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RELATIONSHIP AMONG COGNITIVE STYLES OF FIELD INDEPENDENCE, FIELD DEPENDENCE AND SENIOR SECONDARY STUDENTS' ACHIEVEMENT IN MATHEMATICS IN ILORIN EAST LOCAL GOVERNMENT, KWARA STATE

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Abstract

Mathematics is key to science and technological development of any nation. Research has revealed the downward trend in students' performance in Mathematics and this has been partly traced to teacher and learner-related factors. Therefore, this study investigated the relationship between cognitive styles of field independence/ field dependence and students' achievement in Mathematics in Ilorin East Local Government, Kwara State. The objectives of the study were to assess: (i) students' profile of academic achievement (ii) students' cognitive styles (FI/FD) (iii) the relationship among field independence, field independence and students' achievement in Mathematics. The study adopted a descriptive research design of correlational type. The sample comprised 270 students III in Ilorin East, Kwara State. An adapted version of FI and FD Scale by Wyss (2002) and an adopted Mathematics Performance Test in WAEC May/June 2022 multiple choice past questions were used for data collection. The reliability coefficients and face and content validity of the instruments were determined. The data collected were analyzed using frequency count, percentage, and Multiple regression at 0.05 level of significance. The findings of the study revealed a significant positive relationship among

field independence/ field dependence and students' achievement in Mathematics (R^2 =.041; F=5.684, p 0.05). The study concluded that students' academic performance in Mathematics has positive relationship with students' cognitive styles of field independence and field dependence. The implication of this study is that students' cognitive style is a positive factor of students' achievement in Mathematics. It was recommended among others that stakeholders, especially teachers, should take into account students' cognitive styles and adapt their teaching methods to suit the learners' cognitive styles especially in teaching mathematics.

Key words: Academic achievement Cognitive styles, Field dependence, and Field independence

Introduction

Mathematics as a school subject is an essential tool that plays important roles in every aspect of human life. Its importance can be felt in areas like science and technology. It also plays a critical role in shaping students' later stage of occupational options especially in the contemporary Nigeria, where greater emphasis is being placed on industrial and technological development. This might be the reason Okafor (2005) opined that no nation can develop scientifically and technologically without proper foundation in Mathematics. This might equally be the reason the subject is regarded as a universal language and a way of thinking which we all need, in small or large measure, to make sense of the world around. Mathematics as a subject stands high above other school subjects because of its universal utility in every area of human endeavour and is one of the prerequisite subjects required for admission into various higher institutions of learning in Nigeria. It should, therefore, be seen not only as a school subject to be learnt but also as a service to other areas of human endeavour.

This implies that Mathematics holds a prominent place in the technological development of a nation, and academic success in this subject is very important considering its importance in rapid scientific and technological development in the world at large. In spite of the importance of Mathematics, high rates of low academic

achievement in the subject is being recorded on yearly basis especially among senior secondary school students in external examinations (Ajayi, 2014). This statement is buttressed with the recent Statistics of May/June Students' Performance in Mathematics in West African Examination Council (2022) which revealed that a total of 1,222,505 candidates, amounting to 76.36 per cent of the 1,601,047 candidates that successfully wrote the examination, obtained credits and above in Mathematics. The statistics, however, represent a decrease of more than five per cent in performance when compared with the 81.7 per cent pass rate recorded in 2021. It is quite discouraging that, despite the efforts of the Federal Government of Nigeria at forestalling the trends of students' inconsistent academic performance in Mathematics.

In order to address this fluctuating performance in Mathematics, scholars and researchers have focused their attentions on different factors responsible for this identified issue. For instance, McGuire (2000) identified variables such as teacher factor which consist of mastery of the subject matter, instructional techniques, classroom management, communication skills, personality, and negative attitude of students towards Mathematics as the main causes of low academic performance. This implies that, though teachers have been persistently held responsible for low academic performance, students too cannot be completely exonerated as they have important roles to play in making sure effective teaching and learning takes place. However, to examine variables that can enhance students' academic achievement, cognitive styles especially bipolar categorization of field dependence and field independence has attracted attention of researchers.

Cognitive style, as a variable, determines distinct ways in which people usually respond to the same task under the same condition. Pitcher (2002) and Srinivas (2011) referred to cognitive styles of field independence and field dependence as the extent to

which individual uses internal or external frame of references in addressing a given problem. Cognitive style is the relatively stable strategies, preferences and attitudes that define individual consistent modes of perceiving, remembering and problem solving. As observed by Okwo and Otuba (2007), the differences between FI and FD learners are more likely the result of varying information processing skills such as analytical, independent or dependent, externally or internally motivated and influenced or not influenced by field structure.

Field independence and field dependence cognitive styles, according to Hall (2000), was defined as a reflection of the extent to which an individual uses external or internal frame of references or cues as a guide in solving problems. A FI individual is described as analytic, competent, individualistic, task oriented, intrinsically motivated and thorough while a FD individual is described as group oriented, sensitive to environmental cues and criticisms, externally motivated who prefer external information and group-oriented task. It was affirmed that students with FI cognitive styles tend to thrive in scientific disciplines while students with FD cognitive styles tend to do better in humanitarian disciplines.

Several researchers such as Ramlah and Nasir (2007), Miller (2007), Theen and Abdullah (2008), Ogan (2012), Ahmadzade and Shojae (2013), Leila and Moslem, (2013) and Onyekuru (2015) had conducted and investigated the relationship among cognitive styles and students' academic achievement and found out that there is a significant positive relationship among students' academic achievement and their cognitive styles. Hence, this current study examined cognitive styles of field independence, field dependence and Senior Secondary School Students' academic achievement in Mathematics in Ilorin East, Kwara State.

Statement of the Problem

In Nigeria, fluctuations and downward trend in the performance of students in

Mathematics at secondary school level as reported in the statistics on yearly basis has been a serious concern to educators and researchers. Could this be because of the variables of this study not taking into consideration in the teaching and learning of Mathematics in secondary schools? This could be reason Njagi (2015) affirmed that lack of flexibility in the way instructors teach in relation to students preferred cognitive style is one of the problems affecting performance in Mathematics.

In a related study by Rastegar (2016) affirmed that students' cognitive styles play an important role in facilitating learning and it can make or mar students' performance. It was therefore reported that there was a positive relationship between cognitive style and students' performance in English Language. This study considered English Language as a subject. In a related manner, Idika (2017) conducted a study on the influence of cognitive style on secondary school students' achievement and attitude to chemistry in Ibadan, Oyo state. It was reported that there was a significant relationship between cognitive styles and academic achievement, but field independent students performed better than field dependent students in their academic achievement.

From the foregoing, it can be inferred that there is lack of in-depth studies especially in the current locale and most of the related studies in this area focused on other subjects and they are foreign based which calls for further studies to reaffirm the external validity of the studies. This is the gap the researcher intended to fill to complement what exists in the literature by examining the relationship among cognitive styles of field independence, field dependence and senior secondary school students' academic achievement in Mathematics in Ilorin East Local Government, kwara State.

Purpose of the Study

The main purpose of this study was to investigate the relationship among cognitive styles of field independence, field dependence and students' achievement in

Mathematics in Ilorin East Local Government Area of Kwara State. Specifically, the study examined the:

a. Level of senior secondary school students' field independence and field dependence

b. Level of senior secondary school students' performance in Mathematics

Research Questions

The following research questions guided the focus of this study:

a. What is the level of senior secondary school students' field independence and field dependence in Ilorin East?

b. Is there any relationship among field independence, field dependence and students' academic achievement in Mathematics in Ilorin East Local Government Area of Kwara State?

Research Hypothesis

The following null hypothesis was formulated from the research questions to sharpen focus of the study.

H_{01}: There is no significant relationship among cognitive styles of field independence, field dependence and students' academic achievement in Mathematics in Ilorin East Local Government Area of Kwara State.

Methodology

The research design adopted for this study was a descriptive design of correlational type. Correlation research design was, therefore, adopted in this study because the researcher intended to investigate the relationship among field independence, field dependence and students' academic achievement in Mathematics in Ilorin East Local Government Area of Kwara State. The population of this study comprised all secondary school students in Ilorin East Local Government Area of Kwara

State, while the target population was all senior secondary school students III in the Local Government.

Simple random sampling technique was used to select 6 senior secondary schools in Ilorin East Local Government Area of Kwara State. In addition, stratified sampling technique was used to categorize the schools into public and private schools. Simple random sampling technique was then used to select 3 public and 3 private secondary schools from Ilorin East Local Government Area of Kwara State. This gave every school an equal chance of being selectedin the study. Simple random sampling technique was also used to select 45 senior secondary school students III from each of the six senior secondary schools selected making the total of 270 senior secondary school students III. Senior secondary school students III were selected because the researcher believes that, they have covered the mathematics syllabus. The instruments used for the collection of data in this study was a questionnaire forms. Instruments employed were Cognitive Style of Field Independence and Field Dependence developed by Wyss (2002) and Academic Performance Test was adopted from WAEC May/June 2022 multiple choice past question in collecting data for the study.

Field Independence and Field Dependence Assessment Scale developed by Wyss (2002) was adapted to collect data on cognitive styles of senior secondary school students The questionnaire contained 9 statements for each of the two cognitive styles (Field Dependence or Field independence) which were used to measure the respondents' preference for each cognitive style dimension. The highest score in the field dependence/independence is 45 (5 x 9). The highest score between the two dimensions (FD/FI) indicated strength or inclination to that cognitive style. The instrument was rated on 5-point Likert scale as indicated below: Very true of me = 5, True of me= 4, Almost true of me= 3, Untrue of me = 2, Very untrue of me= 1.

In a recent study, Winanti (2016) reported a Cronbach Alpha score of .94 and a

test re-test reliability index of .84. For the purpose of this study, items 1, 2, 3, 5, 7 in section 'A' and 2, 4 and 7 in section 'B' of the instrument were reworded. This is because the instrument was foreign based. The researcher, in order to ascertain the reliability of the cognitive style of field independence/independence scale, used internal consistency method of testing reliability in the form of Cronbach Alpha. The instrument revealed reliability coefficient of 0.71 for field independence and 0.75 for field dependence respectively. This attested to the appropriateness of the instrument in measuring what it intends to be measured.

Mathematics Performance Test in WAEC May/June 2022 multiple choice past questions was adopted to measure students' performance in Mathematics. This is a standardized test, and the psychometric property of the test has been determined. Fifty

Variables	Score Range	Frequency	Percentage	Mean Score
Cognitive Styles				
FI		128	46.7	34.66
FD		144	53.3	37.26
Total		**270**	**100.0**	
Acad.Performance				
Passed		233	86.3	57.17
Failed		37	13.7	
Total		**270**	**100.0**	

Results in Table 1 revealed that out of 270 secondary school students that participated in the study, 128 (46.7%) were field independent with the mean score of 34.66, while 144 (53.3%) were field dependent with the mean score of 37.26. This means that the total points scored by both field independent and field dependent students were also above the mean score. This implied that, the secondary school students in Ilorin East Local Government Area of Kwara State had relatively equal field independent and field dependent cognitive styles. Finally, results in Table 1 showed that out of 270 secondary school students involved in the study, 233 representing 86.3% obtained the pass marks in Mathematics performance test with the mean score of 57.17, while 37 representing 13.7% failed the mathematics performance test. This showed that the majority of the secondary

school students sampled for the study passed the test in Mathematics.

Hypotheses Testing

The null hypothesis was stated thus:

H_0: *There is no significant relationshipamong field independence, field dependence and students' academic achievement in Mathematics.*

2a Summary of the Multiple Regression Analysis

Dependent variable = Mathematics
Multiple R = .202
R Square = .041
Adjusted R Square = .034
Standard Error of the Estimate =18.602

Results in 2a revealed that field independence and field dependence jointly yielded a coefficient of multiple regression (R = .202) and a multiple correlation square (R^2= .041) representing 4.1%. This implied that the combination of field independent and field dependent cognitive styles accounted for 4.1% of the observed variation in students' academic performance in Mathematics.

Table 2b: Results of Regression Analysis of Relationship among FI, FD and academic achievement in mathematics

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3933.916	2	1966.958	5.684	.004[b]
Residual	92394.247	267	z346.046		
Total	96328.163	269			

a. Dependent Variable: performance
b. Predictors: (Constant), FD, FI

Results in Table 2b revealed that the variables of field independent and field dependent cognitive styles and students' academic performance in Mathematics had significant positive relationship as seen in the degree of freedom of 2 and 269 with F-ratio of 5.684, which is significant at .004. Therefore, there exists a significant relationshipamong the two independent variables and the dependent variable.

Table 2c: Parameter Estimate of Regression Analysis of Field Independent and Field Dependent Cognitive Styles to the Students' Performance in Mathematics

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	30.005	14.223		2.110	.004
	FI	.403	.313	.080	1.287	.199
	FD	1.104	.330	.207	3.342	.001

a. Dependent Variable: Performance

a. Dependent Variable: PerformanceVariables in the Equation:

a. Dependent variable: Performance in Mathematics
b. Independent Variables: FI, FD

Results in Table 2c reveal the relative contribution of each of the independent variables to the dependent variable. It revealed that field independent cognitive style has a Beta weight of .080 and the t-value of 1.287 which is not significant at .199 while field dependent cognitive style has Beta weight of .207 and t-value of 3.342 which is significant at .001. Based on the values of Beta weights and t-ratio for each independent variable, it was shown that only field dependent cognitive style had significant relative contribution to the students' academic performance in Mathematics.

Discussion of the Findings

The discussion of the findings of this study was guided by the research questions and hypothesis of the study. From the data collected from the study, it was found that the respondents had both field independent and field dependent cognitive styles. This result is not surprising as psychologists are fully aware that there is individual difference in cognitive styles which result to different people responding to and addressing differently the same task. Concerning academic performance, the respondents had high performance in Mathematics. This performance may be because of the quality of teachers, environment and highly impressive teaching and learning improvement interventions in technology and instructional materials.

Similarly, the result of the study revealed that there was a significant relationship between field independent, field dependent cognitive styles and the students' academic performance in Mathematics. This mode of result is possible because cognitive styles determine how students acquire, process information, and solve a given problem in the classroom. Several studies in the past have reported similar results. For instance, this

finding buttresses the findings ofOmode, (2009), Sozcu, (2014), Njagi (2015),and Idika (2017) who found out that there was a significant relationship among field independence, field dependence and students' academic performance with field independent students performed better than field dependent students.

Conclusion

It was concluded from the findings of the study that there was a significant relationship between field independence and field dependence and students' academic performance in Mathematics. This means that cognitive styles of field independence and field dependence is a strong determinant of students' academic performance in Mathematics.

Recommendations

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

i. Arising from the finding of the study that there was a positive relationship among field independent, field dependence and students' academic achievement, it was therefore recommended that teachers should take cognizance of the students' cognitive styles and adapt their teaching methods to suit these identified individual differences in learners.

ii. Parents should also play a supportive role by identifying students' cognitive styles early and encouraging them to be flexible in the way they address a given problems based on their cognitive styles.

iii. Finally, it was recommended that educational psychologists, as one of the main stakeholders in education, should be well-involved in the education policy and implementation to give the deserved attention to the variables of cognitive styles

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