ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

# *Influence of Gender and Achievement Motivation on Primary five Pupils' Multiplicative Thinking in Calabar Education Zone of Cross River State*

[1]**Ekpenyong Efiong Ibok, Ph.D**
ibokekpenyong@yahoo.com

**Edet Sunday Thomas**
*Department of Educational Foundations*
*Faculty of Education*
*University of Calabar, Calabar*

[1]**Nkereuwem Edet Nyong**
[1]*Department of Science Education*
*Faculty of Education*
*University of Calabar, Calabar*

## Abstract
*This study examined influence of gender and achievement motivation on primary five pupils' multiplicative thinking in Calabar Education Zone of Cross River State. Two hypotheses were formulated to direct the study. Ex-post facto research design was adopted for the study. A total sample of 800 pupils, out of 7979 pupils, was selected from 31 primary schools for the study using stratified and simple random sampling procedures. Questionnaire on Determinants of Multiplicative Thinking and Multiplicative Achievement Test were the instruments used for data collection. The established reliability estimate of the instrument ranged from .76 to .80. Independent t-test and One way Analysis of Variance (ANOVA) were the statistical techniques adopted to test the hypotheses at .05 level of significance. The result of the analyses revealed that gender, achievement motivation significantly influence pupils multiplicative thinking among pupils in primary five in Calabar Education Zone of Cross River State. Based on these findings, it was recommended, among others, that Mathematics teaching and evaluation strategies should be free from gender bias. This will make males and females to see themselves as equal, capable of competing and collaborating in school activities.*
**Keywords**: Gender, Achievement, Motivation, Multiplicative, Thinking

## Introduction
Multiplicative thinking represents the learner's mental adaptive processing of multiplication concepts by using different methods and approaches in various mathematical problem contexts. It requires a new level of sophistication in thinking about numbers and operations. This sophistication is inherent in the nature of

multiplication. Considering the level of complexity inherent in the nature of multiplication, one requires a more complex approach when thinking about numbers and operations. Basic multiplicative tasks are considered to be foundational for further advancement in Mathematics. They form the bases for learning, multiplication multi-digit, fractions, ratios, division and decimal (Ell, Irwin & McNaughton, 2004).

Multiplication has posed a lot of problems to children at upper and lower levels of primary school (Ell, Irwin & McNaughton, 2004; Siemo, 2005). Children frequently find multiplicative tasks to be a stumbling block in their Mathematics process because it consists of unfamiliar concepts involving complex relations. The highly conceptual nature of multiplicative tasks makes it particularly difficult for pupils to understand. Many use inefficient and inaccurate counting method and encounter difficulties in memorizing tables (Greer, 2006). These difficulties are in the language used in the teaching, the calculations involved, the symbols associated with it, fear and teachers' poor attitude to work (Adebayo, 2006). It also appears that in the subconscious mind of the pupils, a wrong impression has been made that at the stage where they are, it seems virtually too late or impossible to study mathematics concepts including multiplicative tasks and understanding in order to succeed in the subject. If basic multiplicative tasks are not acquired during the primary school years, it is highly unlikely that deficit may not occur in secondary school performance (Parmjit, 2012).

Seah (2004) in his research found that pupils demonstrate very limited understanding of the multiplication concepts, with their knowledge restricted to procedural rather than conceptual understanding. Clark and Kamil (1996) in their study found that pupils have trouble in gaining the knowledge of multiplication meaning fully throughout primary school. Children having troubles in gaining that knowledge of multiplication meaningfully is not necessarily because of its mathematical content, but due to a lot of factors which could be teacher related factors, student related factors, school factors or home environment related factors (Siemo, 2005). The problems of teaching multiplicative tasks have existed since the introduction of the subject in the school. Inability of pupils to acquire this required knowledge in multiplication is one of the major problems in studying primary school Mathematics. Pupils lack effective method of problem solving in multiplicative tasks (Biggs, 2017). This has resulted to pupils showing negative attitude, loss of interest and lack of attention in class during instructions involving multiplicative task which lead to pupils' poor academic performance in Mathematics (OECD, 2012).

Much concern has been expressed by government, parents as well as teachers regarding the fact that a large number of pupils are not able to solve many of the mathematics problems involving multiplicative tasks needed in their everyday life and work. Much has been said and several possible explanations have been suggested with regard to the general lack of interest in mathematics and the general poor performance at public

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

examinations like First School Leaving Certificate Examination (FSLC). Perhaps, our pupils see little significance for logical reasoning especially those involving multiplicative tasks and hence they are not motivated to develop these skills. This could be traceable to poor teaching methods on the parts of the teacher. Many factors have been implicated for this state of mind in Mathematics education. Again, several attempts have also been made by Mathematics educators and other experts in the field of education to address this problem of low performance in Mathematics, to improve mathematics performance and to bridge the gender disparity in mathematics performance, including spirited gender awareness, efforts by governments as well as interventions by NGO; but not much has been achieved. This may probably be due to the fact that these attempts may have failed to address issues related to gender difference and achievement motivation as the determinants of multiplicative thinking among primary five pupils which prompted the investigation of the problem.

Gender differences in learning Mathematics continue to be a focus of interest and the majority of studies showing that there is a common belief that males are better in Mathematics. It is plausible to say that both personal and corporate beliefs, generated due to some genetic differences between females and males are the underlying reasons for gender difference being handled at this level in Mathematics and other fields. Chebet (2016) defines gender as the process by which individuals who are born into a biological category of males or females become the social category of men or women through the acquisition of locally defined attributes of masculinity and feminity. Enukoha (1995) states that female students tend to think that Mathematics should be for boys, and this thinking affects their performance in the subject. In the Mathematics class, most girls see themselves inferior to the boys and may not also be motivated sufficiently for the learning process. The feeling of inferiority and lack of motivation makes the girls to withdraw from the learning task (Multiplication task). They tend to withdraw their interest, efforts and concentration from Mathematics and Mathematics- related subjects to other areas of study (Enukoha, 1995). This withdrawal may hinder the female pupils' achievements in multiplication tasks.

Mbuthia (2011) found that female students performed better than the male counterparts in mixed secondary schools, while male students recorded a better performance compared to their female counterparts in single sex secondary schools. Kosgei and Bii (2007) in their research on gender differences and attitudes towards learning of mathematics among secondary school students, found that both boys and girls have positive attitudes towards learning of mathematics though boys were more inclined than girls. Guzel (2004) stated that the female students' attitude towards mathematics is more positive than the male students. Despite spirited gender awareness efforts, gender disparity in pupils' performance in Mathematics persists. Hence, there is a need to explore more on gender differences in pupils' achievement in Mathematics in primary schools with a view of suggesting possible intervention strategies.

Addy (2006) investigated primary school teachers' and pupils' attitudes toward Mathematics and their effects on pupils' achievement in Manya Krobo district, Ghana. The simple random sampling technique was used to select 400 primary class six pupils (200 male and 200 females) in forty primary schools. Two attitude questionnaires of Likert scale type and an achievement test were used to collect data. The independent t-test, the multiple regression technique and Pearson Product Moment correlation were used for data analysis. The results indicated that there was no significant difference between primary class six boys' and girls' attitudes towards Mathematics. Also, there was a significant difference in Mathematics achievement between primary class six boys and girls in favour of girls. Research, according to Johnson (2000), has suggested that on empirical level, girls perform better on reading and writing subjects while boys perform better on quantitative subjects such as Mathematics and Science. Bharadwaj, Giorgi, Hansen and Neilson (2012) investigated the gender gap in Mathematics. They used data from the 2006 and 2009 Programme for International Students Assessment (PISA) test. This PISA was designed to produce students' outcomes that are comparable across countries and to provide information about the characteristics of successful students, families, schools and national educational system. PISA data includes distinct components as students, parents and school questionnaires and the results of three test for Mathematics, science and reading. The researchers used questionnaires and test results. Boys and girls differ significantly in perception about their own ability in Mathematics, conditional on Mathematics test scores. Wang and Evans (2011) studied a multiplication programme based on systematic practice aimed at improving children's recall of basic multiplication fact. Four year 5 classes were recruited to participate in the study. Two classes practiced multiplication tasks using pencils and paper worksheets and another two classes practiced on computers. The study used a quasi-experimental pretest/post-test design. The sample involved in the study was 64 pupils (37 students computer based and 27 students pencil and paper instruction based). The results showed a significant difference between the groups and a non- significant difference between male and female students.

Motivation is a very important psychological concept which helps an individual to consistently strive to achieve an objective. Motivation is an inner drive in an individual to excel in whatever he or she is doing. Motivation has a dual component of intrinsic and extrinsic values. Extrinsic motivation involves the need to strive to achieve an objective. The teacher can relate the teaching of any Mathematics topic to a particular objective thereby enhancing extrinsic motivation. If the pupils begin to appreciate the objectives of Mathematics education, then it is likely that they can be intrinsically motivated to learn Mathematics. Without this intrinsic motivation, pupils will lack the commitment to learning for better performance in Multiplicative tasks and if the teacher does not foster intrinsic motivation through the objectives, pupils' commitment to the learning of Multiplicative task will be highly compromised. Motivation influence what and how much is learnt (Enukoha, 1995). According to Yildirim (2012), motivation to learn is

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

influenced by the individual emotional state, belief, interest, goals and habits of thinking. When a learner is motivated, permanent learning will occur. In learning, the inner directedness can influence a child to acquire more knowledge with the view to achieving more success and satisfaction, becoming more current and building personality standards.

Bircan and Sunger (2016) investigated the contribution of the motivational strategies on cognitive engagement of seventh grade students' science achievement in New York. Cross sectional correlational research design was used. The data were gathered from the seventh grade students of public middle schools by means of three data collection instruments namely, Background Characteristics Survey (BCS), Motivation and Cognitive Engagement Scale (MCES) and Science Achievement Test for 7th Grade (SAT). The MCES is a self-report instrument including the selected items from the Science Learning Inventory (SLI- Part A) and from Turkish Version of Motivated Strategies for Learning Questionnaire (MSLQ) in order to measure students' motivational beliefs (self-efficacy and task-value) and the level of their cognitive engagement. A total of 861 seventh grade students participated in the study. Multiple Linear Regression Analysis was used to analyze the data. Results revealed that achievement motivation positively and significantly contributed to the prediction of students' science achievement which is attributed to multiplicative tasks.

Effiong (2008) used 303 students from eight schools in Eket Education Zone of Akwa Ibom State in a study to determine whether any relationship exists between achievement motivation and academic performance in Mathematics among primary school pupils. Results showed that there is a positively significant relationship between motivation and pupils' academic performance. Pupils with high achievement motivation performed significantly higher academically. In another study, to investigate the influence of motivation strategies on academic performance of junior secondary school students in Cross River State of Nigeria, Ogba (2008) used a sample of 441 junior secondary three students selected from the area. It was found that students who are high in achievement motivation show some level of superiority in academic performance over the low achievement need students, though such superiority may not approach statistical significance. Bull (2016) argues that incentive value of a task is an important determinant of task choice which is attributed to multiplication task, and that individuals will tend to perform task (multiplication tasks) that they positively value and avoid those that they negatively value. Literature has shown that enhancing the incentive value of studying would drive pupils to engage in that task, increase level of achievement as a result, and show drive or desire to be an important component of motivation.

**Statement of hypotheses**

The following null hypotheses were formulated to guide the study:

**Ho1:** There is no significant influence of gender on multiplicative thinking among primary five pupils in Calabar Education Zone of Cross River State

**Ho2:** There is no significant influence of achievement motivation on multiplicative thinking among primary five pupils in Calabar Education zone of Cross River State.

**Methodology**

The study area was Calabar Education Zone of Cross River State. The research design used for this study was the ex-post facto design. The researchers used this design because the independent variables which are gender and achievement motivation of pupils were variables that have occurred already and the researcher had no direct control over them. The population for the study consisted of all primary five pupils in Calabar Education Zone which comprises of Biase, Akamkpa, Odukpani, Akpabuyo, Calabar South, Bakassi, and Calabar Municipality Local government Areas. There are one hundred and fifty-four (154) public primary schools and seven thousand nine hundred and seventy nine (7979) pupils, including male and female pupils. A multi-stage sampling technique, involving stratified and simple random techniques, was adopted in selecting 800 pupils for the study. The schools were stratified based on gender and local government area. Out of a total of 154 public primary schools, 31 (20%) schools were randomly selected for the study; from the selected schools in each local government area, 10% of the total number of pupils were selected using proportional sampling technique giving a total sample of 800 pupils for the study.

Two instrument were used, a questionnaire on determinants of multiplicative thinking and multiplicative achievement test. The questionnaire title "Questionnaire on Determinants of Multiplicative Thinking" consisted of two sections, A and B. Section A described the bio data of the respondent which include gender while section B was developed on the main variable such as achievement motivation. The questionnaire was based on four point scale used in measuring respondents' level of agreement or disagreement such as Strongly Agree, Agree, Disagree and Strongly Disagree. Multiplicative achievement test consisted of 25 items constructed by the researchers used to test pupils' ability in multiplicative tasks. The instruments were face-validated by two experts in Measurement and Evaluation from the University of Calabar. Correction were pointed out by the experts and adjusted by the researchers and the document was considered valid. The reliability estimate of the questionnaire was established through test-restest reliability which give .78 and .80 while pupils' multiplicative achievement test was established through Kuder Richardson formula K-R20 which give .76. The independent t-test was used in testing hypothesis one while hypothesis two was tested with One Way Analysis of Variance (ANOVA).

**Presentation of results**

The result of the analysis is presented in the tables 1, 2 and 3. The hypotheses were tested at .05 level of significance.

**Ho1:** There is no significant influence of gender on multiplicative thinking among primary five pupils in Calabar Education Zone of Cross River State.

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

The independent variable in this hypothesis is gender while the dependent variable is pupils' multiplicative thinking. To test this hypothesis, gender was classified into two groups (Male and female). Based on the classification, their means were compared using the independent t-test analysis and the result is presented in Table 1.

**Table 1:**Independent t-test analysis of influence of gender on multiplicative thinking

| Variable | N | $\bar{x}$ | SD | df | t-cal | p-val |
|---|---|---|---|---|---|---|
| Male | 389 | 16.89 | 4.32 | | | |
| Female | 411 | 14.96 | 5.63 | 798 | 5.457 | .000 |
| Total | 800 | 15.90 | 5.28 | | | |

*Significant at 0.05 level of significance

The result of the analysis (t=5.457; p=0.000) as presented in Table 1 indicates that there is a significant influence of gender on pupils' multiplicative thinking among primary five pupils. With this result, the null hypothesis was rejected at 0.05 level of significance and alternative hypothesis was accepted**.**

**Ho2:** There is no significant influence of pupils' achievement motivation on their multiplicative thinking among primary five pupils in Calabar Education Zone.

The independent variable in this hypothesis is achievement motivation (categorized as High, Average and Low), while the dependent variable is pupils' multiplicative thinking. Based on this categorization, one-way analysis of variance (ANOVA) test statistics was employed in testing the hypothesis based on their academic achievement in Multiplicative thinking. The result of the analysis is presented in Table 2.

**Table 2:** One-Way Analysis of Variance on influence of pupils' achievement motivation on multiplicative thinking among primary five pupils

| Motivation | N | $\bar{x}$ | SD | | |
|---|---|---|---|---|---|
| Low | 299 | 15.04 | 4.99 | | |
| Average | 319 | 17.98 | 5.26 | | |
| High | 182 | 14.99 | 4.22 | | |
| Total | 800 | 16.20 | 4.85 | | |
| **Sources of variable** | **SS** | **df** | **MS** | **F-value** | **P-value** |
| Between group | 2767.488 | 2 | 1383.744 | | |
| Within group | 51008.114 | 797 | 64.000 | 21.621 | .000 |
| Total | 53775.606 | 799 | | | |

*Significant at 0.05 level (Critical $F_{2,\ 797} = 3.00$)

The result of analysis in Table 2 (F=21.621; p=.000) indicates that the null hypothesis was rejected at 0.05 level of significance while the alternate was upheld. This implies that there is a significant influence of pupils' achievement motivation on multiplicative thinking among primary 5 pupils. A post hoc test-multiple comparison was used and the result is presented in Table 3.

**Table 3**: LSD post hoc test analysis on the influence of pupils' achievement motivation on multiplicative thinking among primary 5 pupils

| Achievement Motivation | Low (n=299) | Average (n=319) | High (n=182) |
|---|---|---|---|
| Low | 15.04[a] | -2.94[b] | 0.05 |
| Average | -4.57*[C] | 17.98 | 2.99 |
| High | 0.07 | 4.02 | 14.99 |
| Ms within 64.00 | 0 | | |

P<.05

a= Group mean along the principal diagonal

b= Mean differences above the principal diagonal

c= t -values below the principal diagonal.

The Post hoc test-multiple comparisons result indicates the Fisher's significant t-value of -4.57 and 4.02 and a non-significant t-value of 0.07. This implies that pupils with average/low achievement motivation (t=-4.57; p=.000) and pupils with average/high achievement motivation (t=4.02; p=.000) have significant influence on their multiplicative thinking.

**Discussion of the findings**

The result of the first hypothesis revealed that there is significant influence of gender on pupils' multiplicative thinking. Gender differences in learning Mathematics continue to be a focus of interest and the majority of studies show that there is a communal belief that males are better in Mathematics. The finding agreed with Enukoha (1995) who states that female students tend to think that Mathematics should be for boys, and this thinking affects their performance in the subject. The finding of this study also agreed with Bharadwaj, Giorgi, Hansen and Neilson (2012) who investigated the gender gap in Mathematics and found that boys and girls differ significantly in perception about their own ability in Mathematics. This implies that gender difference accounted significantly to pupils' multiplicative thinking among primary 5 pupils in the study area.

The result of the second hypothesis revealed that there is significant influence of achievement motivation on pupils' multiplicative thinking. Motivation is a very

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

important psychological concept which helps an individual to consistently strive to achieve an objective. Motivation influences what and how much is learnt. According to Yildirim (2012), motivation to learn is influenced by the individual's emotional state, belief, interest, goals and habits of thinking. When a learner is motivated, permanent learning will occur. The finding of the study is in consonance with the finding of Effiong (2008) who studied to determine whether any relationship exists between achievement motivation and academic performance in Mathematics topics of primary school pupils. Results showed that there is a significant relationship between motivation and pupils' academic performance.

## Conclusion

Based on the findings of this study, it could be concluded that achievement motivation of pupils' toward multiplicative tasks irrespective of gender become very necessary and essential because it helps them develop strategies independent of the instruction and keep these strategies as part of their informal knowledge system which helps them solve problems without the need for direct instruction from a teacher. Therefore, gender and achievement motivation are very important factors and should be considered when developing the multiplicative thinking ability of pupils.

## Recommendations

On the basis of findings of the study, the following recommendations were made:

1. Since gender differences exist in multiplicative thinking, Mathematics teaching and evaluation strategies should be free of gender bias. This will make males and females to see themselves as equal, capable of competing and collaborating in school activities.
2. Since achievement motivation influences pupils multiplicative thinking, teachers and parents should motivate pupils to study Mathematics through words of encouragement and tangible rewards at efforts made by the pupils in Mathematics.

## References

Addy, C. K. K. (2006). Primary school teachers' and Pupils' attitudes' toward Mathematics and their effects on Pupils' achievement in Manya Krobo District. Unpublished Master's degree Thesis, University of Cape Coast.

Adebayo, M. (2006). School Mathematics Reforms: implications for Mathematics Teachers preparation. *Journal of Teacher education*, 48(3), 187-206.

Bharadwaj, P., Giorgi, G. D., Hansen, D. & Neilson, C. (2012). The Gender Gap in Mathematics: Evidence from Low-and-Middle Income countries. Retrieved on October 20, 2012, from www.standford-edu/~degiogi/Test%20score%20Paper-web/pdf.

Biggs, T.W. (2017). *Teacher qualification: Understanding the effectiveness of teacher attributes in Mathematics.* Ibadan: Bounty Press Ltd.

Bircan, H. & Sunger, S. (2016). The role of motivation and cognitive engagement in science achievement among seventh grade students. *International Journal of Science Education,* 27(4), 509-529.

Bull, E. (2016) California Science Students Perception of their Classroom Learning Environment. *Educational Research and Evaluation*, 12(1), 3-25.

Chebet, C. M. (2016). Gender differences in mathematics performance among secondary school students in Bureti sub-county, Kericho County Kenya. Unpublished MEd Thesis, Kenyatta University.

Clark, F. B. & Kamil, C. (1996). Identification of multiplicative thinking in grades 1-5. *Journal for Research in Mathematics Education*, 27, 41-51.

Effiong, N. C. (2008). Students achievement motivation and academic performance in Eket Educational Zone. Unpublished M. Ed. Dissertation, University of Calabar, Calabar.

Ell, F., Irwin, K. & McNaughton, S. (2004). Two pathways to Multiplicative thinking. In I. Putt, R. Faragher & M. Melean (Eds.), *Mathematics education for the Third Millennium towards 2010* (Proceeding of 27th annual Conference of the Mathematics Education Research Group of Australasia, Townsville pp 199-206). Sydney: Mega. Retrieved on June 29, 2001 from www.merga,net.au/publications.counter.php.

Enukoha, O. I. (1995). *The psycho-cultural basis for teaching Mathematics*. Owerri: Executive publishers.

Greer, B. (2006). Multiplication and division as models of situations. In D. Grouws (Ed.), *Handbook of research on Mathematics teaching and learning* (pp. 276-295). New York: Macmillan Publication Company.

Guzel, H. (2004). The relationship between students' success in physics lessons and their attitudes towards mathematics. *Journal of Turkish Science Education*, 1(1), 50-72.

Johnson, R. C. (2000). *Child Psychology behavior and development.* New York: John Wiley & Son.

Kosgei, A. K. & Bii, J. (2007). Gender Differences and Attitude Towards Learning of Mathematics Among Secondary Students in Keiyo District. *International Journal of Educational Development*, 22(1), 1-9.

Mbuthia, A. N. (2011). Factors influencing Mathematics Performance among Secondary School Students. Unpublished M.ED Thesis, Kenyatta University, Nairobi, Kenya.

Ogba, F. (2008). Motivational strategies and academic achievement in Mathematics. Unpublished Master Thesis, University of Calabar.

Organization for Economic Cooperation and Development (OECD) (2012). *Gender Equality in Education, Employment and Entrepreneurship: Final Report to the MCM.* Paris*:* OECD Publishing.

Parmjit, S. (2012). Multiplicative thinking and learning. In N. M. Seel (Ed.), *Encyclopedia of the sciences of learnin*g. Boston, MA: Springer.

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

Seah, T. K. R. (2004). An investigation of the depth and breadth of students' Knowledge of Multiplication as a Basis of the Development of Multiplication Thinking. Unpublished M.Ed. Thesis, Griffin University, USA.

Siemo, D. (2005). Multiplicative thinking. Retrieved on March 7, 2011 from www.eduweb.vic.gov.au/edulibrary/public/teachlearn/ppmultithinking.pdf.

Wang, L. C. & Evans, R. (2011). Shrinking Classroom Age Variance Raise Student Achievement: Evidence from Developing Countries, Retrieved April 23, 2011 from www.wd.Worldbank.org/Serlet/AVDSP/IB/document/AVPS5527achievement .pdf.

Yildirim, S. (2012). Teacher support, motivation, learning strategy use and achievement: A multi-level mediation model. *The Journal of Experimental Education,* 80(2), 150-172.