Effect of Metalinguistic Learning Approach on Senior Secondary School Students' Interest in Statistics in Makurdi

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Abstract - *This study examined the effects of meta-linguistic learning approach on senior secondary school students' interest in statistics. The study employs quasi-experimental design of non-randomized pretest posttest control group type. Two research questions and two hypotheses guided the study. A sample of 350 SS2 students was drawn from a population of 2,665 SS2 students in Makurdi Metropolis. In each of the four sampled secondary schools, intact classes were used. Two sets of lesson plans on the topics under study were developed for the experimental and control groups respectively. Data were collected using Statistics Interest Inventory (SII). Research questions were answered using means and standard deviations while the hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance. Findings among others include that Metalinguistic Learning Approach (MLA) improved students' interest in statistics and that MLA did not significantly differentiate between male and female students' interest scores in statistics. Based on the findings of this study, it was recommended that mathematics teachers should be encouraged to use MLA in their mathematics classroom among others.*

Keywords: *Improving, Metalinguistics, Learning Approach, Interest, Statistics, Mathematics Teachers.*

INTRODUCTION

The knowledge of statistics is important not only for scientific progress and development but also for its day-to-day application in social sciences, arts, government, business, management studies and household chores. It is an important aspect of school mathematics that has various applications in the life of a learner especially in planning, decision making and research.

Statistics as a branch of mathematics is a body of theories and methodologies employed in analyzing data and using numerical evidence to choose among several alternatives, decisions and actions when not all relevant facts are known (National Teachers' Institute, 2009). It is thus a science comprising rules and procedures for collecting, organizing, summarizing, describing, analyzing and interpreting numerical data which are used in making decisions, valid estimates, prediction and generalizations (Salami, 2001).

In recognition of the enormous importance of statistics, it is studied as an aspect of Senior Secondary School Mathematics. Mathematics as a secondary school subject thus comprises five main areas namely: Algebra, Geometry, Number and Numeration, Introductory Calculus and Statistics. Statistics is that branch of mathematics involving the study of data presentation, measures of central tendency, measures of dispersion, graphical presentation of data and probability (Federal Ministry of Education, 2007).

Despite the importance of mathematics to students and society at large, the general achievement in school mathematics has more often than not been affected by students' poor performance in the statistics section of public mathematics examinations over the years in Nigeria. The Annual Report of the Chief Examiner of the West African Examination Council (WAEC, 2002, 2004, 2007, 2010 & 2012) has indicated that achievement in the statistics section of the public mathematics paper is poor among the secondary school students.

The WAEC Chief Examiner`s Report (2004) specifically advanced reasons for students' poor achievement in Mathematics to include: shallow knowledge of basic principles, concepts and appropriate application of laws and formulae; confusion between similar and related topics, for instance bar chart and histogram, dependent and independent events, numerator and reciprocal factors; lack of mastery of the subject language, resulting in misinterpretation of facts.

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This position alludes to the fact that concepts in mathematics should be properly explained to the learners in order to improve upon their overall achievement in mathematics. The Chief Examiner's Report is an evident that students have problems in understanding and interrelating symbols and peculiar language used in Statistics. According to Salami (2001), statistics like any other subject has its own technical language. He pointed out that it is always good and beneficial for students who will use the language of statistics in their various examinations to acquaint themselves with the commonly used vocabularies, notations and symbols. The poor acquaintance of mathematics students with the commonly used terminologies, notations, formulae and symbols in statistics may result in low interest and subsequently poor achievement in the subject. Their inability to differentiate and establish relationships between vocabularies, notations and symbols in statistics could be an obstacle to their high interest and achievement. Many of the students may not be able to reflect on the language of statistics and how to use the knowledge of the language to solve problems. The cause of students' low interest and poor achievement in statistics may be therefore traceable to the low level of students' metalinguistic knowledge of statistics.

Metalinguistics is a compound word made up of 'meta' and 'linguistic'. Meta which is an ancient Greek term meaning 'beyond' can be interpreted in the context of language learning as going beyond communication and meaning, and to instead focusing attention on the underlying structures (Dekemel, 2003). Linguistics on the other hand refers to language and in this case, the language of statistics. The language of statistics has structure, and an implicit knowledge of this structure is essential to the students' interest and achievement in the subject. Metalinguistics is therefore the ability of the students to reflect on oral and written language and how it is used (Wallach, 2008).

Furthermore, metalinguistics is an acquired awareness of language structure and function that allows one to reflect on and consciously manipulate the language (Fielding-Barnsely & Purdie, 2005). To Bialystok (2007), it is a term used to describe a construct, theory or model to explain the interaction between language and written text. It is this act of interaction that will bring explicit consciousness of linguistic form and structure in order to consider how they relate to each other and produce underlying meanings. Metalinguistic ability can therefore be defined similarly as metacognition. It is an ability to view and analyze language as a 'thing', language as a 'process' and language as a 'system' (Mora, 2001). According to this researcher, Meta-linguistics can be classified into various categories of ability to consciously reflect on the nature of language by using skills such as: an awareness that language has a potential greater than simple symbols; an awareness that words are separable from their inferents, that is, meaning that resides in the mind and not in the name; and an awareness that language has a structure that can be manipulated on the realization that language is malleable so that one can change and write things in different ways.

In this study, metalinguistics is considered as the ability of the students to reflect on the use of the language of statistics since metalinguistics deals with the conscious knowledge of forms and meanings of relationships in a language. Metalinguistics can therefore be determined from students' ability to perceive and apply various notations, symbols, formulae and vocabularies in statistical language, judge the appropriateness of their usage, define terminologies, substitute symbols, apply formulae and understand arbitrary language. Students of mathematics who study statistics therefore need Metalinguistic Learning Approach (MLA) that may enable them comprehend the statistics language.

Another considerable factor for students' poor achievement in mathematics is the students' low interest in the study of the subject (Obodo, 2004). Akinsola and Papoola (2004) observed that lack of interest by the students is a major problem associated with students' low achievement in mathematics. He further pointed out that students' low interest in mathematics makes them to absent themselves from its lessons. This interest is defined as the feeling one has in wanting to know or learn about something (Hornby, 2006). Available studies have shown that students generally have low interest towards mathematics (Obodo, 2007). Abakpa and Igwue (2014) further explained that lack of interest in mathematics has led to poor attitude and achievement in the subject. Interest according to Adetula (1989) as cited in Abakpa and Igwue (2014) is the energizer of learning without which meaningful learning may not take place. Thus, students' interest is a major influence on how well they learn and what they learn.

Elliot, Kratochwill and Travers (2002) defined interest as an enduring characteristics expressed by a relationship between a person and a particular activity or object. This implies that interest is built in the child for an activity when his needs, capacities and skills

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are good matches to the demands offered by such an activity. In order to stimulate students' interest in mathematics class, the learning task should commensurate with his wealth of experience and ability to handle such tasks. Otherwise, the child looses interest, which invariably may lead to poor achievement.

Uloko and Usman (2008) studied the effect of ethnomathematics teaching approach on students' interest and achievement in locus. A sample of 253 SS2 students was used for the study. This comprised 135 male and 122 female students sampled from four secondary schools in Zone B Educational zone of B of Benue State. The research is a quasi-experimental design. Intact classes were used. Two research instruments, namely locus achievement test (LAT) and locus interest inventory (LII) were used for collection of data. The reliability coefficients of the instruments were 0.99 and 0.81 respectively. The mean and standard deviation were calculated to answer research questions while Analysis of Covariance and coefficient correlation were used to test the hypotheses. The result indicated that students in the experimental group achieved higher scores than those in the control group. Furthermore, the result showed that there was a significant relationship between interest and achievement in locus.

Research findings have shown that instructional approach of a teacher affects the students' interest in learning and as such, the mathematics teacher is expected to arouse and sustain this form of interest. Zakarriya (2002) opines that interest motivates learning and that students who are interested in a subject tend to study it happily, frequently and more effectively. Being metacognitive in nature, will MLA generate a high rate of interest that will increase the success of students' achievement in statistics aspect of mathematics in public examinations?

The issue of whether students' interest will be influenced by gender is another variable of concern to this study. Prior researches on the differences in the interest between male and female students showed mixed results. While significant differences exist in some studies, others show no differences.

According to Akinsowon and Osisanwon (2014), female students are considerably less interested in science subjects than male students and that this can be attributed to the stereotype that it is only for males. They further explained that people have the conception that women in sciences, technology and mathematics (STEM) careers are not good as their male counterparts except they are extremely and outstandingly good at what they do. Similarly, Amelink (2012) discovered that interest in mathematics is noticeably lower among female students than male students. On the contrary, Koller, Baumert and Schnabel (2006) reported gender differences in favor of male students in mathematics interest. With reference to statistics, Colin and Ian (2009) reported that female students were more interested in aspects of statistics that are related to surveys while males were more interested in aspects relating to problem solving and also contexts that are associated with sports.

Generally, students tend to put more effort to retain knowledge and achieve higher scores in the subject they find interesting to them. Will MLA then improve students' interest in statistics when employed? Finally, will the use of MLA equally improve both male and female students' interest in statistics?

STATEMENT OF THE PROBLEM

If secondary students are to improve their achievement in mathematics at SSCE, the level of the metalinguistic knowledge of the students which might depend so much on their interest, must appreciate. Their inability to differentiate and establish relationships between vocabularies, notations, formulae and symbols as well as their lack of understanding and ability to interrelate the symbols and special language structure as used in statistics may have all be as a result of their low interest in the study of mathematics.

Although secondary school students are frequently required to write terminal examinations and other tests to constitute their continuous assessment, they typically have limited experience in communicating the language of statistics especially in the written form. This has resulted in low interest and mathematics achievement among secondary school students. Research findings indicate the existence of relationship between teaching approaches and students' interest (Uloko & Usman, 2008). This is to say, good teaching will increase students' interest and achievement in statistics while poor teaching approach brings about low interest and poor achievement.

Metalinguistic Learning Approach (MLA) has been proved to be effective and a good teaching approach that has increased students' interest and achievement in English Language (Claire & Heidi, 1997). But mathematics and statistics educators are yet to take full advantage of the potentials of this approach; yet the understanding of the language of

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statistics is fundamental to the students' high interest and achievement. This study is therefore an attempt to ascertain the efficacy of MLA when it is applied by mathematics teachers. It will also ascertain if MLA will improve statistics interest of both male and female students.

PURPOSE OF THE STUDY

The main purpose of this study was to determine the extent to which the adoption of Metalinguistic Learning Approach will affect the interest of the senior secondary school students in statistics. Specifically, the study sought to examine the interest rating in statistics interest inventory (SII) of students taught statistics in experimental and control groups; and determine the mean interest ratings of female and male SS2 students taught statistics in the experimental.

Ho1: There is no significant difference between the mean interest scores of students taught statistics in experimental and control groups.
Ho2: There is no significant difference between the mean interest rating of female and male SS2 students taught statistics in the experimental group.

METHOD

The design used for this study was quasi-experimental of pretest and posttest non-randomized group design. It was carried out in Makurdi metropolis of Benue State, Nigeria. The population consisted of all the 2,665 senior secondary school two (SSS2) students in all the 21 government grant-aided senior secondary schools in Makurdi metropolis of Benue State in Nigeria. Using random and purposive sampling techniques, a sample of 350 SS2 students in 12 intact classes from the selected schools was used. The experiment lasted for six weeks while the instrument used for the study was Statistics Interest Inventory (SII). It was a 16 item test instrument constructed by the researcher. This instrument was validated by one expert each from mathematics education, educational psychology and educational measurement and evaluation of the Department of Science Education and Department of Educational and General Studies, University of Agriculture, Makurdi. Pre-test was formally administered to the subjects of study before the commencement of the study. Using Cronbach-Alpha, the reliability coefficient of the SII was 0.86. The data collected were analyzed using means and standard deviations to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses formulated.

RESULTS

Table 1. Interest Ratings and Standard Deviations of Students Taught Statistics Using MLA and CTA

Group	N	Pre-SII Mean	SD	Post-SII Mean	SD
Experimental	175	2.38	2.12	2.96	2.01
Control	175	2.15	1.97	2,26	1.42
Mean difference		0.23		0.7	
Total	350				

The results in Table 1 shows that the Pre-SII mean interest scores of the experimental and control groups were 2.38 and 2.15 respectively. This has given rise to a difference of 0.23 in the mean interest scores of both groups in the course of the study. On the other hand, the Post-SII mean interest scores of the experimental and control groups were 2.96 and 2.26 respectively and thereby resulting in a mean difference of 0.70.

The result in Table 2 reveals that $F(1,349) = 843.66$, $P=0.00<0.05$.This implies that there is a significant difference in the mean interest scores of students taught statistics in the experimental and control groups. The null hypothesis of no significant difference is thus rejected. This implies that the use of MLA enhanced high interest of students taught statistics during the period of this study.

Table 2. Summary of ANCOVA Test on Mean Interest Ratings of Students Taught Statistics in Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11384.15	2	5692.07	526.90	.00
Intercept	15355.55	1	15355.55	1421.43	.00
Pre-SII	408.15	1	408.15	37.78	.00
Group	9114.00	1	9114.00	843.66	.00
Error	3748.61	347	10.80		
Total	624662.00	350			
Corrected Total	15132.75	349			

p = .00 < .05

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Table 3. Descriptive Statistics of Experimental Group on Male and Female Students' Interest

Group	N	Pre-SII Mean	SD	Post-SII Mean	SD
Male	94	2.72	2.91	3.03	2.62
Female	81	2.00	2.57	2.88	1.33
Mean difference		0.72		0.15	
Total	175				

Table 4. Summary ANCOVA Test on Mean Interest Ratings of Male and Female Students Taught Statistics in Experimental Group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	447.03	2	223.52	15.93	.00
Intercept	10158.64	1	10158.64	723.89	.00
Pre-SII	199.18	1	199.18	14.19	.00
Sex	10.96	1	10.96	.78	.38
Error	2413.75	172	14.03		
Total	394907.00	175			
Corrected Total	2860.78	174			

P = .38 > .05

The results in Table 3 reveals that the Pre-SII mean interest scores of the male and female students were 2.72 and 2.00 respectively. This has given rise to a mean difference of 0.72. On the other hand, the Post-SII mean scores of the male and female students were 3.03 and 2.88, thereby resulting in a mean difference of 0.15 in the course of the study.

To test this hypothesis, ANCOVA statistic was computed and shown in Table 4. From the table, $F(1,174) = 0.78$, $P=0.38>0.05$.This means there is no significant difference between the mean interest ratings in SII of male and female students taught statistics in the experimental class. The male and female students in the experimental group therefore exhibited similar interest in the statistics topics covered in the course of the study. That is, MLA enhances similar interest in both male and female students in the statistics concepts.

DISCUSSION

The mean differences in interest scores of 0.23 in the Pre-SII and 0.7 in the Post-SII indicate that MLA had widened the interest ratings between the experimental and control groups during the study period. This therefore implies that MLA enhances students' interest in the study of statistics. The result is in consonance with Binda (2006) who discovered that mathematics teachers need to teach the language of mathematics in order to enhance students' interest and achievement in the subject.

The mean differences in the interest scores of 0.72 in Pre-SII and 0.15 in Post-SII of the male and female students in the experimental group narrowed down the interest ratings between them. This implies that MLA enhanced interest of both male and female students in the course of the study. The finding is also in line with the research result of Daniel (2000) who found out that familiarity with mathematical symbols enhances male and female students' interest and achievement in mathematics. At any rate, the finding is in disagreement with the research result of Colin and Ian (2009) who reported that females were more interested in aspects of statistical literacy that are related to surveys while the males students were more interested in aspects relating to problem solving and also contexts that are associated with sports.

The fact that the learning tasks in the topics taught during the period of study commensurated with the wealth of experience of the male and female students and their ability to handle such tasks might have contributed to the improvement of the interest of the male and female students in the study of statistics.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the study takes a cursory look at the efficacy of MLA through experimentation. This was done through extensive review of related and relevant literature which revealed some relevant gaps that the study attempt to fill. The MLA proved to be efficient as students improved on their statistics interest. Most

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importantly is the friendly nature of MLA which does not discriminate on the basis of gender. This is because the difference between the mean interest ratings of both male and female is not statistically significant.

It is recommended that Ministries of Education, State Secondary School Education Boards and other relevant stakeholders are encouraged to promote MLA by organizing regular conferences, seminars and workshops for serving teachers to acquaint themselves with the procedures for using MLA. Curriculum planners and mathematics text book writers should be encouraged to include MLA in their books as complementary to other teaching methods. School Administrators and Inspectors in collaboration with Ministries of Education should encourage mathematics teachers to use MLA in mathematics classroom.

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