

Cognitive Styles as A Correlate of Pupils' academic Achievement in South-East, Nigeria



**Ifelunni, Clara O. (PhD)¹, Rev Fr. Ezema, Victor S (PhD)², Ugwu, Gloria C. (PhD)³,
Rev Fr. Eze, Celestine O. (PhD)⁴, Ncheke, Damian C. (PhD)⁵**

^{1,2,3,4,5}Department of Educational Foundations, Faculty of Education, University of Nigeria, Nsukka Enugu State, Nigeria

ABSTRACT: The study sought to investigate cognitive styles as determinants of academic achievement of pupils in South-East, Nigeria. Four research questions guided the study in line with the specific purposes of the study. The study was also guided by three null hypotheses. Correlation survey research design was adopted for the study. A population of 357,115 primary five (5) pupils in all the 5,378 public primary schools in South-East, Nigeria was used for the study. The sample for the study comprised four hundred (400) primary 5 pupils using Yaro Yamane's formula. A multistage sampling technique was used to draw the respondents. Two instruments were used for data collection, namely: Group Embedded Figure Test (GEFT) for cognitive style and pupils' academic achievement proforma which was used to collect achievement scores of the pupils in Mathematics for three terms. The average score of each pupil for the three terms was determined. The instrument was validated by three experts from University of Nigeria, Nsukka. Group Embedded Figure Test as a standardized instrument has a reliability estimate of 0.82. Scores from respondents were analysed using Pearson's Product Moment Correlation Coefficient and regression analysis. Specifically, Pearson's Product Moment Correlation Coefficient and Coefficient of Determination were used to answer research questions. In addition, regression ANOVA was used to test all the hypotheses at 0.05 level of significance. The findings of the study revealed, among others, that there is a significant correlation between field dependent cognitive styles and academic achievement of primary school pupils in Mathematics. It was recommended, among others, that The Federal and State Ministries of Education should organize and sponsor periodic workshops, conferences and seminars for teachers and head-teachers on the different cognitive styles and how they affect learning in order to actualize high academic achievement of primary school pupils especially in Mathematics.

INTRODUCTION

In order to achieve, a pupil needs to be guided to set a target he/she intends to accomplish and follow up with hard work and determination. But the urge to achieve this set target varies from one individual to another. For some, the need for achievement is very high while for others it is very low (Lansu & Cillessan, 2012). A well prepared learning environment, reinforcement, interaction among peers, good cognitive styles among others, can have a great influence on children's academic achievement. The meaning of academic achievement may vary depending on the context it is used. Academic achievement is significant to pupils because it determines their goal attainment. Ganai and Ashraf (2013) defined academic achievement as the knowledge gained or skills acquired in the school subjects usually designed by test scores or marks assigned by the teacher. Ifelunni, Ugwu, Aneke, Ibiam, Ngwoke, Ezema, Oraelosi, & Ede (2019) stated that academic achievement is the outcome of a pupil's learning effort in the school setting in Mathematics. Brownsard (2002) defined academic achievement as the overall academic performance of pupils in the school. It is assessed by the use of teachers rating test and examination. Academic achievement is a person's performance in a given subject area such as Mathematics, English Language, and the sciences, among others. Academic achievement is about the learning outcome of the pupils. Academic achievement of pupils has been of great concern to parents, guardians, teachers and government agencies, among others. Academic achievement of pupils will be anchored on mathematics for the purpose of this study, reasons being that mathematics is one of the core subjects in primary schools.

One variable likely to determine the academic achievement of primary school pupils is cognitive styles. It is essential that teachers take note of its influence on learners. Cognitive styles of pupils may help teachers to know how best to present their lessons. Cognitive style has been reported to be one of the significant factors that may impact students' achievement in various school subjects (Cakan, 2000). Cognitive style, according to Kholodnaya (2002) is defined as a psychological system that regulates and controls an individual's cognitive functioning. Ifelunni (2019) also opined that cognitive style is the individual differences in the way pupils think, reason, remember, understand situations and translate such situations for problem-solving. A number of cognitive styles have been identified and studied over the years. These include: Klein (1951) Sharpener / Levellers cognitive style, Witkin (1954) Field Dependence / Field Independence cognitive style, Pask (1972) Holist / Serialist cognitive style, among others

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(Altun&Cakan, 2006). However, field independence / field dependence will be used for this study. This is based on the fact that field independence versus field dependence lays emphasis on the use of social interaction in the development of cognition. There are three field related cognitive styles which include Field Independent (FI), Field Dependent (FD) and Field Neutral (FN) (Witkin, Oltman, Raskin& Karp, 1971).

Field dependent students, as asserted by Witkin in Lucas-Stannard (2003) have a preference for group works and require extrinsic motivation and more structured reinforcement from teachers while field independent students rather prefer individual work and tend to be intrinsically motivated. These are the two extremes of the field dependent and field independent cognitive styles while the individuals that are more adaptable to any situation are called the field neutral learners. They are at the middle of the field Independent (FI) and field Dependent (FD) learners. The field neutral learners prefer moderation in their daily activities with less routines and protocols (Nnodi, 2012). But at a perceptual level, Kholodnaya (2002) stated that field independent personalities are able to distinguish figures as separate from their backgrounds compared to field dependent individuals who experience events in an undifferentiated way. In addition, field dependent individuals have a greater social orientation relative to field independent personalities.

To buttress this point, Daniels in Yunusa and Tukur (2011) summarizes the general tendencies of field dependent and independent learners as follows: Field-dependent individuals rely on the surrounding perception field; have difficulty attending to, extracting and using non salient cues, among others. While the field-independent individuals: perceive objects as separate from the field; can dissemble relevant items from non-relevant items within the field; provide structure when it is not inherent in the presented information, among others. In addition, the characteristics of field-dependent learners are as follows; perceives globally, experiences in a global fashion, adheres to structures as given, makes broad general distinctions among concepts, sees relationships and social orientation. The characteristics of field-independent learners on the other hand include; perceives analytically, experiences in an articulate fashion, imposes structures of restrictions, makes specific concept distinctions, little overlap (Ruttun, 2009: 1026).

Studies have recognized a number of connections between cognitive style and learning (Messick in Kozhevnikov, 2007). Dwyer and Moore (2001) found the field independent learners to be superior to field dependent learners on tests measuring different educational objectives. In the field of education, cognitive styles have analytical power for academic achievement beyond general abilities (Sternberg & Zhang, 2002). Being field dependent, field neutral or field independent have a role to play in the learning situation. Although, some studies revealed that field independent students perform better than field dependent students, some others said that they perform similarly (Nnodi, 2012). However, studies have identified a number of connections between cognitive style and learning. Cognitive styles have either positive or negative relationships with academic achievement depending on the nature of the learning task the pupils are expected to undertake.

South-East, Nigeria is made up of five states namely, Enugu, Anambra, Ebonyi, Abia and Imo. There is availability of educational institutions such that every child unless otherwise deprived would have opportunity to go to school. However, experience and research evidence indicate that despite the enormous number of public and private owned primary schools within the region, children are still observed to be performing poorly, probably because the particular cognitive style that suits them has not been identified, thus leading to poor academic achievement in Mathematics. One then begins to wonder whether if cognitive styles are determinants of this inadequate academic achievement in Mathematics or not. It is against this background that the study investigated cognitive styles as determinant of academic achievement of primary school pupils in Mathematics in South-East, Nigeria.

STATEMENT OF THE PROBLEM

There is a descending trend in the academic achievement in Mathematics of primary school pupils in Nigeria in general and South-East, Nigeria in particular as shown by some researchers. For education to achieve the goal of national development, the primary school level is critical as it forms a basis for the overall development of a child. This level of education dictates the tune for the future development of the child and the success of other levels of education. There are hues and cries about the poor academic achievement of pupils at this level by various stakeholders in education.

Unfortunately, it will appear as if not much attention is being paid to this level as evidence abound to show poor academic achievements of pupils, especially in the South-East. Many reasons have been given for this. While some believe that factors associated with the teacher, classroom environment could mar or promote academic achievement of children. For some, it would appear that cognitive styles of pupils could be a major determinant of their poor or improved academic achievement. This may be why primary school pupils who are exposed to the same teaching experience by the same teacher in Mathematics, may be seen to perform at different levels of achievement.

Given these conflicting thoughts and the worrisome academic achievement of pupils in South-East, Nigeria, there is need to explore how cognitive styles determine academic achievement of primary 5 pupils in public primary schools in South-East, Nigeria. Herein lay the problem of the study. Put in a question form, therefore, the problem of this study is, "What is the correlation between cognitive styles and pupils' academic achievement in Mathematics?"

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Purpose of the Study

The general purpose of this study was to examine cognitive styles as determinant of academic achievement of primary school pupils in South-East, Nigeria. Specifically, the study sought to:

1. Establish the proportion of primary 5 pupils with the various cognitive styles.
2. Determine the correlation between field dependent cognitive style and academic achievement of primary school pupils in Mathematics.
3. Ascertain the correlation between field independent cognitive styles and academic achievement of primary school pupils in Mathematics.
4. Ascertain the correlation between field neutral cognitive styles and academic achievement of primary school pupils in Mathematics.

Research Questions

The following research questions guided the study:

1. What is the proportion of primary 5 pupils with the various cognitive styles?
2. What is the correlation between field dependent cognitive style and academic achievement of primary school pupils in Mathematics?
3. What is the correlation between field independent cognitive style and academic achievement of primary school pupils in Mathematics?
4. What is the correlation between field neutral cognitive styles and academic achievement of primary school pupils in Mathematics?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance;

HO₁: There is no significant correlation between field dependent cognitive styles and the academic achievement of primary school pupils in Mathematics.

HO₂: Field independent cognitive styles and the academic achievement of primary school pupils in Mathematics have no significant correlation.

HO₃: Field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics have no significant correlation.

METHOD

Design of the Study

This study adopted a correlation survey research design. Correlation survey research design according to Nworgu (2015) seeks to establish what relationship exists between two or more variables. Correlation survey research design studies indicate the direction and magnitude of the relationship among the variables.

Participants

A total of 400 pupils in South-East, Nigeria participated in the study. The researchers took account of some inclusion criteria. Among these are pupils who must be within the age range of 8 to 15, must be at the primary level, both gender was included. The researchers also conducted the study in accordance with the ethical standards of the American Psychological Association (American Psychological Association, 2010).

Instruments for Data Collection

Two instruments were used for data collection for this study. They are; the Group Embedded Figure Test (GEFT) developed by Witkin, Oltman, Raskin & Karp (1971) and Pupils' achievement test score proforma. The Group Embedded Figure Test (GEFT) by Witkin et al (1971) was adopted for the study. It is a standardized instrument with a reliability estimate of 0.82. The test consists of three sections. Section one of the GEFT includes seven patterns mainly designed to warm up the respondents, sections two and three include nine patterns each. Each pattern is considered the dominant visual field and the respondents' ability to identify the labelled simple form within the pattern determines whether they are Field dependent, Field neutral or Field independent. The first seven patterns are given for practice purposes. The highest score on the GEFT is, therefore, 18. The respondents' total score is formed by the number of simple figures correctly traced in sections 2 and 3 of the test. Respondents were given 10 minutes to complete each part. Respondents whose scores fall from 0 to 8 were defined as field dependent, those who scored from 9 to 14 were defined as field neutral and those who score from 15 to 18 were labelled Field Independent learners (Witkin et al, 1971). The scores of pupils with field dependent, field neutral and field independent cognitive style were correlated with their achievement score.

Pupils' academic achievement proforma was used to collect achievement scores of the pupils in Mathematics for three terms. The average score of each pupil for the three terms (first, second and third term results) was determined. The average scores

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of pupils in Mathematics were correlated with their scores from the instrument that addressed their cognitive styles. Each instrument was numbered in such a way that a pupil was assigned a number that was written on all the instruments that concern him/her.

To ensure that the instrument is reliable for the present study, it was validated by experts in Childhood Education, Educational Psychology and Measurement and Evaluation and pilot tested on 30 randomly selected pupils from different schools in Asaba, Delta state. Cronbach Alpha coefficient value of 0.84 was obtained, therefore it was considered to have satisfactory psychometric properties.

Method of Data Collection

Prior to the commencement of the research approval was sought from the Ministry of Education of the states where the schools used for the study are located. Furthermore, approval was sought from the head teachers of the participating schools. The head teachers gave their consent after being satisfied with the objective of the research. Thereafter, the head teachers informed the parents about the research at a Parent-Teachers Association (PTA) meeting where they unanimously consented since it does not expose their wards to any form of risk. To ensure confidentiality of responses, the researchers did not include any identification data such as name, phone number or contact address. Subsequently, the researcher with the help of three research assistants administered the instruments. The research assistants were briefed on how to distribute and collect data from the participants.

Method of Data Analysis

Data collected were analysed using Pearson's Product Moment Correlation Coefficient and regression analysis. Specifically, Mean, Standard Deviation, Pearson's Product Moment Correlation Coefficient and Coefficient of Determination were used to answer research questions. Regression ANOVA was used to test formulated hypothesis.

RESULTS

Results of Pearson Product Moment Correlation (PPMC) and Regression Analysis are presented in tables 1 to 7.

Research Question 1

What is the proportion of primary 5 pupils with the various cognitive styles?

Table 1. Frequency and percentage of the proportion of primary 5 pupils with the various cognitive styles

Cognitive Styles	Frequency	Percentage
Field dependent	220	55.0
Field neutral	148	37.0
Field Independent	32	8.0
Total	400	100.0

The result of the study as presented in Table 1 showed the proportion of primary 5 pupils with the various cognitive styles. The result of the study showed that 220 primary 5 pupils representing 55.0% had field dependent cognitive styles, 148 pupils representing 37.0% had field neutral cognitive styles while 32 pupils representing 8.0% had field independent cognitive styles. The finding of the study therefore showed that majority of the study pupils had field dependent cognitive styles (that is, the range of the scores ranged between 0 – 8).

Research Question 2

What is the correlation between field dependent cognitive style and academic achievement of primary school pupils in Mathematics?

Table 2. Pearson's Product Moment Correlation Field Dependent Cognitive Style and academic achievement of primary school pupils in Mathematics

Variable	\bar{x}	SD	N	r	R ²
Field Dependent Cognitive Style	5.16	2.15	220	0.19	0.04
Academic Achievement	61.6	814.33			

R² = coefficient of determination

Result in Table 2 shows that the correlation between field dependent cognitive style and academic achievement of primary school pupils was 0.19. This means there was a low positive relationship between field dependent cognitive style and academic achievement of primary five pupils. The coefficient of determination associated with 0.19 is 0.04. The coefficient of determination indicates that 4% of field dependent cognitive style accounted for primary school pupils' academic achievement in mathematics. This is an indication that 96% of the variation in pupils' academic achievement in mathematics is attributed to other factors other than field dependent cognitive style.

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Hypothesis 1

There is no significant correlation between field dependent cognitive styles and the academic achievement of primary school pupils in Mathematics.

Table 3. Regression Analysis of field dependent cognitive styles and primary school pupils' academic achievement.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1623.254	1	1623.254	8.15	0.01
Residual	43379.605	218	198.989		
Total	45002.859	219			

$\alpha = 0.05$

The result in Table 3 shows that an F-ratio of 8.15 with associated probability value of 0.01 was obtained. This probability value of 0.01 is less than 0.05 level of significance set as bench mark for testing the hypothesis and it was found to be significant. The null hypothesis which stated that there is no significant correlation between field dependent cognitive styles and the academic achievement of primary school pupils in Mathematics is therefore rejected and inference drawn is that, there is a significant correlation between field dependent cognitive styles and the academic achievement of primary school pupils in Mathematics.

Research Question 3

What is the correlation between field independent cognitive style and academic achievement of primary school pupils in Mathematics?

Table 4. Pearson's Product Moment Correlation Field Independent Cognitive Style and academic achievement of primary school pupils in Mathematics

Variable	\bar{x}	SD	N	r	R ²
Field Independent Cognitive Style	15.84	3.12	32	0.31	0.09
Academic Achievement	63.4	87.16			

R² = coefficient of determination

Result in Table 4 shows that the correlation between field independent cognitive style and academic achievement of primary school pupils was 0.31. This means there was a low positive relationship between field independent cognitive style and academic achievement of primary five pupils. The coefficient of determination associated with 0.31 is 0.09. The coefficient of determination indicates that 9% of field independent cognitive style accounted for primary school pupils' academic achievement in mathematics. This is an indication that 91% of the variation in pupils' academic achievement in mathematics is attributed to other factors other than field independent cognitive style.

Hypothesis 2

There is no significant correlation between field independent cognitive styles and the academic achievement of primary school pupils in Mathematics.

Table 5. Regression Analysis of field independent cognitive styles and primary school pupils' academic achievement.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	869.032	1	869.032	3.155	0.08
Residual	8262.147	30	275.405		
Total	9131.180	31			

$\alpha = 0.05$

The result in Table 5 shows that an F-ratio of 3.15 with associated probability value of 0.08 was obtained. The probability value of 0.08 is greater than 0.05 level of significance set as bench mark for testing the hypothesis and it was found not to be significant. The null hypothesis which stated that there is no significant correlation between field independent cognitive styles and the academic achievement of primary school pupils in Mathematics is therefore not rejected and inference drawn is that, there is no significant correlation between field independent cognitive styles and the academic achievement of primary school pupils in Mathematics.

Research Question 4

What is the correlation between field neutral cognitive style and academic achievement of primary school pupils in Mathematics?

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Table 6. Pearson's Product Moment Correlation Field Neutral Cognitive Style and academic achievement of primary school pupils in Mathematics

Variable	\bar{x}	SD	N	r	R2
Field Neutral Cognitive Style	10.70	1.31	148	0.11	0.01
Academic Achievement	62.48	14.16			

R² = coefficient of determination

Result in Table 6 shows that the correlation between field neutral cognitive style and academic achievement of primary school pupils was 0.11. This means there was a low positive relationship between field neutral cognitive style and academic achievement of primary five pupils. The coefficient of determination associated with 0.11 is 0.01. The coefficient of determination indicates that 1% of field neutral cognitive style accounted for primary school pupils' academic achievement in mathematics. This is an indication that 99% of the variation in pupils' academic achievement in mathematics is attributed to other factors other than field neutral cognitive style.

Hypothesis 3

There is no significant correlation between field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics.

Table 7. Regression Analysis of field neutral cognitive styles and primary school pupils' academic achievement.

Model	Sum of Sq	Df	Mean Square	F	Sig.
Regression	328.347	1	328.347	1.644	0.20
Residual	29166.293	146	199.769		
Total	29494.640	147			

$\alpha = 0.05$

The result in Table 7 shows that an F-ratio of 1.64 with associated probability value of 0.20 was obtained. The probability value of 0.20 is greater than 0.05 level of significance set as bench mark for testing the hypothesis and it was found not to be significant. The null hypothesis which stated that there is no significant correlation between field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics is therefore not rejected and inference drawn is that, there is no significant correlation between field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics.

DISCUSSION OF THE FINDINGS

The findings of the study were discussed in line with the research questions and hypotheses that guided the study.

The crux of research question one was on the proportion of primary school pupils in the different cognitive styles. The result of the study shows that a large number of the pupils have field-dependent cognitive style. This means that a greater percentage of the children operate without critical thinking. This is worrisome as no nation can survive without children who can think critically and solve problems that confront them.

There is a special advantage in being field dependent, field neutral or field independent. In other words, being field dependent, field neutral and field independent all have different roles to play in the improvement of academic achievement. However, studies have shown that field independent cognitive style performed higher than their field dependent counterpart (Yunusa&Tukur, 2011 and Dwyer & Moore, 2001). Teachers, parents and other stakeholders in the education of the primary school child are encouraged to devise means of making pupils more field independent to help them become critical thinkers that will contribute their quota to the betterment of themselves and the society at large. When pupils identify their appropriate cognitive styles and are able to meet up with that identified cognitive style to improve their achievement early especially at the primary school level, it will prepare them for the next level of education and even prepare them to face the challenges of life in general. This is because they will possess critical thinking skills required to function effectively and efficiently.

In addition, the result of the study shows that there was a low positive relationship between field-dependent cognitive style and academic achievement of primary five pupils. Furthermore, the result shows that there is significant correlation between field-dependent cognitive styles and the academic achievement of primary school pupils in Mathematics. The finding of the study corroborates the findings of Mbakwem&Mkpa(2003) which revealed that there was a significant difference in achievement between field dependent and field independent respondents. It also revealed that cognitive style has significant influence on students' academic achievement. The finding is at variance with that of Altun&Cakan (2006) who revealed that even when the effect of GPA on attitude score was removed field dependent and field independent students demonstrated similar attitudes towards computers. In order words, there was no significant relationship between cognitive styles (field dependent and field independent) and academic achievement.

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The finding of this study is also parallel to that of Ruttun (2009) which revealed that there is no significant difference among students with different cognitive styles in the test-gain scores which show that all the students who took part in the experiment made improvement with the given learning system. The inference drawn therefore is that, there is a significant correlation between field dependent cognitive styles and the academic achievement of primary school pupils in Mathematics. This means that the sample of the study still depends on outer-directed learning rather than self-directed learning. This does not make for critical thinking and may be counter-productive to Nigeria's quest for technological development which must be laid at this foundational level of education.

Result of the study also shows that there was a low positive relationship between field independent cognitive style and academic achievement of primary five pupils. The result also shows that there is no significant correlation between field independent cognitive styles and academic achievement of primary school pupils in Mathematics. The finding of the study is consistent with that of Yunusa and Tukur (2011) whose major finding revealed that independent cognitive style students achieved significantly higher than their dependent cognitive style counterpart in Mathematics Achievement Test. The finding is also similar to that of Dwyer and Moore (2001) which reveals the field independent learners to be superior to field dependent learners on tests measuring different educational objectives. The finding of the study is also in consonance with Kozhevnikov (2007) where it was found that field independent individuals are likely to learn more effectively under conditions of intrinsic motivation and are influenced less by social reinforcement. The conclusion drawn therefore is that, there is no significant correlation between field independent cognitive styles and the academic achievement of primary school pupils in Mathematics. However, even though the relationship is low, the positive relationship between field independent cognitive styles and academic achievement means that pupils' achievement in Mathematics is likely to increase as their proneness to field independent cognitive style increases. Therefore, pupils' should be encouraged to adopt the field-independent cognitive style so that their academic achievement will be improved.

Furthermore, the results of the study show that there was a low positive relationship between field neutral cognitive style and academic achievement of primary five pupils. The coefficient of determination indicates that 1% of field neutral cognitive style accounted for primary school pupils' academic achievement in mathematics. This is an indication that 99% of the variation in pupils' academic achievement in mathematics is attributed to other factors other than field neutral cognitive style. In addition, there is no significant correlation between field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics. The finding of the present study is consistent with the findings of Ipek (2011) who conducted a study on the effects of variations in text density levels and the cognitive style of field dependence on learning from CBI tutorial in Turkey. The result of the study revealed that no significant interaction was observed between the cognitive style of field dependence and text density levels on reading comprehension scores. It shows that cognitive style has no significant influence on achievement. The finding is at variance with that of Onyekuru (2015) who revealed that there was a significant relationship between field dependence-field independence cognitive style and gender. The conclusion therefore is that, there is no significant correlation between field neutral cognitive styles and the academic achievement of primary school pupils in Mathematics. What the findings of the present study (1% of field neutral cognitive style accounting for primary school pupils' achievement) implies is that in reality, pupils' cognitive styles are either inclined to field dependent or field independent hence neutrality in reality is non-existent, at least, on the basis of this study.

CONCLUSIONS

From the results of the study, it was concluded that majority of the pupils have field dependent cognitive styles and the pupils' cognitive styles correlated with their academic achievement in Mathematics.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made;

1. The finding of the study showed that there is a significant correlation between academic achievement and the different cognitive styles. Childhood educators are therefore implored to be aware of the individual differences in children in their teaching and how these affect them academically in order to make for improved academic achievement.
2. The Federal and State Ministries of Education should organize and sponsor periodic workshops, conferences and seminars for childhood educators, parents, teachers and head-teachers on the different cognitive styles and how they affect learning in order to actualize high academic achievement of primary school pupils.

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