Motivation as a Differential Predictor of Mathematics Achievement of Pupils in South-East, Nigeria

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Abstract: The study sought to investigate motivation as a determinant of academic achievement of primary school pupils in Mathematics in South-East, Nigeria. Three research questions guided the study in line with the specific purposes of the study. The study was also guided by three null hypothesis. The correlational survey research design was adopted for the study. A population of 357.115 primary 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 400 primary 5 pupils using Yaro Yamane's formula. A multistage sampling technique was used to draw the participants. Two instruments were used for data collection: namely, scale of intrinsic and extrinsic motivation in the classroom by Harter and Mathematics achievement test developed by International Association for the Evaluation of Educational Achievement (IEA). The instruments were validated by three experts from University of Nigeria, Nsukka. Data collected was analyzed using Cronbach alpha formula. An internal consistency reliability coefficient of 0.85 was obtained for the scale of intrinsic and extrinsic motivation in the classroom, 0.87 for Mathematics achievement test and an overall coefficient of 0.84 was obtained. Scores from participants were analyzed 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 hypothesis at 0.05 level of significance. The findings of the study revealed, among others that there is a significant correlation between intrinsic motivation and primary school pupil's academic achievement in Mathematics in South-East, Nigeria 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 motivation types and how they affect learning in order to actualize high achievement in Mathematics for primary school pupils.

Key words: Intrinsic motivation, extrinsic motivation, achievement, pupils, motivation, Mathematics

INTRODUCTION

The trend of poor academic achievement of primary school pupils in Mathematics have been confirmed by many researchers (Chukwu, 2001; Nwoye, 2009). Teachers who mark junior secondary school examination scripts complained about this poor academic achievement (Obiweluozo, 2014). This is probably because the Mathematics foundation which is very weak at the primary school level is carried forward to junior secondary school and subsequently into senior secondary school. This is confirmed by the results of the West African Examination Council from 2013-2016. Analysis of the results in Mathematics from the years 2013, 2014, 2015 and 2016 revealed that the percentage of students that passed during this period were reported to be 36.00, 31.30, 34.18 and 38.68, respectively (WAEC., 2013-2016). This shows a very poor academic achievement as the pass rate is below average, even though there is a little improvement from 2014-2016 results. It is a known fact that to secure admission to institutions of higher learning, a credit in Mathematics is compulsory especially in the Sciences and Humanities (Joint Admission and Matriculation Board (JAMB., 2006). Therefore, the need to aim at improving pupil's academic achievement in Mathematics.

A number of factors have been recognized as causes of poor academic achievement of primary school pupils especially, in Mathematics. Onuka and Durowoju (2011) posited that factors such as teacher's qualification, availability of teachers, school factors, instructional materials, availability of learning facilities, student's characteristics, pupils to teacher ratio, motivation and gender, among others can possibly have some influence on academic achievement. In order to achieve success,

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therefore, a pupil should be guided to set a target he/she intends to accomplish and follow up with hard work, motivation and determination, among others. The drive to achieve set target varies from one individual to another. For some individuals, the need for success is very high while for some others it is very low (Cillessen and Mayeux, 2004) and it could be a product of the motivation to succeed and to avoid failure (Omeyo, 2010). Poor academic achievement among primary school pupils could be attributed to a range of factors such as motivation which could be intrinsic or extrinsic.

The idea of motivating pupils is an important aspect of effective learning. Researchers (Lepper and Henderlong, 2000; Pintrich, 2003) have found that giving children some choice and opportunities for personal responsibility increases their internal motivation and intrinsic interest in school tasks. Tella (2003) posited that of all the personal and psychological variables that have attracted researchers in the area of educational achievement, motivation seems to have gained more popularity in its use to determine academic achievement. It may be possible, therefore, that lack of motivation is responsible for pupil's poor academic achievement. For the purpose of this study, motivation is that force that arouses the interest of the pupils towards school. Another determinant of academic achievement could be gender of the child and its relationship with motivation and pupil's achievement.

Gender could be another factor that influence pupil's achievement. Unamma described gender as sex role identity which include division of labour, power, inequalities and other cultural concepts of masculine and feminine which most societies stimulate during the process of socialization. Okeke opined that gender is a socially constructed roles and socially learned behaviours and potentials associated with being males and females. Maduewesi (2005) opined that men and women are naturally different but all culture interpret and elaborate these natural biological differences into a set of social potential about what behaviours and activities are suitable for each of them.

The study was carried out in South-East, Nigeria which 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 in Mathematics. Some children who are in school are not seen to be achieving maximally, probably because they were not motivated to learn, thus, leading to poor academic achievement in

Mathematics. One then begins to wonder whether motivation is a determinant of this inadequate achievement in Mathematics or not. It is against this background that the study investigated motivation as determinant of achievement of primary school pupils in Mathematics in South-East, Nigeria.

Purpose of the study: The general purpose of this study was to examine motivation as determinants of Mathematics achievement of primary school pupils in South-East, Nigeria. Specifically, the study sought to:

- Ascertain the correlation between intrinsic motivation and achievement of primary school pupils in Mathematics
- Determine the correlation between extrinsic motivation and achievement of primary school pupils in Mathematics
- Determine the relationship among gender, motivation and achievement of primary school pupils in Mathematics

Research questions: The following research questions guided the study:

- What is the correlation between intrinsic motivation and achievement of primary school pupils in Mathematics?
- What is the correlation between extrinsic motivation and achievement of primary school pupils in Mathematics?
- Determine the relationship among gender, motivation and achievement of primary school pupils in Mathematics

Hypothesis: The following null hypothesis guided the study and were tested at 0.05 level of significance:

- H_{O1}: there is no significant correlation between intrinsic motivation and primary school pupil's achievement in Mathematics
- H_{O2}: extrinsic motivation and achievement of primary school pupils in Mathematics have no significant relationship
- H_{O3}: there is no significant relationship among gender, motivation and achievement of primary school pupils in Mathematics

MATERIALS AND METHODS

Design of the study: This study adopted a correlation survey research design. Correlation survey research design, according to Nworgu (2006), 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 that the participants must be within the age range of 8-15, must be at the primary school level, both gender were included. The researchers also conducted the study in accordance with the ethical standards of the American Psychological Association.

Instruments for data collection: Two instruments were used for data collection for this study. They are: scale of intrinsic versus extrinsic motivational orientation in the classroom developed by Harter (1981). Mathematics achievement test developed by International Association for the Evaluation of Educational Achievement (IEA., 2005).

Scale of intrinsic versus extrinsic motivational orientation in the classroom developed by Harter (1981) was adopted by the researcher. The instrument is a standardized instrument with a reliability estimate of 0.72. It has five subscales and each of the five subscales contains six items (Two additional sample items are included at the beginning, for practice, although, these are not scored). Thus, the instrument is made up of 30 items in all. Within each subscale, three of the items are worded to begin with the intrinsic orientation and the other three began with the extrinsic orientation. The scoring key as presented on page 22 of the manual is 4 = most intrinsic, 1 = most extrinsic. Each item is given a two-letter code under its number. A score of 4 designates the maximum intrinsic orientation and a score of 1 designates the maximum extrinsic orientation. Since, items were counterbalanced with regard to which aspect of the statement was presented first, the two orders of the four possible scores vary from question to question. For items where the intrinsic aspect occurs first, the order is 4, 3, 2, 1. For those in which the extrinsic aspect is first, the order is just the reverse, 1-4. The scores of pupils with intrinsic and extrinsic motivation will be used to correlate their achievement scores. This was used to answer the research questions.

The researcher adapted the Mathematics achievement test developed by International Association for the Evaluation of Educational Achievement (IEA., 2005). Items with different difficulty levels were selected in order not to discriminate between higher and lower achievers. This instrument has 27 items with most of the items taken from TIMSS (Trends in International Mathematics and Science Study). The items were scored one for correct answer and zero for blank or incorrect answer.

To ensure that the instruments are reliable for the present study, it was validated by experts in childhood education and educational psychology and pilot tested on 30 randomly selected primary school pupils in Asaba, Delta State. Cronbach alpha coefficient value of 0.84 and 0.89, respectively were 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. The instruments were returned on the spot.

Method of data analysis: Data collected were analyzed 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 AND DISCUSSION

Sample characteristics: The demographic characteristics of the participants analyzed with descriptive statistics is presented on Table 1.

The participant's demographic results revealed that 215 (53.75%) of the participants were female while the remaining 185 (46.35%) were male participants. The 178 (44.5%) were rural dwellers while 222 (55.5%) were urban dwellers. The table further revealed that participants within the age bracket of

Table 1: Participant's demographic results

Variables	Frequency	Percentage
Gender		
Female	215	53.75
Male	185	46.25
Location		
Rural	178	44.50
Urban	222	55.50
Age		
1.8-10	278	69.50
11-13	101	25.25
14-15	021	5.25

Table 2: Pearson's product moment correlation analysis of intrinsic motivation, extrinsic motivation and achievement of primary school pupils in Mathematics

Variables	$\overline{X}$	SD	N	r	R^2
Intrinsic motivation	61.11	12.53	400	0.74	0.54
Extrinsic motivation	61.79	12.81		0.69	0.48
Academic achievement	62.19	14.49			

R^2 = Coefficent of determination

Table 3: Regression analysis of intrinsic motivation and primary school pupil's academic achievement

Model	Sum of squares	df	Mean square	F-values	Sig.
Regression	45939.541	1	45939.541	483.288	0.00
Residual	37832.356	398	95.056		
Total	83771.897	399			

$\alpha = 0.05$

8 and 10 years of age were 278 (69.5%), those within the age bracket of 11-13 years of age were 101 (25.25%) while those between 14 and 15 years were 21 (5.25%).

Research question 1: What is the correlation between intrinsic motivation and achievement of primary school pupils in Mathematics?

Result in Table 2 shows the correlation coefficient of the relationship between intrinsic motivation and achievement of primary school pupils in Mathematics. Results show that the correlation between intrinsic motivation and academic achievement of primary school pupils was 0.74. This means there was a positive relationship between intrinsic motivation and achievement of primary five pupils. The coefficient of determination associated with 0.74 is 0.54. The coefficient of determination (0.54) indicates that 54% of intrinsic motivation accounted for primary school pupil's academic achievement in Mathematics. In order words, 54% of pupil's academic achievement in Mathematics is predicted by intrinsic motivation. This is an indication that 46% of the variation in pupil's academic achievement is attributed to other factors other than intrinsic motivation.

- H_1: there is no significant correlation between intrinsic motivation and primary school pupil's achievement in mathematics

Table 4: Regression analysis of extrinsic motivation and primary school pupil's academic achievement

Models	Sum of squares	df	Mean square	F-values	Sig.
Regression	40435.449	1	40435.45	371.35	0.00
Residual	43336.449	398	108.8860		
Total	83771.897	399			

$\alpha = 0.05$

In order to test Hypothesis 1 (H_{O1}), regression analysis was used. The result in Table 3 shows that an F-ratio of 483.288 with associated exact probability value of 0.00 was obtained. This exact probability value of 0.00 is <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 intrinsic motivation and primary school pupil's academic achievement in Mathematics is therefore, rejected and inference drawn is that there is a significant correlation between intrinsic motivation and primary school pupil's academic achievement in Mathematics in South-East, Nigeria.

Research question 2: What is the correlation between extrinsic motivation and achievement of primary school pupils in Mathematics?

Result in Table 2 also shows the correlation coefficient of the relationship between extrinsic motivation and academic achievement of primary school pupils in Mathematics. Results show that the correlation between extrinsic motivation and academic achievement of primary school pupils was 0.69. This means there was a positive relationship between extrinsic motivation and academic achievement of primary five pupils. The coefficient of determination associated with 0.69 is 0.48. The coefficient of determination indicates that 48% of extrinsic motivation accounted for primary school pupil's academic achievement in Mathematics. In order words, 48% of pupil's academic achievement in Mathematics is predicted by extrinsic motivation. This is an indication that 52% of the variation in pupil's academic achievement is attributed to other factors other than extrinsic motivation.

- H_2: extrinsic motivation and academic achievement of primary school pupils in Mathematics have no significant relationship

In order to test hypothesis 3 (H_{O3}), regression analysis was used. The result in Table 4 shows that an F-ratio of 371.35 with associated exact probability value of 0.00 was obtained. This exact probability value of 0.00 is <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 extrinsic motivation and academic achievement of primary school pupils in Mathematics have no significant relationship is therefore, rejected and inference drawn is that, extrinsic motivation and achievement of primary school pupils in Mathematics have significant relationship.

The results of the study show that there is a positive relationship between intrinsic motivation and achievement of primary five pupils. In addition, the result shows that there is a significant correlation between intrinsic motivation and primary school pupil's academic achievement in Mathematics. The finding of the study is consistent with that of Cole (2008), Moneta and Spada (2009) and Walker *et al.* (2006). For Cole (2008) students who are intrinsically stimulated and significantly engaged because of interest in meaningful learning activities are more likely to achieve high levels of performance than those for whom the conclusion of learning activities is simply a means of avoiding punishment or getting rewards. And for Moneta and Spada (2009), high intrinsic motivation has resulted in direct positive relationship towards student preparedness before examination and coping with stress as well. In other words, intrinsic motivation leads to better academic performance. While Walker *et al.* (2006) opined that intrinsic motivation, self-efficacy and cognitive processing gives positive relationship towards the achievement of academic success in terms of grade point average of students. Furthermore, it means that there is a positive relationship between intrinsic motivation and student's academic performance. In conclusion, therefore, there is a significant correlation between intrinsic motivation and primary school pupil's academic achievement in Mathematics in South-East, Nigeria. The finding of the present study is a welcome one, since, the goal of any educational system is to produce a crop of children who are 'internally' directed to achieve rather than being 'outwardly' directed. It also means that in spite of the poor achievement of pupils in Nigeria today, there is hope, since, these children mobilize their internal resources to perform. This shows that intrinsic motivation the pupils possess helped significantly in the improvement of their academic achievement especially in Mathematics.

The findings also show that there was a positive relationship between extrinsic motivation and academic achievement of primary five pupils. In addition, the result shows that extrinsic motivation and academic achievement of primary school pupils in Mathematics have a significant relationship. This is parallel to a study by Moneta and Spada (2009) where it was found that

students who were intrinsically motivated to gain knowledge aim at maximizing academic performance. It also contradicts the study by Ahmed and Bruinsma who posited that students who reported higher intrinsic form of motivation also reported higher academic achievement. This result supports studies by Mills and Blankstein (2000) which shows that there is a positive relationship between academic performance and extrinsic motivation which then totally contradicts other previously mentioned studies that see intrinsic motivation as the best motivation to produce good examination results.

The inference drawn, therefore is that extrinsic motivation and academic achievement of primary school pupils in Mathematics have significant relationship. This means that pupils may not be achieving the desired learning, since, they only want to be prompted or motivated by an external force before they can achieve. This does not promote educational and national development as what promotes national development is the willingness of the individual to self-achieve without being dependent on external force. The good news however is that the result contradicts the results on the relationship between intrinsic motivation and academic achievement of primary school pupils showing that they may have answered this section ignorantly.

CONCLUSION

From the foregoing discussions based on the results of the study, the following conclusions were made. The pupils have high intrinsic and extrinsic motivation resulting in a positive relationship between motivation (intrinsic and extrinsic) and Mathematics achievement of primary school pupils. Female pupils performed better than the male pupils and this could be attributed to the on-going efforts by stakeholders in the education sector to de-masculine mathematics and other science subjects for the technological advancement of the country.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made. The finding of the study showed that there is a significant correlation between academic achievement and motivation types. 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 especially in Mathematics. 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 motivation types and how they affect learning in order to actualize high academic achievement of primary school pupils.

ACKNOWLEDGEMENT

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