Nigerian Journal of Clinical and Counselling Psychology

Vol. 17, May 2011 Issue 1, & Issue 2,

ISSN: 1118 – 4035

Nigerian Journal of Clinical and Counselling Psychology

Vol. 17, May 2011, Issue 1 & Issue 2, . ISSN: 1118 – 4035;

Editorial Board

**Nigerian Journal of
Clinical and Counselling Psychology**

Information for Authors

The Nigerian Journal of Clinical and Counselling Psychology is concerned with the psychological, social, behavioural, medical, paediatric and ethical aspects of the applied field of clinical and counselling psychology. The journal publishes contributions of research, clinical, counselling and theoretical interest. Contributions from other disciplines, which have a close bearing on psychology for example, psychiatry, sociology, social work, nursing and educational issues are, however, encouraged. Although primary emphasis is placed on empirical research, the journal also welcomes articles concerned with important clinical, theoretical and methodological issues, as well as reviews of relevant literature. Book reviews, summaries of proceedings of important national and international workshops, conferences and symposia falling within the aims of the journal will also be featured. The journal is non-racial and non-political and does not discriminate on grounds of religion and sex. It is published twice a year, in May and November.

Prospective contributors should take particular note of the following details:

(1) The entire manuscript, which includes the title page, abstract, and key words, text, tables, figures and legends, should be typewritten on A4 size paper, double-spaced. Manuscript length should not normally exceed 20 pages.

(2) A concise abstract of not more than 150 words should be included.

(3) Authors should follow the reference and citation styles as prescribed in the publication manual of the American Psychological Association (APA).

(4) Each article submitted for consideration must be accompanied with non-refundable reviewer's fee of ₦5, 000 in cash or bank draft.

(5) Neither the Editors nor the Editorial Board members shall be liable for any article(s) lost in transit.

Manuscripts should be submitted in triplicate and addressed to one of the following:

The Editorial Office
c/o Oyesoji Aremu
Department of Guidance & Counselling,
University of Ibadan,
Ibadan, Nigeria

Festus D. Kolo
(M.C.A.N)
Department of Education,
Faculty of Education,
Ahmadu Bello University,
Zaria, Nigeria

Anthony V. Naidoo
University of Western Cape,
Institute of Counselling,
Bellville 7535,
South Africa.

Adedeji S. Olugbenga
Department of Educational Management,
University of Ibadan,
Ibadan, Nigeria.

Virginia A. Amadi.
Department of Educational Psychology,
University of Port – Harcourt,
Port – Harcourt,
Nigeria.

Amos A. Alao
Guidance & Counselling Centre,
University of Botswana,
Gaborne, Botswana.

Subscription Rates

Single copy: US$10.0

Annual subscription (Two copies): US$18

All business communications and enquiries in respect of subscriptions, renewals, and placement of advertisements, orders and remittances should be directed to the Editorial Office. Bank drafts or Western Union Money Transfer and not personal cheques should be sent to the Editor.

From the Editor

In these issues of NJCCP, eighteen articles are published. These articles were found publishable from the array of articles submitted for publication consideration. While some articles are stepped down for want of space, others were just not fit for consideration. For every issue of NJCCP, it is now customary for an editorial opinion to be heard. This is to raise the standard of the journal. You would recollect that this has been the practice since my assumption of the Editorial leadership of the Journal. This would not only be sustained, I plan to invite seasoned academics as guest editors in the future edition of the Journal.

The current issues have some articles beyond the immediate environment of the Journal. We go from Ibadan to Niger Delta and Enugu, where four articles featured. These articles from Jonathan Oghenekohwo, F.G. Paulley and Peter Abu, and Ada Nwaneri were interesting and expository. Back home, Abidoye Sarumi, Adebowale T. Adedoyin, Olaleye Y. Lydia, T.O. Adegoke, Joshua Adeleke, R.A. Animashaun, Catherine Chovwen, Fadekemi Oyewusi, Omobola Adelore, Adekeye Abiona, Eugenia Okwilagwe, and Adejuwon Grace singly contributed interesting papers. A number of articles also enjoyed team-writing. In this wise, researchers like Jimoh, A.M., Taiwo, A.K, Adetona, M.B., Animashaun, R.A., Afolabi, S.E., and Aremu Oyebisi featured. These articles are scholarly, analytical and thoughtful.

In the context of these articles, I place a demand of attention on readers and some scientific references to researchers who might want to use the articles as bases for their works. This issues of NJCCP is a fruit of collaboration. My gratitude goes to our teaming reviewers. Thanks for your outstanding reviews.

Oyesoji Aremu, cf., jp

Contents

Pattern of Students' Achievement in Mathematics: Gender Roles

Joshua O. Adeleke
Institute of Education,
University of Ibadan, Nigeria.

Abstract

Variation is a constant phenomenon observable in nature. Achievement of students in important subjects such as Mathematics is not left out. This study, therefore, attempted to investigate existing pattern in students' achievement in mathematics. It further examined the role gender played in understanding such pattern. Four hundred and thirteen Senior Secondary 3 students were selected for the study using a multi-stage and stratified sampling techniques to draw subject from selected intact Science class, schools and three Local Government Areas (LGA) in Ibadan metropolis. Mathematics Achievement Test comprising eighty items covering five major components of Senior Secondary School Mathematics curriculum—Number and Numeration, Algebraic process, Geometry, Mensuration and Trigonometry was constructed by the researcher and used for data collection. Split half reliability coefficient (r) estimated on the entire test was 0.74. The result shows that students generally performed above average in Number and Numeration (mean=77.18), algebraic process (mean=71.02), Geometry (mean=53.50), and Mensuration (mean= 54.41). The performance of the students was below average in Trigonometry (mean= 44.48). It was equally found that, there is significant difference between male (mean= 82.48) and female (mean=69.44) achievement in Number and Numeration (t_{411}=5.47; $p<0.05$). Significant difference is also find in algebraic process between male (mean=75.70) and female (mean=63.77) (t_{411}=4.85; $p<0.05$). In Geometry, significant mean difference between male (mean= 59.41) and female (mean=45.24) is found, (t_{411}=5.17; $p<0.05$). There is significant mean difference in male(mean=55.95) and female(51.95) achievement in Mensuration, ($t_{411}=2.24$; $p<0.05$). Significant mean difference between male and female students' achievement in Trigonometry is not found. It is hereby suggested that mathematic educators should rise up to the challenge at hand by researching into strategies that will bring about better learning of geometry at all levels of Education. Needs to bridge the gap in male and female students' achievement in mathematics should be given priority to promote gender equity in the society.

Key Words: Mathematics, Achievement pattern, Gender role.

Background

Stable conclusion is yet to be drawn on gender differences in mathematics achievement. Characteristic difference is one of the theories supporting pattern of achievement between male and female students. According to Smith,(1998) confidence, motivation, and interest in the mathematical field eventually results in mathematical ability gaps. Consequently, More males are found to be professional in the fields of mathematics, than Females, (Spelke 2005). Spelke's discussions of this disparity have focused attention on a pair of long standing claims. First, there are fewer female on mathematics field because fewer female exhibit high talent in these fields. Second, this gender difference has a genetic basis: females have less intrinsic aptitude for mathematics. Three other claims for gender differences in mathematics have equally received attention of researchers in the past. One claim asserts that males and females are predisposed from birth to learn about different things: Male infants learn about objects and their mechanical relationships, whereas female infants learn about people, emotions and personal relationships (Cohen, 2003; Browne, 2002). From these beginnings, boys have more aptitude than girls to develop the knowledge and skills required by mathematics. The second claim according to Spelke (2005) focuses on the specific cognitive systems that give rise to effective reasoning in mathematics. Boys have better command over these systems, (Geary, 1998; Kimura, 1999). A third claim focuses on gender disparities at the upper end of the ability distribution: males show greater variability in inherent mathematical talent, and therefore they predominate in the pool of highly talented students from which future mathematicians will emerge (Nowell & Hedges, 1998). Many discussions on the biological basis of boys and girls cognitive capacity focus on evidence that sex hormones modulate performance on specific cognitive tasks (Kimura, 1999; Halpern, 2000; & Baron-Cohen, 2003) the existence and nature of these effects may be relevant, if performance on tasks influenced by hormones gave one sex a cognitive advantage in mathematics.

Claims that by nature boys orient to object and girls orient to people are reviewed by (Browne, 2002 and Pinker, 2002). These claims were supported by Baron-Cohen (2003) with proposition that males are predisposed to learn about objects and their mechanical interactions, whereas females are predisposed to learn about people and their emotional interactions. Baron-Cohen cited as evidence an experiment conducted on some boys and girls (Connellan, Baron-Cohen, Wheel Wright, Batis: and Ahluwalia, 2000). They viewed side by side, an active and expressive person and a similar sized inanimate object. Boys looked longer at the inanimate object while girls looked longer at the person. Connellan et al's (2000) experiment seems to have given compelling support to the claims, however replica of the experiment is yet to be found in literature. The lack of replication is particularly curious, because a large, older literature suggests that male and female infants are equally interested in people and objects (Maccoby and Jacklin, 1974).

Numerous experiments in the 1960s compared infants' visual attention to faces versus inanimate patterns (Spelke, 2005). One study, for example, assessed infants' visual attention to a live person in a free play setting at one and three months and assessed their visual attention to pictures of faces and inanimate displays in a controlled setting at the latter age. Male and female infants looked equally at the live person at both ages at three months, all infants looked longer at the face than the inanimate display, and this preference was greater for the male infants. Spelke's findings, like others (Rochat, 2001), provide no evidence that male infants are more focused on objects and female infants are more focused on people from birth onward.

In addition, Connellan et al's (2000) experiment does not attempt to determine the basis for infants' preferences between the people and object. Assertions that infants prefer one category of entities to another must address a range of critical questions. Does the preference depend on the categorical distinction between the entities or on other differences between the two displays, such as their rate of motion or distribution of colour or contrast? Does the preference generalize to other members of the two categories or is it specific to the tested pair? These questions are raised by Cohen, (2003); Mandler, 2004; Quinn and Oates, 2004. Connellan et al. (2000) did not discuss critical controls against experimental bias. Because newborn infants cannot hold their heads erect, their visual preferences are influenced by the way in which they are positioned and supported; because one of the two stimuli was a live, expressive person, preferences also could be influenced by that person's behaviour. Baron-Cohen (2005) has indicated that the experimenters' attempted to minimize bias, but a replication with more stringent controls would be desirable. However, Connellan et al's (2000) experiment has received extra ordinary attention in popular discussions of the origins and nature of cognitive sex differences (Baron –Cohen, 2005; Cronin, 2005; Hauser, 2005; Sax, 2005). Because of the breath and force of the arguments that have been based on it, it is important to evaluate its key prediction. According to Spelke (2005), if newborn male infants are predisposed to learn about mechanical objects, then older male infants are expected to show superior knowledge of objects and their behaviour. Over the past three decades, many experiments have investigated infants' perception of and learning about objects. This literature has received wide attention by experimental Psychologists, Popular Science writers, and televised science programmes, but it has not surfaced in discussions of the origins of cognitive sex differences (Spelke 2005).

In most of these studies, according to Spelke (2005), the performance of male and female infants is compared systematically. Most studies find no gender differences. Some studies find an advantage for female infants, particularly in the domains of mechanical reasoning and the ages at which new abilities emerge (Baillargeon, Kotovsky, and Needham, 1995). For example experiments have assessed infants' understanding that an object travels farther when hit by a heavier object; female infants achieve this understanding at 5.5 months and male infants achieve it at 6.5 months (Kotovsky and Baillargeon 1998). Such findings according to Spelke (2005) do not imply that female infants are superior to male infants at mechanical reasoning, because female infants develop somewhat more rapidly across the board, and so their superior performance is not likely to be specific to objects. Moreover, research on infancy has not been subjected to the powerful techniques of meta-analysis that are needed to evaluate positive findings of gender differences. Meta-analysis of cognitive gender differences as explained by Spelke (2005) are rare in infant research because they depend on significant effects, whereas the vast majority of studies of cognitive development in infancy report no significant Gender differences.

Thousands of studies of human infants, conducted over three decades, provide no evidence for male advantages in perceiving, learning, or reasoning about objects, their motions, and their mechanical interactions. Instead, male and female infants perceive and learn about objects in highly convergent ways (Spelke, 2005). This conclusion accords well with old literature especially that of Maccoby and Jacklin (1974), whose review of an older literature led them to characterize the notion that girls are more socially oriented as the first of many "Unfounded beliefs about gender differences". The question that now calls for immediate answer is "at what stage of human development does gender difference emerges?" Actually, mathematical reasoning does not depend on commonsense knowledge about objects, because intuitive reasoning about object mechanics is prone to errors and misconceptions. According to Spelke (2005), true mathematical reasoning may emerge when students at the college begin to use both number and geometry to structure their understanding of the physical world. To what extent does literature support the claim that male are better endowed than females with specific cognitive mechanisms that are critical for successful learning of mathematics?

Formal mathematics is an achievement in the history of life on earth (Spelke 2005). Only humans in complex cultures develop and operate on natural number concepts and use numbers and geometry to map and measure their surroundings. Because formal mathematics has existed for only a few thousand years, it must depend on older, more primitive systems that evolved for different purposes and that humans have harnessed to solve new problems (Geary, 1996; Kimura, 1999). Research in developmental and Cognitive Psychology serves to probe the nature and development of these systems and of the processes by which different systems come together to support new concepts and operations (Carey, 2001; Newcombe, 2002; Spelke, 2003). Such research provides evidence for five different cognitive systems at the core of students' mathematical thinking. One system serves to represent small, exact numbers of objects: the differences between one, two and three (Butterworth, 1999). A second system serves to represent large, approximate numerical magnitudes: the difference in number (Though not weight or volume) between, for example 60 kobo and 40 Naira (Barth, Kanwisher & Spelke, 2003). A third system consists of the quantifier's number words and verbal counting routine that students gain with the acquisition of a natural language (Wynn, 1992). The fourth and fifth systems serve to represent environmental geometry and landmarks, respectively for purposes of navigation, spatial memory and geometrical reasoning (Newcombe & Huhenlocher, 2000; Wang & Spelke, 2002). When secondary school students solve arithmetic problems, they activate areas of the brain that are involved in representing numerical magnitudes, language and space (Dehaene, Spelke, Pinel, Stanescu & Tsivkin, 1999). When college students are given a host of mathematical tasks, their performance show signatures of these systems (Fergenson, Dehaene & Spelke, 2004). Are males and females biologically predisposed to develop one or more of the systems to different degrees and is one sex better able to harness the systems for mathematical reasoning and achievement?

For humans to meaningfully engage in mathematical reasoning, the five core systems must come together. Three developmental transitions have been investigated between 4 and five years of age, children first bring their understanding of number word meanings together with their non-symbolic representations of small and large numerosities (Le Corre, 2004). Between 6 and 10 years, children connect their representations of number and geometry by constructing and using a central device in elementary mathematics: the number line (Siegler & Opfer, 2003; Siegler & Booth, 2004). No gender differences have been reported at any of these transition points, even in studies with substantial sample sizes (Spelke 2005). Gender differences emerge on more complex quantitative tasks (Spelke 2005). In most studies these differences begin during secondary school age and grow larger with increasing age (Beilstein & Wilson, 2000, Brandley, 2003). Brandley (2003) was of the opinion that the gender gap in mathematics achievement appears early in secondary school, where female students were found to have a higher initial mathematics scores than male students, He went further to say that gender difference in mathematics achievement become less substantial as students progress through secondary school. He said gender differences in mathematics achievement are declining as male students showed significant greater gains than females in mathematics through secondary school. Contrary to Brandley (2003) is the position of Haigh(1995). He investigated the relationship between gender and the mathematics sub – test in the scholastic aptitude test (SAT). One of the major findings of this study was that male subjects as a group achieved significantly higher mean score than their female counterparts on the SAT mathematics score. In summary girls were found to perform better than boys at pre-primary level, boys catch up with them at primary school level and overtake them at secondary school level and maintain the position all through life.

Further research findings on gender differences also, on student's cognitive achievement in mathematics have attracted the interest of many researchers and educators (McGinnis & Pearsall, 1998; Popoola 2002; Kelly, 2003; Adeleke, 2007) . In spite of the existence of many of such studies, more investigations are being undertaken in this area. This is because a definite and stable picture of gender differences in mathematics achievement is yet to emerge. Though Popoola (2002) concluded that there is no effect of student gender on achievement in algebra aspect of mathematics yet this study investigated further whether gender plays a major roles on pattern of achievement of students in different components senior secondary school Mathematics.

Statement of the Problem

A characteristic difference is noticed from person to person as well as from group to group. This difference also seems to be noticed in the Mathematical performances among Male than Female students. Identifying pattern of achievement of male and female students in mathematics constitute a challenge to researchers. This study therefore investigated gender roles on pattern of achievements of students in Senior Secondary Mathematics

Research Questions.

Based on the stated problem, the following research questions were answered:

1. What is the pattern of students' achievement in Senior Secondary Mathematics.

2. Is there any significant effect of gender on the existing pattern of students' achievement in Mathematics?

Methodology

Research Design

This study is an *ex-post facto* (non-experimental) research.

Sample

This study used a multi-stage sampling technique. Three Local Government Areas (LGA) were randomly selected from the five existing ones in Ibadan metropolis. stratified sampling was also employed and the selected LGAs formed the strata. Ten schools were selected from the three strata, using the method of sampling proportion to size, that is, the number of eligible co-educational senior secondary schools in each stratum (selected LGA). An intact science class of SS3 students was randomly selected from each of the selected schools. Four hundred and thirteen students comprises 251males and 162 females were used for the study.

Instrumentation:

Mathematics Achievement Test comprising eighty items covering five major components of senior secondary school mathematics curriculum—Number and Numeration, Algebraic process, Geometry, Mensuration and Trigonometry was constructed by the researcher and used for data collection. Split half reliability coefficient (r) estimated on the entire test was 0.74.

Data Collection

The researcher went to the 10 selected schools for the administration of the test to the selected SS3 students. Data collection lasted 2 weeks.

3.7 Data Analysis

Descriptive statistics—mean and standard deviation were used as statistical tools to provide an answer to research question one while, independent t-test was employed by the researcher to provide an answer to research question two.

Results

Research Question One

What is the pattern of students' achievement in Mathematics

Table 2: Students' Pattern of Achievement in Mathematics

Content	Total		
	Mean	N	Std. Deviation
Number and Numeration	77.18	413	24.07
Algebraic Process	71.02	413	25.09
Geometry	53.50	413	28.14
Mensuration	54.42	413	16.72
Trigonometry	44.48	413	15.18

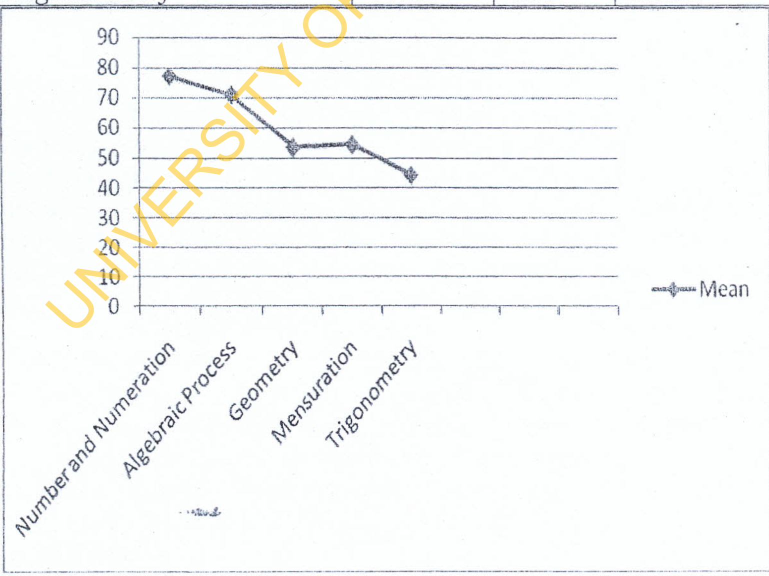

Fig 1: Pattern of Achievement in Mathematics

Table 2 and Fig 1. Show that students generally performed above average in Number and Numeration (mean=77.18), algebraic process(mean=71.02), Geometry (mean=53.50), and Mensuration (mean= 54.41). The performance of the students was below average in Trigonometry (mean= 44.48). It is clearly observed that students' experienced low achievement in Geometry, mensuration and Trigonometry compared with Number and Numeration and Algebraic process.

Research Question Two.

Is there any significant effect of gender on the existing pattern of students' achievement in Mathematics?

Table 3: Effect of Gender on Students Pattern of Achievement in Mathematics Contents

Content	Male			Female			t-test		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	T	df	P value
Number and Numeration	82.49	251	20.04	69.44	162	27.22	5.47	411	0.000
Algebraic Process	75.70	251	24.03	63.77	162	25.05	4.85	411	0.000
Geometry	59.41	251	28.63	45.24	162	25.28	5.17	411	0.000
Mensuration	55.95	251	16.75	51.95	162	16.44	2.24	411	0.026
Trigonometry	45.84	251	14.91	42.48	162	15.42	1.89	411	0.06

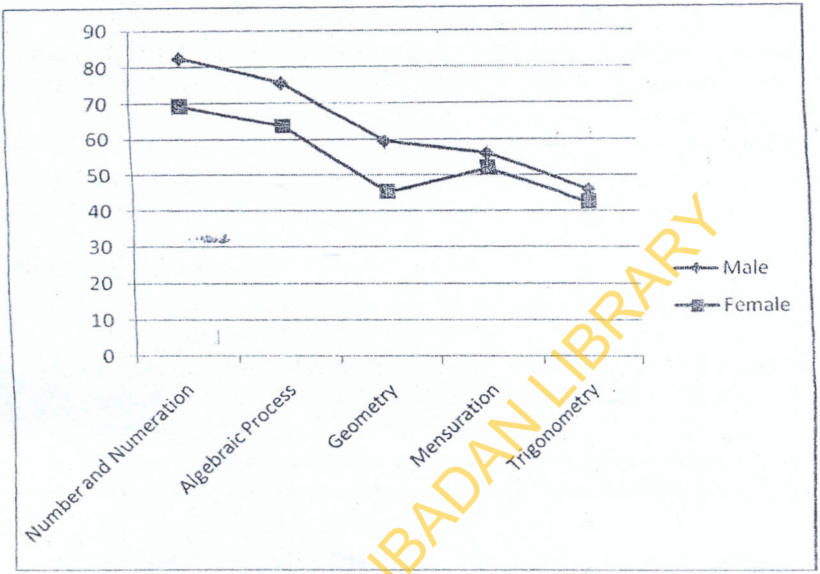

Fig 2: Pattern of Achievement in Mathematics.

Table 3 and fig. 2 reveal a pattern of achievements between male and female students in Mathematics. Generally, Male students performed significantly higher in the components of senior secondary mathematics investigated than their female counterparts. It is found that, there is significant difference between male (mean= 82.48) and female (mean=69.44) achievement in Number and Numeration (t_{411}=5.47; $p<0.05$). Significant difference is also find in algebraic process between male (mean=75.70) and female(mean=63.77) (t_{411}=4.85; $p<0.05$). In Geometry, significant mean difference between male (mean= 59.41) and female (mean=45.24) was found, (t_{411}=5.17; $p<0.05$). There is significant mean difference in male(mean=55.95) and female(51.95) achievement in Mensuration, (t_{411}=2.24; $p<0.05$). Significant mean difference between male and female students' achievement in Trigonometry is not found.

Discussion

It was found in this study that male students achieved significantly better in the Senior Secondary mathematics components (Number and Numeration, Algebraic process, Geometry, Mensuration and Trigonometry) investigated. The finding makes one to ask a question, what do male and female students devote their study time for? Answer to this question may serve as explanation for the observed difference in mathematics achievement between male and female students. The finding however corroborates the findings of Baron- Cohen, (2003); Geary, (1998); Kimura, (1999), that secondary school male students perform better than female in mathematics. Some other researchers in this area claim equality in performance among male and female students in mathematics (Halpern, Wai, & Saw 2005; Pinker, 2002). The result however contradicts Brandley's (2003) opinion that the gender gap in mathematics achievement appears early in secondary school, where female students were found to have a higher initial mathematics scores than male students, He went further to say that gender difference in mathematics achievement become less substantial as students progress through secondary school. He said gender differences in mathematics achievement are declining as male students showed significant greater gains than females in mathematics through secondary school. Significant achievement in trigonometry was not observed. In spite of capacity building workshops organized by federal and state Governments, the finding still corroborates West African Examination Council Chief examiners' reports (1997,1999 & 2000) where Trigonometry was consistently identified as the areas in which most of the students performed most poorly from year to year. This calls for attention. Mathematics educators should concentrate efforts towards instructional strategies that boost students' achievement in geometry, Mensuration and Trigonometry.

Conclusion

The findings of this study have meaningful implications for classroom mathematics teachers, curriculum planners and mathematics educators. Based on the results of the study, it is clear that gender difference exists between male and female achievement in mathematics and that male students perform better than their female counterparts. This is an era where gender equality is the message for the hour. All stakeholders in education industry should double effort to bridge the existing gap in mathematics achievement between male and female students.

Recommendations

Based on the findings of this study, the following recommendations are made

- Periodic career workshop should be organized especially for female students where the importance of mathematics will be emphasized.
- Inspectorate divisions of both federal and states should be equipped with adequate and specialized personnel for effective inspection of the curriculum implementation process that will equally support female students to achieve like their male counterparts.
- Workshops and Seminars should be organized for teachers where they will be exposed to various enhancement strategies. This is needful to assist every student especially female achieve significantly in mathematics

References

Adeleke, J.O. (2007). Identification and Effect of Cognitive Entry Characteristics on Students' Learning Outcomes in Bearing In Mathematics. An Unpublished PhD. Thesis University of Ibadan.

Baron – Cohen, S. (2005). *The male Condition.* The New York Times, Op – ed P 15.

Barth, H. Kanwisher, N. and Spelke, E. (2003). The Construction of large number representations in adults Cognition, 86, 201 – 221.

Beilstein, C.D, and Wilson, J.F. (2000). Landmarks in route learning by girls and boys perceptual and motor skills, 91, 877 – 882.

Brandly, K.D (2003). Individual Differences and school Effects. *The Development of mathematics Achievement in secondary school.* University of Kentucky.

Browne, K.R. (2002). Biology at work: Rethinking Sexual equality. New York: McGralo-Hill

Butterworth, B. (1999). The mathematical Brain, London Macmillan. Byron L. Zamboanga Smith College.

Carey, S. (2001). Evolutionary and Ontogenetic Foundations of arithmetic mind Cohen, L.B. (2003). Unresolved issues in infant categorization. In the Rakison and L.m. Oakes (Eds.) *Early Category and Concept development* (pp. 190 – 209) New York: Oxford University.

Connellan, J, Baron – Cohen, S, Wheel Wright, S, Batki, A. and Ahluwalia, J. (2000). Sex differences in human neonatal social perception. Infant Behaviour and Development, 23, 113 – 118.

Dehaene, S. Spelke, E. Pinel P. Stanescu R. and Tsivkin S. (1999). Sources of mathematical thinking: Behavioural and brain – imaging evidence. Science, 284, 970 – 314.

Feigenson, L; Dehaene S. and Spelke E. S. (2004). Core Systems of number. Trends in Cognitive Sciences, 8, 307 – 314.

Geary, D.C. (1998). Male, Female. The evolution of humansex differences. Washington. DC. *American Psychological Association.*

Haigh, C . F . (1995). Gender differences is SAT scores: Analysis by Race and Socio – Economic. Level. Abstracts Dissertation international vol. 56, no.5 P1147A

Halpern, D. Wai, J. and Saw, A. (2005). A Psychobiosocial model. Why females are sometimes greater than and sometimes less than males in mathematics achievement. Gender differences differences in mathematics (pp 48-) New York. Cambridge University Press.

Hauser, M.D. (2005). Comments on Baron – Cohen's "The assortative mating theory". Edge: The Reality Club, 158: from http://www.edge.org/

Kelly, D.B. (2003). The Development of Mathematics Achievement in Secondary School Individual Differences and School Effects.

Kimura, D. (1999). Sex and Cognition Cambridge, MA: MIT Press No well, A and Hedges, L.V. 1998. Trends in gender differences in academic achievement from 1960 – 1994: An analysis of differences in mean, variance, and extreme scores. Sex Roles, 39, 21 – 43.

Kotovsky, L and Baillargeon, R. (1998). The development of Calibration – based reasoning about collision events in young infants. Cognition, 67, 311 – 351.

Le Corre, M. (2004). The Construction of the positive intergers: A case study of human cognition as a product of evolution culture. Unpublished doctoral dissertation, New York, University.*Learning*, NewYork: Macmillan Publishing Co.

Maccoby, E.E and Jacklin, C.N (1974). Psychology of Sex differences Stanford, CA: Stanford University Press.

Mandler, J.M. (2004). The foundation of mind: Origins of conceptual thought. New York: Oxford University Press.

Mc Ginnis, J.R. and Pearsall M. (1998). Teaching Elementary Science Methods to Women: A male Professors Experience from two perspectives. *Journal of research in Science Teaching,* 35, 919 - 949

Newcombe, N.S. (2002). The nativist – empiricist controversy in the context of recent research on Spatial and quantitative development. *Psychological Science,* 13, 395 – 401.

Newcombe, N.S. and Huttenlocher, J. (2000). Making Space: The development of Spatial representation and reasoning Cambridge, MA: MIT Press.

Nowell, A. & Hedges, L.V. (1998). Trends in gender differences in academic achievement from 1960 – 1994: An Analysis of differences in Mean, Variance, and Extreme Scores, *Sex Roles,* 39, 21 – 43.

Pinker, S. (2002). The blank slate: *The modern denial of human nature.* New York: Viking.

Popoola, A.A. (2002). Effects of Heoristic Problem Solving and Programmed Instructional Strategies on Senior Secondary School Student Learning Outcomes in Mathematics in Ekiti State, Nigeria. An Unpublished Ph.D. Thesis. University of Ibadan. 115 – 123.

Quinn, P.C and Oates, J.M (2004). Early category representations and concepts. In J.M. Oates and A Grayson (Eds.), *Cognitive and language development in children,* (2nd ed., pp. 21 – 60). Oxford, England: Black well.

Rochat, P (2001). The infant's world Cambridge, MA: Harvard University Press.

Sax, L (2005). Why gender matters. New York: Doubleday.

Siegler, R.S. & Booth, J.L. (2004).. Development of numerical estimation in young Children. *Child Development* , 75, 428 – 444.

Siegler, R.S. & Opfer, J. (2003). The development of Numerical estimation: Evidence for multiple representations of numerical quantity. *Psychological Science*, 14, 237 – 243.

Smith, E.L. (1998). Implications of teachers' conceptions of science teaching and learning. What research says to the science teacher: The process of knowing. (Ed.) Mary Budd Rowe. Washington, DC: National Science Teachers Association.

Spelke E.S. (2005). Sex differences in Intrincic Aptitude for mathematics and Science. (Pp 29 – 56). New York: Oxford University Press.

Spelke, E.S. (2003). Core Knowledge. In N.Kanwisher and J. Duncan (Eds.) Attention and performance: Vol 20. Functional neuroimaging of visual Cognition. (Pp 29 – 56). New York: Oxford University Press.

Wang R.F and Spelke, E.S (2002). Human Spatial representation: Insights from animals. Trends in Cognitive Sciences. 6, 376 – 382.

West Africa Examination Council's Chief Examiners' reports. (1997, 1999, and 2000).

Wynn, K. (1992). Addition and Subtraction by human infants, Nature, 358, 749 – 750.