Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.5, No.8, 2014 

# Cognitive Style Profiles and Physics Achievement of senior secondary school students in Ogun State, Nigeria

Oludipe, Bimbola Dupe (PhD)
Curriculum Studies and Instructional Technology Dept., Faculty of Education,
Olabisi Onabanjo University. Ago-Iwoye
bimbolaoludipe@yahoo.com, +234-805-5373-172

**Abstract**
This study analysed physics students' cognitive styles and physics achievement of senior secondary school students. Five hypotheses were tested. The sample consisted of 107 Senior Secondary III physics students from four co-educational secondary schools in Ogun State. These students were categorized as analytic and non-analytic learners based on their performance on the Sigel's Cognitive Style Test (SICOST). Results revealed that most of the students (69%) were analytic, and a significant difference in physics achievement in favour of analytic students was found. Also, a significant difference in favour of analytic boys (as against non-analytic boys) was found. However, there was no significant difference between the physics achievement of analytic and non-analytic girls. Based on these, the first and second, fourth and fifth hypotheses were rejected while the third hypothesis was upheld. The study concluded that teachers should endeavour to find out students' cognitive style and use strategies consistent with it.
**Keywords:** Cognitive styles, physics achievement, senior secondary, students, profiles

## Introduction

The way an individual perceives, organizes and interprets an information is a function of his cognitive style. Put in another way, Riding and Rayner, (1998) define it as the way information is organised and represented; Bollistic & Tallent-Runnels, (1991) view it as the ways in which one goes about organising and processing information to complete a task. Katrina (2006) sees cognitive style as the ability to carry out abstract thinking. Tella (2008) was of the view that cognitive style is sine-qua-non to the evaluation of students' achievement in learning and a significant predictor of future achievement. Psychologists have come up with various dimensions of cognitive style. Robinson and Gray (1974) identified three cognitive styles among school children- Categorical, Descriptive and Relational styles. Kagan, Moss and Sigel (1963) classified individuals as either Analytic or Non-analytic, while Witkin, Moore, Goodenough & Cox, (1977) grouped individuals into Field Dependence or Field Independence.

A field independent person is able to easily break-up organized perceptual field, easily sort out an item from its contextual setting and analyze them critically, while field dependents tend to preserve the holistic nature of a stimulus configuration. Analytic and Non-analytic classification has been shown (Kagan et al. 1963) to be similar to the field Independence-dependence classification. At the level of intellectual functioning, the field dependent person is "global" in his approach and does not differentiate cognitively between experiences. In contrast, field independent person separates the object from the field and consequently can be more analytic and articulate about his experiences (Faterson 1972).

Data from most research studies on cognitive style and student performance suggests that an individual's cognitive style invariably influences his performance on a variety of learning tasks. An earlier study by Cohen (1969) revealed that non-analytic children scored lower on tests requiring mathematical computations than their counterparts. In contrast to that, Babalola, (1979) found that field-independent cognitive style students showed positive interest and achieved better in mathematics and science. Wieseman (1992) investigated the relationship of students' cognitive style to their academic performance across curricula. Findings indicate that the subjects were predominantly field dependent, socially oriented learners. A significant correlation between low grades and a field dependent cognitive style was also found. Similarly, Whittington & Raven (1995) among other findings, found that females were more field independent than the general female population. In the path-analytic study of cognitive style as predictor of Chemistry achievement carried out by Aghadiuno (1992), analytic individuals performed better than non-analytic individuals in Chemistry achievement Test. Also, Lyon (1994) found that analytic students performed better than non-analytic students in using computer-based instruction in office systems. In Griffin and Franklin's (1996) study, 143 students were identified as analytic or non-analytic based on their performance on cognitive style test. Results further indicated that analytic students performed significantly better on course test and had higher academic potential than non-analytic students.

In contrast to this general trend, some studies have found little or no relationship between cognitive style and academic achievement, and others have revealed that analytic students did not perform better than non-analytic students. Altun and Cakan (2006) in their study on the relationship between students' academic achievement, cognitive style and attitude towards computer science, found no relationship between cognitive

style and academic achievement. Earlier study by Hsu (1994) found that field independent students did not demonstrate better performance than the field dependent students. Supporting this view was Brenner (1997). He investigated the cognitive styles of students who were enrolled in distance education courses for one semester, the study's hypothesis predicted that analytic students would be more successful in distance education tele-courses than non-analytic students. Findings revealed that the hypothesis was rejected. Analytic students were not more successful in asynchronous distance education tele-courses than non-analytic students. It was concluded that cognitive style had no impact on student success in distance education, and should encourage educators to offer distance education to all types of students. Lending credence to this, Clark (1992) in his meta-analysis to determine the relationship of cognitive style construct of field dependence/independence to achievement in computer programming found that a positive relationship between a student's degree of field independence and success in computer programming classes. Class level, programming language and the test used to measure field independency did not significantly differentiate the correlations. Adeyanju (1985) posited that field independent students have a sharp perceptual focus, a greater ability to structure information and solve problems. They are good at effectively weighing and thinking reflectively on concept cues. (Oyekan 1984; Thornell 1997). In addition, the field Independent learners are said to have greater intellectual curiosity as they express desires to investigate new ideas and seek additional information. In same vein, Macnab (1991) believed that the development of the skill of problem-solving and spatial visualization lies in the development of analytic ability. Also, Chinien (1992) was of the opinion that analytic learners are task-oriented, set regulated goals, seek less guidance in problem solving, less social support and prefer to work individually.

Field dependent learners are seen to be attuned to social interaction, they favour structure, teacher direction and feedback, and they benefit from instruction in problem solving. In addition, findings have even shown vocational students to be field dependent (Hansen 1997).

Many studies have shown that sex differences exist between cognitive styles and achievement. In fact, Witkin's field-dependent cognitive style theory predicted that females are more likely to have a social or field dependent cognitive style, whereas males are more analytical or field independent cognitive styled. These differences include personality and information processing characteristics that may have cognitive origins (Portis & Simpson 1995). These predictions were established in the study of some researchers. Fritz (1992) found that males were more field independent. Onyejiaku (1980) revealed non-analytic boys scored significantly than the non-analytic girls, and analytic boys scored significantly more than analytic girls. Koleoso, Oyekan and Olabode (1998) found that female and male field independent groups are academically superior to their field dependent counterparts. This agrees with the findings of Balik (1974); Onyejiaku (1980); Busari (1987); Fritz (1992). Part of the reasons adduced was that females more than males rely on acculturated values to interpret situations, desire peer input to organize experience and shape decisions, and want a variety of instructional modalities to derive meaning from an experience. Male students in contrast to females, preferred situations that involved numbers and logic, computing and solving mathematical problems, and benefited from course work that was logically and clearly organized and assignments that were meaningful. Females tended to need laboratory activities with interaction from peers (Fritz 1992). However, the study of Buckley (1992); and Sonumesi (1994) reported no significant difference in the academic attainments of female field independent and male field independent Senior Secondary II students in Chemistry achievement.

From the foregoing, it is glaring that research studies on cognitive style as it affects students' achievement have been inconsistent and often contradictory. Infact, few studies have been carried out in the area of sciences, which are basic to any technological growth of any nation. Based on these, it is therefore important that more empirical researches be carried out to further shed light on whether cognitive style influences achievement in the sciences, especially the physical sciences where very little research evidences are available. This researcher shares the view of Onyejiaku, (1980) that refusing to find out the cognitive styles of learners is like administering some drugs to an unknown ailment. Knowing how best students learn can best inform teachers on good choices of content, resources and teaching strategies. Also, it may lead to accommodation of a variety of learners in the classroom, and improve students' achievement and improved communication with administrators, parents, counselors and policy-makers.

**Statement of problem**

This study analysed the cognitive styles profiles and Physics achievement of senior secondary school Physics students in Ogun state.

**Research Question**

1) What is the predominant cognitive style of the students sampled in this study?

**Hypotheses**

$H_o1$ There is no significant difference between the physics achievement scores of students that are analytic styled and those that are non-analytic.

$H_o2$ There is no significant difference between the physics achievement scores of analytic male students and non-analytic male students

$H_o3$ There is no significant difference between the physics achievement scores of analytic female students and non-analytic female students

$H_o4$ There is no significant difference between the physics achievement scores of male and female students that are analytic styled

$H_o5$ There is no significant difference between the physics achievement scores of male and female students that are non-analytic styled

**Methodology**

**Research Design**

This study is an ex-post facto research in which the independent variables had already occurred and no manipulation was done to them the context of this study.

**Population**

The population comprised of all senior secondary school students in Ijebu- East Local Government area of Ogun-State.

**Sample and sampling procedure**

The sample was made of 107 SS III Physics students comprising 69 males and 38 females (age range between 14.0 years and 19 years, with the mean age coming to 16.1 years; SD 1.92) randomly selected from four co-educational secondary schools in Ijebu-East Local Government area of Ogun-State. The four co-educational secondary schools were purposely selected from Ijebu-East local Government area of Ogun State. The criteria for selection include the following:

1) The school must be co-educational and must be offering physics

2) The Senior Secondary school 3 (SSS 3) students must have been taught the topics listed in the Physics Achievement Test.

**Instruments**

Two instruments were used for data collection. These are:

- Sigel's Cognitive Style Test (SGST), and
- Physics Achievement Test (PAT)

Sigel's Cognitive Style Test was developed by Sigel (1967) was modified by Onyejiaku (1980) to reflect the Nigerian Environment. This modified version was adopted for use in this study. It was re-validated by the researcher. The test-retest reliability after a two weeks' interval was found to be 0.73. The instrument was made up of 20 cards numbered 1-20. It is a reasoning test used to measure how students choose and analyse sets of drawings of common objects, animals, plants or artifacts for the purpose of classifying them. Each card consists of three pictures, two of which could have one thing or the other in common. As explained earlier, the statements made by the students regarding the way they perceive the pictures and classify any two together were categorized into three: Analytic-Descriptive(AD); Categorical-Inferential(CI); and Relational-Contextual (RC).

Analytic-Descriptive(AD) individuals classify stimuli based on the overt physical attributes like part or whole. They group two objects together based on common characteristics which are directly discernible. For example, for pictures of a chair, table and man, a chair and a table can be categorized together because they both have four legs.

Categorical-Inferential(CI) individuals here group objects together based on super- ordinate features which are not directly discernible but are inferred. It is an imaginative tendency or ability to think abstractly. For example, a table and a chair are grouped together because they are furniture.

Relational-Contextual (RC) individuals here group stimuli that are interdependent or functionally related. They classify objects together based on features establishing a relational link between them. For example, the man can sit on the table or chair.

The Physics Achievement Test was made up of 45 items in multiple choice format with four options (one correct response and three distractors). The Table of specification drawn reflected the various levels of behavioral objectives and the topics as shown below.

**Table 1: Test Blueprint of Achievement Test in Physics**

| Behavioral Obj. / Topic | Knowledge | Comprehension | Application | Total |
|---|---|---|---|---|
| 1) Mechanics | 3 | 4 | 6 | 13 |
| 2) Heat | 2 | 2 | 3 | 7 |
| 3) Optics | 2 | 2 | 3 | 6 |
| 4) Electricity | 2 | 3 | 4 | 9 |
| 5) Waves | 1 | 2 | 2 | 5 |
| 6) Magnetism | 1 | 2 | 1 | 5 |
| Total | 11 | 15 | 19 | 45 |

Originally, the researcher generated 100 items. The procedure for test construction was followed in planning and compilation of the test. These items were presented to three physics teachers to evaluate with respect to structure, adequacy and relevance of the items to the content coverage. Modifications were made based on their judgements. Thereafter, the test was administered to 100 SS 3 Physics students in Ibadan North local Government area of Oyo-State. These students were similar to those for whom the test was intended. From the results obtained, the difficulty and discrimination indices of each item was computed. Items with positive discrimination and difficulty indices of between 0.45 and 0.65 were retained. Eventually, 45 items met these criteria. Kuder-Richardson Formula 20 was used to establish the reliability coefficient of 0.64 for the test.

**Procedure**

The instruments were administered two weeks before the SS 3 students started their mock examination. This was to ensure that the topics listed in this study have been covered in the schools The Physics teachers in these schools served as research assistants. They administered the instruments to the students and handed them over to the researcher after completion.

**Scoring of the Instruments**

For the Physics Achievement Test, each correct item response attracted a score of 1, while zero score was awarded a wrong response. The maximum total score was 45.

For the Cognitive Style Test, the researcher produced the scoring manual that was used in scoring the students' responses to the test. A score of one mark was given to each trial for each of the three identifiable styles. The score was based on the stated reason for grouping two of the three pictures in a triad. The different responses were scored and summed up separately for each student.

In this study, **Analytic Style students** are students who score above the median on Analytic-Descriptive (AD) and Categorical-Inferential (CI) scores and below the median on Relational-Contextual (RC) scores.

**Non- Analytic Style students** are students who score above the median on Relational-Contextual (RC) scores and below the median on Analytic-Descriptive (AD) and Categorical-Inferential (CI) scores.

**Data Analysis**

The data collected were analyzed using frequency counts, simple percentages, and t-test analysis.

**Results**

Research Question

What is the predominant cognitive style of the students sampled in this study?

**Table II: Frequency Distribution of Cognitive Style**

| Cognitive style | Frequency | % |
|---|---|---|
| **Analytic** | **74** | **69** |
| **Non-Analytic** | **33** | **31** |

Table II above shows that 69% of the students are analytic, while the remaining 31% are Non-analytic.

**Hypothesis 1(Ho1)**

There is no significant difference between the Physics achievement scores of students that are analytic styled and those that are non-analytic.

**Table III: t-test analysis of Analytic/ Non-analytic students**

| Cognitive style | N | Mean | SD | df | T | p | Remark |
|---|---|---|---|---|---|---|---|
| Analytic | 74 | 34.58 | 5.74 | 105 | 1.638 | .016 | Sig. |
| Non-analytic | 33 | 27.37 | 5.52 | | | | |

* significant at p< 0.05

Table III above revealed that analytic students returned a higher mean score than Non-analytic students and the difference was found to be significant at the 0.05 level of significance. Therefore, Ho1 was not supported by the data collected in this study.

**Hypothesis II**

There is no significant difference between the Physics achievement scores of male analytic and non-analytic students.

**Table IV: t-test analysis of Male Analytic/ Non-analytic Students**

| Sex | Cognitive style | N | Mean | SD | df | t | P | Remark |
|---|---|---|---|---|---|---|---|---|
| Male | Analytic | 49 | 33.41 | 5.92 | 67 | 1.264 | .013 | Sig. |
| | Non-analytic | 20 | 28.30 | 5.36 | | | | |

* significant at p< 0.05

Table IV above revealed that male analytic students returned a higher mean score than male Non-analytic students and the difference was found to be significant at the 0.05 level of significance. Therefore, Ho2 was not supported by the data collected in this study.

**Hypothesis III**

There is no significant difference between the Physics achievement scores of female analytic and non-analytic students.

**Table V: t-test analysis of Female Analytic/ Non-analytic Students**

| Sex | Cognitive style | N | mean | SD | df | t | P | Remark |
|---|---|---|---|---|---|---|---|---|
| Female | Analytic | 25 | 29.01 | 6.42 | 36 | 1.844 | .061 | Not sig. |
| | Non-analytic | 13 | 27.15 | 5.83 | | | | |

Table V above revealed that female analytic students returned a higher mean score than female Non-analytic students but the difference was not significant at the 0.05 confidence level. Therefore, Ho III was supported by the data collected in this study.

**Hypothesis IV**

There is no significant difference between the Physics achievement scores of male and female students that are analytic styled.

**Table VI: t-test analysis of Male and Female students that are Analytic styled**

| Sex | N | Mean | SD | Df | t | P | Remark |
|---|---|---|---|---|---|---|---|
| Male | 49 | 34.41 | 5.16 | 72 | 1.428 | .018 | Sig. |
| Female | 25 | 25.96 | 4.72 | | | | |

Table VI above revealed that analytic male students returned a higher mean score than analytic female students, and this difference was found to be significant at the .05 level. Based on this, Hypothesis IV was not supported by the data collected in this study. In other words, there was a significant difference between the Physics achievement scores of male and female students that are analytic styled.

**Hypothesis V**

There is no significant difference between the Physics achievement scores of male and female students that are non-analytic styled.

**Table VII: t-test analysis of Male and Female students that are Non-Analytic styled**

| Sex | N | X | SD | df | t | p | Remark |
|---|---|---|---|---|---|---|---|
| Male | 20 | 30.02 | 5.49 | 31 | 1.646 | .033 | Sig. |
| Female | 13 | 24.15 | 5.11 | | | | |

Table VII above revealed that non-analytic male students returned a higher mean score than non-analytic female students, and this difference was found to be significant at the .05 level. Based on this, Hypothesis V was not supported by the data collected in this study. In other words, there was a significant difference between the physics achievement scores of male and female students that are non-analytic styled.

**Summary of Findings**

1) There is a significant difference between the Physics achievement scores of students that are analytic styled and those that are non-analytic.
2) There is a significant difference between the Physics achievement scores of analytic male students and non-analytic male students
3) There is no significant difference between the Physics achievement scores of analytic female students and non-analytic female students
4) There is a significant difference between the Physics achievement scores of male and female students that are analytic styled
5) There is a significant difference between the Physics achievement scores of male and female students that are non-analytic styled.

**Discussion**

The finding that analytic learners returned a significantly higher mean score than non-analytic learners is in agreement with the findings of Babalola (1979), Aghadiuno (1992) and Lyon (1994). They found that analytic students achieved better than non-analytic students in Mathematics, Chemistry and in using Computer-based instruction in offices respectively. However, this finding contradicts those of Hsu (1994) and Brenner (1997). The Science of Physics is an action subject that demands spatial visualization, critical thinking, ability to solve problems, and effectively weigh concept cues. In addition, the Science of Physics demands greater intellectual curiosity in breaking down a stimulus configuration and being able to assemble it together again, desire to investigate new ideas and seek additional information. These according to Macnab (1991) lies in the development of analytic ability.

The findings that analytic boys returned a significantly higher mean score than analytic girls, and non-analytic boys also returned a significantly higher mean score than non-analytic girls contradict the findings of Buckley (1992) but supports the findings of Busari (1987) and Onyejiaku (1980). These findings are gender-

sensitive, in which case, boys in both cases, performed better than the girls. The reason could be that the boys are academically better than the girls. However, a myriad of evidences point to the fact that some misconceptions and socio-psychological factors in the home, school and society impede girls' enrolment and achievement in the sciences. Prominent among these is the long-standing misconception that Science is male preserve, and females lack intellectual capability for visual-spatial skills needed for abstract reasoning, especially the Physical Science. There is also the belief that this makes girls show preference for Biological Sciences than Physical Science where girls are always least-represented. Girls' experiences in the classroom are sometimes even worse. For example, in our classrooms, there is differential teacher-pupil interactions which tend to favour the boys as they receive more attention from teachers than the girls, teachers tend to mystify the Sciences by presenting it as difficult and abstract, also, teachers mainly make use of lecture method of instruction, whereas girls are more responsive to instructional methods that foster collaboration, teachers have low expectations from girls as they allow for shorter "wait-time" for them, and they sometimes pass comments that are often discouraging to girls. The curriculum and school textbooks are not too girl-friendly as they sometimes are gender insensitive (Erinosho, 2000).

**Conclusions and Recommendations**

Improving academic achievement in Physics demands that teachers know how best students learn. This is very important as different learners have different modes of conceptualization of a given stimulus. In other words, individual differences exist among pupils in a classroom and this has further been buttressed by the findings of this study. Understanding these differences will assist teachers on the choice of content, resources and instructional strategies. It will also help in the accommodation of different learners in the classroom. Strategies that enhance analytic ability of students should be employed during teaching. Biases against women and masculine misconception of Science must be reversed and girls should be assisted to develop their analytic potentials.

.

**References**

Aghadiuno, M.C.K. (1972). A Path Analytic Study of Cognitive Style, understanding of Science and Attitudinal Variables as Correlates of Achievement in Secondary Schools Chemistry. *Unpublished Ph.D. Thesis, U.I. Nigeria*

Altun, A. & Cakan, M. (2006). Undergraduate students' academic achievement, field dependent/independent cognitive styles and attitudes towards computers. Educational Technology and Society, 9(1), 289-297

Babalola, B. A. (1979). The Relationship Between Field – Independent/Field Dependent Cognitive Styles and Academic Achievement in Mathematics and Science Subjects Among Nigerian Secondary School Students. *Journal of the Science Teachers' Association of Nigeria. 18, 1, 56-59.*

Balik, M. J. (1976). Effects of Cognitive Style on Arithmetic Achievement in second, fourth and sixth grade boys and girls. *Dissertation Abstracts International 37(2), 872.*

Bishop-Clark, C. (1992) Field Independence and Programming Achievement: A Meta-Analysis. Ohio, U.S.A.

Brenner, J. (1997). An Analysis of Students' Cognitive Styles in Asynchronous Distance Education Courses at a Community College. Southwest Virgina Community College, Richlands, VA Virginia, U.S.

Buckley, S. (1992). A study of Field-Independent/Field-Dependent Cognitive Styles of Japanese Students and Correlation with their Academic Achievement in Two American High Schools.

Busari, O. O. (1987) The Relationship among Teacher's Cognitive Style, Teachers' teaching methods and students' achievement in Chemistry in Lagos Metropolis. *M.Phil. Dissertation, University of Lagos. Nigeria*

Chinien, C. A. & Boutin, F. (1992). Cognitive Style FD/FI as Learner Selection Criterion in Formative Evaluation: A Qualitative Analysis. *Performance Improvement Quarterly, 5(2), 24-33.*

Cohen, R. A. (1969). Conceptual Styles, Cultural Conflict and Nonverbal tests of intelligence. *America Anthropologist 71(5), 828-856.*

Fritz, R. L. (1992). A Study of Gender Differences in Cognitive Style and Conative Volition. *Paper presented at the American Vocational Educational Research Association Session at the American Vocational Association Convention. Georgia, U.S.A.*

Goodenough, D. R. & Karp S.A. (1961). Field Dependence and Intellectual Functioning. *Journal of Abnormal and Social Psychology 63, 241-246.*

Griffin, R. & Franklin, G. (1996). Can College Academic Performance be Predicted using a Measure of Cognitive Style? *Journal of Educational Technology Systems. 24(4), 375-379.*

Hansen J. W. (1995). Student Cognitive Styles in Postsecondary Technology Programs. *Journal-of-Technology,-Education 6(2), 19-33.*

Hsu, T.E. (1994). Effects of Learner Cognitive Styles and Metacognitive Tools on Information Acquisition Paths and Learning in Hyperspace Environments. *Proceedings of selected Research and Development*

*Presentations at the 1994 Natural Convention of the Association for Educational Communications and Technology Indians, U.S.A.*

Kagan, J., Moss, M. and Sigel, I. (1963) The Psychological Significance of Styles of Conceptualization in J. F. Wright and J. Kagan (Eds.), Basic Cognitive Processes in Children. Monographs of The Study for Research in Child Development.

Katrina, L. (2006). Relationship between motivational goals, academic self concept and academic achievement: what is causal ordering? Research centre, University of western Sydney, Australia

Lee, L.C., Kagan, J. and Rabson, A. (1963). The Influence of a Preference for Analytical Categorization upon Concept Acquisition. *Child Development, 24, 433-442.*

Lyons, L. & Carolina, L. (1994) Effect of Learning Style on Performance in using Computer-Based Instruction in Office Systems. *Dela-Pi-Epsilon-Journal, 36(3), 166-175.*

Macnab, W. (1991). Cognitive Style and Analytical Ability and the Relationship to Competence in the Biological Sciences. *Journal of Biological Education 25(2), 135-140.*

Olagbaju W. F. (1995). The Effects of Concept Mapping Strategy, Cognitive Style and Gender on Learning outcomes in Biology. *Unpublished Ph.D Thesis, University of Ibadan, Nigeria*.

Onyejiaku, F. O. (1980): Validation of Modified Sigel's Cognitive Style-test among Nigeria Secondary School pupils. *African Journal of Educational Research 2(1), 142-143.*

Oyekan S. O. (1984). Students' Cognitive Styles and Achievement in Biology. *Unpublished M. A. Ed. Dissertation. OAU. Ile-Ife. Nigeria*

Portis, I. & Simpson F. M. (1995). Evaluation of Cognitive Styles for Pre-professorial Educators. Paper presented at the Annual meeting of the Mid-south Educational Research Association Alabama, U.S.

Robinson, J. E. & Gray J. L. (1974) Cognitive Styles as a Variable in School Learning. *Journal of Educational Psychology. 66 (5): 773-799.*

Tella, A. (2008). Relationship among demographic variables and pupils' reasoning ability. *Electronic Journal of Research in Educational psychology* 6(3), 709-728

Whittington M. S. & Raven, M. R. (1995) Learning and Teaching Styles of Student Teachers in the Northwest. *Journal of Agricultural Extension, 36(4), 10-17.*

Wieseman R. A. (1992). A Follow-up Study on Learning Styles: Using Research to Facilitate Educational Excellence. Paper presented at the Annual Meeting of the Association of Teacher Educators. Alabama. U.S.

Witkin, H.A. Moore,C.A., Goodenough D.R. & Cox, P. (1977). A Cognitive Style Approach to Cross-cultural Research. *International Journal of Psychology 2, 233-250.*

Bassey, S.W., Umoren, G. & Udida, L.A. (2003). Cognitive styles, secondary school students' attitude and academic performance in Chemistry in Akwa Ibom state, Nigeria. Downloaded from http://www.hbcse.tifr.res.in/episteme/episteme-2/e-proceedings/bassey on 11th Dec., 2012