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Influence of Sex and Ability Level on Students' Mathematics Readiness in Enugu State.

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Abstract
The study was investigated to ascertain the influence of sex and ability level on students' Mathematics Readiness in Enugu State. The sample for the study was 203 students which were randomly selected from Nsukka and Obollo-Afor Education Zones in Enugu State. The instrument used for the study was mathematics readiness test (MATHRET) developed and validated by Unodiaku (2012) and revalidated by the researcher in Enugu Education Zone different from the main area of the study. The data obtained with the instrument were analyzed using mean and Analysis of Variance (ANOVA). Mean was employed to answer the research questions posed, while ANOVA was used in testing the formulated null hypotheses at 0.05 significant level. Finding of the study revealed that in general boys are ready more than girls in this test. Moreso, results indicated that the mean difference found between boys and girls was found significant ($P<0.05$) across the three ability level (high, average and low). It was generally found that sex and ability level are factors that influence mathematics readiness of students. It was recommended, among others that teachers should establish differential norms for both boys and girls in each of the ability level.
Keywords: Mathematics Readiness, Ability level, Achievement.

1. Introduction

Achievement of the new-millennium goal on science and technology break though is centered on competency in manipulating mathematics. Mathematics is viewed as tool for achieving success in scientific and technological development of any nation. Umoinyang (1997) viewed mathematics as the springboard for technological and overall national development. Really, without mathematics there is no science, without science there is no technology and without technology there will not be all the factors of modern society (Ukeje, 1997). It may be in consideration of the vital contribution of mathematics to the national development that Nigerian government made the study of mathematics compulsory at all levels of primary and Secondary School system of education in Nigerian as indicated in the National Policy on Education (2004).

Despite the importance of mathematics in societal and national development, its study in Nigerian primary and post-primary levels is bedeviled by incessant poor performance among the learners. Infact, the problems of teaching and learning mathematics in Nigerian Secondary Schools have continued to be topical and attracts the attention of mathematics educators and researchers. The persistent low achievement in mathematics, among Nigerian Secondary School Students is a clear manifestation of this problem (West African Examination Council (WAEC) Chief Examiners' reports (2001-2006); National Examination Council (NECO) Chief Examiner's report, 2009; Bot, 2011; Imoke and Anyagh, 2012; and Unodiaku, 2012).

Idowu (1990) attributed poor performance in mathematics to factors such as ill-preparation of students from the primary schools, lack of dedication among teachers, among others. Unodiaku (2011) attributed students' poor performance in mathematics to insufficient developed mathematics assessment instruments that can validly and reliably measure students' status in mathematics learning. Other factors noted in the literature include lack of mathematics readiness (Okonkwo, 1998; Obienyem, 1998; and Unodiaku, 2010).

Readiness is concerned with acquisition of proper learning skills that can enable the leaner to cope with further or next higher level of learning of the subject-matter or related learning task. Readiness has to do with 'preparedness' or 'mastery' of a subject-matter background knowledge that can enable the learner to cope with further or next higher level of learning of the subject-matter or related learning task (Ansubel, Navok and Hanison, 1978). In general, when a child is prematurely exposed to a learning task before he is adequately ready for it, he not only fails to learn the task in question, instead he adopts a coping-out strategy such as fear, or avoidance if the difficult subject, which is this instance, is Mathematics (Ausubel, Navok and Hanison, 1978; and Igbokwe, 2000). Thus, readiness becomes an essential factor in any learning which involves acquisition of subsequent related skills. This is particularly so with mathematics (Okonkwo, 1998; Igbo, 2004; and Unodiaku, 2011), because of the nature of its structure (Piaget, 1979), and the hierarchical pattern of its curriculum organization (Igbokwe, 2000 in Bot, 2011).

There is paucity of validated mathematics readiness test for identifying the readiness levels of Senior Secondary School entrants for Senior Secondary School mathematics. Teachers and researchers are faced with the problem

of access to locally developed instrument with which to measure students' readiness in Senior Secondary School mathematics level. Consequent upon this situation, Okonkwo (1998) and Obienyem (1998) suggested that Senior Secondary School entrants' mathematical readiness instrument be developed with which the degree of readiness of JSS 3 students intending to resume a new mathematics programme in Senior Secondary School mathematics learning can be investigated. In view of this, Unodiaku (2012) developed and validated a mathematics readiness test (MATHRET) with well known psychometric properties, for use in measuring students' readiness in Senior Secondary Schools level.

Although mathematics readiness tests have been developed and validated as evidenced by some research reports (Melnick and Freedman, 1972; Johnson, 1976; Okonkwo, 1998; Obienyem, 1998; Zuriel, 2002; Zulber, 2004; and Unodiaku, 2012), more needs to be done in various aspects of mathematics teaching and learning to further strengthen the efficacy of mathematics readiness in stemming the problem of mathematics teaching and learning in Nigeria Secondary Schools. Mathematics teaching/learning is one such aspect of school subjects that needs more studies. Furthermore, it is pertinent to observe that classes (especially mathematics classes) in our present day Secondary Schools are large (Okebukola, 1984; and Bello and Abimbola, 1997) and thus students of various ability levels constitutes such classes (Mankilik and Umaru, 2011). Moreso, Bellow and Abimbola, (1997) equally pointed out that the Nigeria educational system, classrooms are generally composed of students of different academic ability levels. Classrooms in Nigeria primary and post primary Schools constitute students of varied ability levels of high, average and low leading to unequal permanence among them. Every class in Nigeria educational system should therefore be considered as being composed of mixed ability level. For instance, research reports (Obioma, 1991; Olosunde and Olaleye, 2010; Madu and Hogan, 2010; and Unodiaku, 2010) vindicated that boys performed significantly higher than girls at all class levels in mathematics. These reports of superiority of boys over girls in mathematics was contradicted by Hilton and Bergland (1974) and Ozofor (2001) who all reported apparent superiority of females over their males counter part in mathematics test. Yet Onibokun (1979) and Usman and Nwoye (2010) reported that there was no significant difference between the male and female subjects' mathematical abilities. It appears that sex differences in mathematics tests are inconclusive and need further enquiry in this study to clarify this notion. Hence any innovation in determining mathematics readiness of students must consider the influence of sex and students' academic ability level.

Literature search revealed insufficient readiness test studies in mathematics as well as insufficient research reports concerning influence of sex and ability levels on students' achievement in mathematics. Therefore, this study was designed to determine the influence of sex and ability levels on students' achievement in mathematics. The ability levels considered in this study are high, average and low. The choice of these three levels was necessitated because the researcher personally observed the existence of these ability levels in the present day Secondary School classrooms.

2. Problem of the Study

Mathematics is the springboard for technological and scientific development of all nations in the universe. But the recent trend of poor performance of students in both internal and external examinations vindicates that students find mathematics difficult due to lack of readiness to learn it. Lack of readiness to learn mathematics is greatly influenced by some factors such as sex and ability level of the learners. To what extent would sex and ability level influence students' mathematics readiness?

3. Purpose of the Study

This study sought to investigate the influence of sex and ability level on students' mathematics readiness. The objectives of this study are:-

i. To determine the achievement of boys and girls when exposed to MATHRET;
ii. To determine the achievement of boys and girls as different ability level when exposed to MATHRET;
iii. To determine the interaction effect of sex and ability level on the achievement of students in mathematics.

4. Scope of the Study

Scope of the study is limited to sex and ability level factors of mathematics readiness to Senior Secondary School class one (SS 1) entrants in Nsukka and Obollo-Afor Education Zones of Enugu State. The contents of the instrument (MATHRET) used for the study adequately covered the four content areas of the junior Secondary School three (JSS 3) National Mathematics Curriculum, namely number and numeration, algebraic processes, geometry and mensuration and everyday statistics.

5. Research Questions

The study attempted to provide answers to the following questions;

i. What are the mean achievement scores of boys and girls exposed to mathematics readiness test?
ii. What are the mean achievement scores of boys and girls due to ability level when exposed to MATHRET?
iii. What is the interaction effect of sex and ability level on the achievement of students in mathematics as measured by MATHRET?

6. Hypotheses

The study was guided by the following formulated null hypotheses. The hypotheses were tested at 0.05 significant level.

Ho_1: There is no significant difference in the mean achievement scores of boys and girls exposed to MATHRET.

Ho_2: There is no significant difference in the mean achievement scores of boys and girls due to their ability levels when exposed to MATHRET.

Ho_3: There is no significant interaction effect of sex and ability level on students' achievement in mathematics as measured by MATHRET.

7. Methodology

7.1 Research Design

The survey research design was adopted for data collection based on MATHRET instrument developed and validated by Unodiaku (2012). The MATHRET was re-validated using three Secondary Schools in Enugu Education Zone which yielded a random sample of one hundred and thirty-seven (137) 2011/12 SS I entrants from population of similar characteristics as that of the main study.

8. Sample and Sampling Procedures

The target population for the study consisted of the entire Senior Secondary School one (SS I) students in Enugu State. A sample of 203 students were randomly drawn and used for the study. The sample was drawn through multi-stage random sampling technique. The reason for the choice of five intact classes was to enable the researcher handle the sample size effectively. The first stage involved randomly selecting two education zones (Nsukka and Obollo-Afor) out of six education zones in Enugu State. This was followed by selecting five intact classes (3 from Nsukka Education Zone and 2 from Obollo-Afor Education Zone) through proportionate stratified random sampling technique. The technique yielded 91 boys and 112 girls bringing the total number of sampled subjects to 203.

For the purposed of data collection, the researcher administered the re-validated MATHRET to the entrants during their first week of resumption in 2011/12 academic year. Computer software (SPSS, version 10.0) was used to analyze the data collected from this Education Zone by applying the Cronbach's alpha reliability procedure in calculating the internal consistency reliability coefficient of the MATHRET which yielded 0.8158. The MATHRET items were drawn from the four content areas of the National curriculum for JSS 3 level, namely number and numeration, algebraic processes, geometry and mensuration, and everyday statistics. The MATHRET was composed of 30 essay questions which covers the four content areas of JSS 3 mathematics curriculum. The questions that the MATHRET covered dealt with ability of the students to approximate, factorize, manipulate, interpret, identify, compare, calculate and draw. Based on the calculated reliability index which was high, the MATHRET was considered a highly reliable instrument for data collection.

The MATHRET was administered to the randomly sampled 210 SS I entrants in the first week of 2011/12 academic year. Five scripts were not returned and two scripts bear neither name nor indication of gender. These seven scripts were therefore not counted, thereby bringing the effective sample size to 203 subjects used for the study. The administration of the instrument provided data analysis. The analysis of data was done using descriptive statistics and ANOVA technique.

9. Results

Research Questions One and Two were answered using Table I below.

Table 1: Mean achievement scores of boys and girls due to ability level when exposed to MATHRET.

		N	Mean	Std. Deviation (SD)	Std. Error
High	Boys	91	10.67	11.404	1.195
	Girls	29	8.17	10.671	1.981
	Total	120	10.07	11.238	1.026
Average	Boys	91	5.05	7.360	.771
	Girls	29	2.55	5.110	.949
	Total	120	4.45	6.947	.634
Low	Boys	91	1.02	2.170	.228
	Girls	29	1.31	1.692	.314
	Total	120	1.09	2.062	.188

Table I revealed that boys of high ability level had mean readiness test score of 10.67 with SD of 11.404, boys of average ability level had mean readiness test score of 5.05 with S.D of 7.360 while other boys of low ability level had mean readiness test score of 1.02 with S.D of 2.170. Moreso, the Table showed that girls of high, average and low ability level had mean readiness test scores of 8.17, 2.55 and 1.31 respectively with S.D of 10.671, 5.110 and 1.692 respectively.

Table 2: Test of Homogeneity of variances using levene Statistic.

	Levene Statistic	df1	df 2	Sig.	Result
High	8.510	1	118	.004	S
Average	20.319	1	118	.000	S
Low	.145	1	118	.704	NS

S = significant at 0.05 probability level.
NS = not significant at 0.05 probability level.

Table 2 revealed that there is no significant difference in the interaction effect in the readiness of boys and girls of high ability level. Similarly, Table 2 indicated no interaction effect in the readiness of boys and girls of average ability level. However result of Table 2 showed that the interaction effect of boys and girls of low ability level is not significant. In other words boys and girls of low ability level exhibit equal readiness level or performance.

Table 3: ANOVA Result

	Sum of Squares	df	Mean Squares	f	Sig	Result
High Between Groups	137.219	1	137.219	1.087	.299	NS
Within Groups	14892.248	118	126.205			
Total	15029.467	119				
Average Between Groups	137.802	1	137.802	2.901	.091	NS
Within Groups	5605.898	118	47.508			
Total	5743.700	119				
Low Between Groups	1.829	1	1.829	.428	.514	NS
Within Groups	504.163	118	4.273			
Total	505.992	119				

NS = not significant at 0.05 probability level.

ANOVA result of Table 3 above revealed that hypotheses 1, 2 and 3 were rejected. The F –calculated values (1.087, 2.801 and .428) are all greater than 0.05 significant level. The hypothesis of no significant difference was therefore rejected. This means that there is significant difference in the mean achievement scores of boys and girls exposed to MATHRET and across the three ability level ($p < 0.05$). The Table also reveled that the mean achievement scores of students of different ability level exposed to the MATHRET performed equally in the test. Result of Table 3 revealed that the interaction effect of sex and ability level (high, average and low) on students achievement in mathematics as measured by MATHRET was not significant ($P<0.05$). In other words, the interaction of sex and high ability level, sex and average ability level, and sex and low ability level were all found not significant ($P<0.05$), as evidenced in Table 3 above under significant column. Table 3 revealed that high, average and low ability level were found significant at .299, 091 and .514 respectively.

10. Discussion of Results

From the findings, it is clear that boys of high and average ability level achieved higher those girls of high and average ability level. However girls of low ability level achieved higher than boys of low ability level. In general boys recorded a total mean score of 16.74 while girls recorded 12.03 with a mean difference of 4.71 in favour of boys. This shows that boys are ready more than girls in this test. This finding is in line with either findings (Obioma, 1985; Olosunde and Olaleye, 2010; Madu and Hogan, 2010; and Unodiaku, 2010) who all reported that boys are more superior to girls at all class levels in mathematics test. However, this finding contradicts Hilton and Bergland, 1974 who reported apparent superiority of females over their male counterpart in mathematics test.

Furthermore, the mean difference found between boys and girls was found significant ($P<0.05$) across the three ability level (high, average and low). This can be clearly seen in the ANOVA result of Table 3 above. This result goes to support earlier postulates of Bellow and Abimbola (1997) who pointed out that the Nigeria educational system, classrooms are generally composed of students of different academic ability levels.

11. Conclusions

The following conclusions are made based on the findings of the study. The findings of this study provided empirical evidence that sex and ability level are factors that influence mathematics readiness of students. Teachers should establish differential norms for both boys and girls in each of the three ability level.

In standardizing the MATHRET, cognizance should be taken of the fact that boys and girls differ significantly in mathematics performance across the three ability level (high, average and low). Consequently, this suggests the establishment of differential norms for both male and female students in the three ability level. If these factors are taken cognizance of in Mathematics pedagogy in Nigerian Secondary Schools Mathematics classroom, there is tendency of Nigeria Government to achieve success in the New-Millennium Development Goals (MDGs) on science and technology breakthrough.

12 Recommendations

Recommendations are made based on the findings as follows:

1. Since sex and ability level are factors that influence mathematics readiness of students, the mathematics teachers should establish differential norms in assessment of mathematics readiness of the students.
2. Workshops, conferences and seminars should be organized frequently for Secondary School teachers by the professional bodies like Science Teachers' Association of Nigeria (STAN) and Mathematics Association of Nigeria (MAN) so as to create awareness to teachers to take cognizance of establishment of differential norms in teaching and evaluation of the students.

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