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Cognitive learning styles as correlates of primary school pupils' academic achievement in mathematics

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Abstract
This study investigated cognitive learning styles as correlates of primary school pupils' academic achievement in mathematics. Two research questions and two hypotheses were formulated. The research design adopted is ex-post facto design and correlational survey Designs. The population of the study comprised 2377 primary five pupils in the 45 public primary schools in Awka South Local Government Education Authority. The sample size of the study was 147 primary five pupils derived through the multi-stage sampling technique. Data for the study was collected by means of questionnaire was validated by three experts and subjected to test of internal consistency. The reliability co-efficient of 0.87 was derived. Mean, Pearson Product Moment Correlation were used to answer the research questions while
T-Test correlational analysis was used to test the null hypotheses at 0.05 alpha level. The findings revealed that there is a high positive relationship between cognitive learning style and male pupils' academic achievement in Mathematics. It was also found out that there was a moderate positive relationship between cognitive style and pupils' academic achievement in mathematics. Based on this finding, i twas recommended amongst others that Seminars and workshop should be organized at state levels, education zone and ministries of education levels where teachers, textbook authors and curriculum planners will be taught various ways of teaching mathematics so as to ensure achievement of pupils irrespective of cognitive learning style in mathematics.

Keywords: cognition, learning syles, primary school pupils, academic achievement, mathematics

Introduction

Proficiency in reading, writing and mathematics are major indicators of social wellbeing for all people, providing not only the skills for meaningful interactions with the world, but also the foundations for success in education and beyond school (Harrison, Goldfeld, Metcalfe & Moore, 2012) [9]. Mathematics is one of the key and foundational subjects taught at different levels of education starting from the pre-primary school to the primary and even beyond to secondary level and tertiary education.

The Federal Republic of Nigeria (FRN, 2013) in her National Policy on Education stipulated that mathematics is a compulsory subject taught starting from the pre-primary through the primary to secondary levels of education in Nigeria. Its function and relevance to education and the society makes it to be regarded as the bedrock of science and technological development thereby serving as the basis for overall learning development. In view of this, Ogan (2012) argued that no nation can develop scientifically and technologically without proper foundation in mathematics.

Mathematics is an aid to representing and attempting to resolve situation in all disciplines. Thompson (2014) [18] opined that mathematics is a subject that teaches critical thinking and problem-solving in a much applied form. The general objective of primary education is to generate interest in mathematics for everyday living, counting notation, addition, subtraction, multiplication, division, weighing, measuring, selling and buying are some of the simple and fundamental processes of mathematics which have practical value in life (FRN, 2013).

To achieve the objectives of primary school education in Nigeria, the learning of mathematics should impart many skills that contribute to the development of the human mind. Khonkarn (2006) [12] reiterated that mathematics trains the learner to think methodically and rationally, analyze various types of situations, anticipate and plan, make decisions and solve problems. Khonkarn further enlightened that mathematics also serves as a tool that facilitates the gaining of knowledge related to science and technology.

The importance of mathematics cannot be under-estimated especially at the primary school level which forms the foundation of schooling. Sequel to this, several studies have shown that the rate of pupils' non-challant attitude towards mathematics could be as a result of poor instructional method of teaching employed by the teacher (Iyi 2011; Moseri, Onwuka and Iweka, 2010) [10, 14]. Other factors of pupils' poor achievement in mathematics could be parental attitude towards mathematics, inadequate number or quality teachers to handle the subject and some teachers lack teaching of some mathematical concept in some selected topics in mathematics. To further buttress this, reports from the Anambra State Universal Basic education Board (ASUBEB, 2018) revealed that the academic achievement of pupils in core subjects especially mathematics has been decreasing year by year. Data collected for the year 2015-2017 revealed a high rate of failure which stood at 31%, 28% and 25% respectively.

From these statistics, it seems that pupils thus develop a dislike for some aspects of mathematics. Ogan (2013) [15] noted that pupils dislike certain topic because they feel the topics are difficult and could not be understood easily. For these reasons many children starting from the primary school experience difficulties in the learning of mathematics. These aspects include probability, statistics,

algebra, geometry trigonometry and number numeration.

The situation of poor achievement in mathematics and other science subjects have prompted this study to explore pupils' cognitive learning style which may be of benefit in improving achievement in mathematics. It has been observed that children have different ways of perceiving and reasoning mathematics concepts based on their mental readiness. In other words, pupils have different cognitive learning styles which may affect their learning.

Cognitive learning style is an individual way of learning, perceiving, thinking and reasoning. Cognitive psychologist such as Ausubel, Bruner, Gagne and educators (teachers) have been interested in understanding the individual differences in cognition and their impact on learning and instruction (Altun & Cakar, 2010) [2]. Pitch (2012) [17] defined cognitive learning style as the relatively stable strategies, preferences and attitudes that determine an individual's typical modes of perceiving, remembering and problem solving. In the context of this study, cognitive learning style is a psychological construct which is concerned with how pupils learn, think, remember, solve problems and relates to others. This implies that each pupil has a preferred cognitive learning style.

The cognitive learning styles which have received the greatest attention in research are field dependent (FD) and field independent (FI). Zhang cited in Kozhevnikov (2013) [13] defined field dependent and field independent as a reflection of the extent to which an individual uses external or internal cues for conduct. Field dependent and field independent are typically referred to as a variable cognitive learning style. An individual is either a field independent (FI) or field dependent (FD) (Witkin in Ogan, 2013) [15]. A field independent (FI) Cognitive learning style learner is described as analytic, competent, individualistic, task oriented, intrinsically motivated, self-structuring, detail oriented and skills (Felder, 2010). A Field-dependent cognitive learning style learner is described as global (holistic) group oriented, sensitive to social interactions and criticisms, externally motivated, passive learners who prefer external information and group project (Hall, 2010).

Similarly, Kozhevnikov (2013) [13] stressed that cognitive learning styles are associated with different parts of the brain and gifted children as young as the age of 6-11 years, who have not received any area-specific training, exhibit specialization in these cognitive learning styles. Sequel to this, there is the need to determine how pupils' cognitive learning style may correlate with their achievement in mathematics. This is because the knowledge of pupils' cognitive learning style is very useful in teaching. Pupils' ability is associated with their cognitive learning styles which help to measure teacher effectiveness and learning outcome (Kalu, 2014) [11]. Pupils' ability as well as cognitive learning style may be influenced by gender.

Gender is socially or culturally constructed characteristic, qualities, behaviours and roles which different societies ascribe to females and males. Therefore, it could be said that learning differences are gender based and are related to the individuals' socialization and culturalization rather than based on biological differences (Feldstein & Jiggins, 2014) [7]. Studies have shown that gender as a variable relates to achievement (Ezeugo & Agwagah, 2010). For instance, Olagunju, (2011) [16] observed that boys choose science courses in high schools than girls, especially mathematics, chemistry, and physics. This is due to the long held view that women are weaker vessels who cannot stand the stress involved in the subjects. To this end, Adeyemi (2014) [1] argued that at present females are struggling to fight the oppression, suppression and domination by their male counterparts in mathematics. Etukudo (2012) [3] found that female pupils performed significantly higher than their male counterparts in mathematics.

Unfortunately, preliminary investigations reveal that there are several outcries over pupils' poor achievement in mathematics starting from the pre-primary education to the tertiary education. This could be attributed to inadequate teachers, use of ineffective instructional materials, poor teaching methods and incompetence of teachers in teaching some mathematics topics. All these reports point to the fact that there is a gap in the field of mathematics. Factors such as the pupils' cognitive learning style and gender have been implicated in the pupils' poor achievement in mathematics. Pupils have different cognitive learning styles which may affect their learning. Pupils with certain cognitive learning styles are either facilitated or hampered by the particular teaching methods to which they are exposed to. Teaching pupils to reason, think critically and solve problems in mathematics generally have been a concern to all educators.

The teacher's knowledge of pupils' cognitive learning styles to mathematics could go a long way in achieving meaningful learning of mathematical concepts. This is because cognitive learning style is a variable that are not observable in themselves and do not lend themselves to experimental methods or manipulations. With regards to these ugly situation teachers, parents, government and the society are disquiet with how to salvage the state of affairs. Hence, the researcher examined cognitive learning styles as correlates of primary school pupils' academic achievement in mathematics in Anambra State.

Research Questions

1. What is the relationship between cognitive learning style and male pupils' academic achievement in Mathematics?
2. What is the relationship between cognitive learning style and female pupils' academic achievement in Mathematics?

Hypotheses

1. There is no significant relationship between cognitive learning style and male pupils' academic achievement in Mathematics.
2. There is no significant relationship between cognitive learning style and female pupils' academic achievement in Mathematics.

Method

The research design adopted is ex-post facto design and correlational survey designs. The study was carried out in Anambra state. The population of the study comprised 2377 primary five pupils (1031 males and 1346 females) in the 45 public primary schools in Awka South Local Government Education Authority. This Information was gathered from the Department of Research and Statistics, Anambra State Universal Basic Education Board ASUBEB, Anambra State 2018/2019 academic year. The sample size of the study was 147 primary five pupils. The multi-stage sampling technique was used in this study. Data for the study was collected by means of questionnaire developed by the researcher. The

first instrument was a standardized instrument on learning Style Questionnaire developed by O'Brien (1985) (Adapted) titled "Questionnaire on Cognitive learning style" (QCS). The face and content validation of the instrument was established using the opinions of three experts. The instrument was subjected to Cronbach Alpha Method to determine the internal consistency of the instrument and an overall co-efficient value of 0.87. Research question 1 was analyzed using mean. Research Questions 2, 3, 4 and 5 were analyzed using Pearson Product Moment Correlation Co-efficient (Pearson r). This was used to determine if a relationship exist between the study variables. Data relating to the null hypotheses 1 and 2 was analyzed using t-test correlational analysis because this statistical tool is used to determine the significant of relationship between two variables.

Results

Research Question 1: What is the relationship between cognitive learning style and male pupils' academic achievement in Mathematics?

Table 1: Relationship between cognitive learning styles and male pupils' academic achievement in Mathematics

N	Correlation co-efficient (r)	Remark
78	.690	High positive relationship

Data in Table 1 reveal a Pearson Product Moment Correlation Co-efficient computed to determine the relationship between cognitive learning styles and male pupils' academic achievement in mathematics. The result reveals that there is a very high positive relationship between cognitive learning styles and pupils' academic achievement in mathematics *(r=.690, n= 78).*

Research Question 2: What is the relationship between cognitive learning styles and female pupils' academic achievement in mathematics?

Table 2: Relationship between cognitive learning styles and female pupils' academic achievement in Mathematics

N	Correlation co-efficient (r)	Remark
69	.552	Moderate positive relationship

Data in Table 2 show the nature of relationship between cognitive style and female pupils' academic achievement in mathematics. The analysis reveals a moderate positive relationship between cognitive style and pupils' academic achievement in mathematics *(r= 0.552, n= 69).*

Hypothesis Testing

Hypothesis 1: There is no significant relationship cognitive learning styles and male pupils' academic achievement in Mathematics.

Table 3: Test of significance between cognitive learning style and male pupils' academic achievement in mathematics

Correlation coefficient (r)	N	Df	t-calculated	t-critical	Decision
.690	78	76	8.72	1.960	Significant

Result presented in Table 3 shows that the t-calculated value (8.72) is greater than the t-critical value (1.960) at 76 degree of freedom. Thus, the null hypothesis was rejected. This means that there is a significant relationship between cognitive learning style and male pupils' academic achievement in mathematics.

Hypothesis 2: There is no significant relationship cognitive learning styles and female pupils' academic achievement in Mathematics.

Table 4: Test of significance between cognitive learning style and female pupils' academic achievement in mathematics

Correlation coefficient (r)	N	df	t-calculated	t-critical	Decision
.552	69	67	5.412	1.960	Significant

Result presented in Table 4 shows that the t-calculated value (5.41) is greater than the t-critical value (1.960) at 67 degree of freedom. Thus, the null hypothesis was rejected. This means that there is a significant relationship between cognitive learning style and male pupils' academic achievement in mathematics.

Discussion of Findings

The finding revealed that there is a high positive relationship between cognitive learning style and male pupils' academic achievement in Mathematics. This implies that male pupils' academic achievement tend to possess a high cognition in their mathematics. This finding opposed the finding of Parkash (2013) that there is a positively low relationship cognitive style and male retention in rural senior secondary school students. The difference in both finding could be as a result of different variable of interest being considered; the present study examined academic achievement while the study of Parkash examined retention. Conversely, this study agreed with Ella (2014) that there was a positive relationship between cognitive styles and male students with different cognitive ability.

The result in hypothesis one revealed that is relationship between cognitive learning style and male pupils' academic achievement in Mathematics. This finding was in tandem with the finding of Ella (2014) that there is a significant difference between the cognitive styles of male e science students of low cognitive ability levels.

The finding revealed that there is a moderate positive relationship between cognitive style and pupils' academic achievement in mathematics. This study agreed with Ella (2014) that there was a positive relationship between cognitive styles and male students with different cognitive ability. On the other hand, this finding opposed the finding of Parkash (2013) that there is a positively low relationship cognitive style and male retention in rural senior secondary school students. The difference in both finding could be as a result of different variable of interest being considered; the present study examined academic achievement while the study of Parkash examined retention. The result in hypothesis two revealed that is relationship between cognitive learning style and female pupils' academic achievement in Mathematics. This finding was in tandem with the finding of Ella (2014) that there is a significant difference between the cognitive styles of female e science students of low cognitive ability levels.

Conclusion

Based on the finding of the study, it was concluded that The aim of the study was to find out cognitive learning styles as

it correlates with primary school pupils' academic achievement in mathematics. Based on the result, it was concluded that there is a high positive relationship between cognitive learning style and male pupils' academic achievement in Mathematics. The study also concluded that there is a moderate positive relationship between cognitive style and pupils' academic achievement in mathematics.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Teachers should use instructional materials and techniques that are not gender sensitive. This will eliminate gender imbalance in classroom and achievement, because the objective of teaching is to make pupil learn or achieve higher not in favour of male or female.
2. Seminars and workshop should be organized at state levels, education zone and ministries of education levels where teachers, textbook authors and curriculum planners will be taught various ways of teaching mathematics so as to ensure achievement of pupils irrespective of cognitive learning style in mathematics.

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