11	-5.12
Analytics	2.12*	1.97*	47.23
MSW = 123.63			

\*P<.05

Group means are on the diagonal , Differences between group means are above the diagonal

Fisher's LSD t-values are below the diagonal

**Table 3: Fisher's Multiple Comparison test of Influence of Cognitive Styles on Students' Academic Performance in Chemistry.**

The result shows that students with analytic cognitive style performed significantly higher in chemistry than the relationals (with  $t = 2.12$ ;  $p < .05$ ) and inferentials ( $t = 1.97$ ;  $p < .05$ ). This finding means that students with analytic cognitive style performed significantly higher than relationals and inferentials.

## Hypothesis II

Students' attitudes toward chemistry are not significantly related to their academic performance in the subject. Using the Pearson Product Moment Correlational Analysis, this hypothesis was tested. The result is presented in Table 4.

Variable	$\bar{x}$	SD	r
Students' attitude toward chemistry (x)	29.81	3.98	
			0.189*
Students' performance in chemistry (y)	43.38	15.92	

\*significant at .05;  $df = 198$ ; critical  $F = 0.14$

**Table 4: Pearson Product Moment Correlational Analysis of influence of students' attitude on their academic performance in chemistry. (N = 400)**

The result of the analysis in table 4 shows that there is a significant positive relationship ( $r = 0.189$ );  $p < .05$  between students' attitude toward chemistry and their performance in chemistry. The null hypothesis was rejected because the calculated r-value of 0.189 was found to be greater than the critical r-value of 0.14 at .05 alpha level and with 198 degrees of freedom. The positive r-value in the result implies that the higher the students attitude, the higher their performance in chemistry. On the other hand the lower the students' attitude to chemistry, the lower their performance in chemistry tends to be.

## DISCUSSION

The first hypothesis showed that analytic cognitive style had significant effect on students achievement in STM (chemistry) than relationals and inferentials. This study result corroborates

previous researches that show that analytic mode of categorization seem to favour students' achievement (Morine, 1992; Asuzu & Onwu 1989).

Morine (1992) speculated that, for instructional heuristic or partly structured tasks (new to the subjects), the learners' scientific inquiry behaviour is likely to be intimately tied to the analytic and inferential mode of categorization. Expanding further, Asuzu & Onwu (1989) stated that analytics and inferentials show curiosity and originality of ideas with scientific task than the relationals. They further maintained that relationals showed greater reluctance than the analytics and inferential to modify hypothesis even with cueing. Analytics subjects are spontaneously able to think scientifically and have a good ability to scan the field of data, that is, make relevant observations and are able to draw internally generated models to try to explain the phenomenon. This trait they said contributes to higher achievement in science. Tamer & Kempa (1990) reported that a higher preference for analytic cognitive styles is related to a higher achievement in tasks that call for higher cognitive abilities.

## **CONCLUSION**

The findings of this study have shown that cognitive styles have significant influence on students' academic performance in chemistry. It has also spotlighted that students' academic performance in chemistry is a function of their attitude. The findings underscore the need for application of cognitive styles by students' for proper understanding of chemistry and that all negative views about the subject should be jettisoned. In the main students with analytic cognitive style have a higher academic performance than student inferentials and relationals.

## **RECOMMENDATIONS**

Based on the findings of this research, the following recommendations were made:

Chemistry teachers should show greater interest in the teaching of the subject using cognitive styles as a way of motivating students to learn the subject.

Workshop should be organized by Science Teachers Association of Nigeria (STAN) for all science teachers to emphasized on the use of cognitive styles as a means of achieving better academic performance in chemistry.

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