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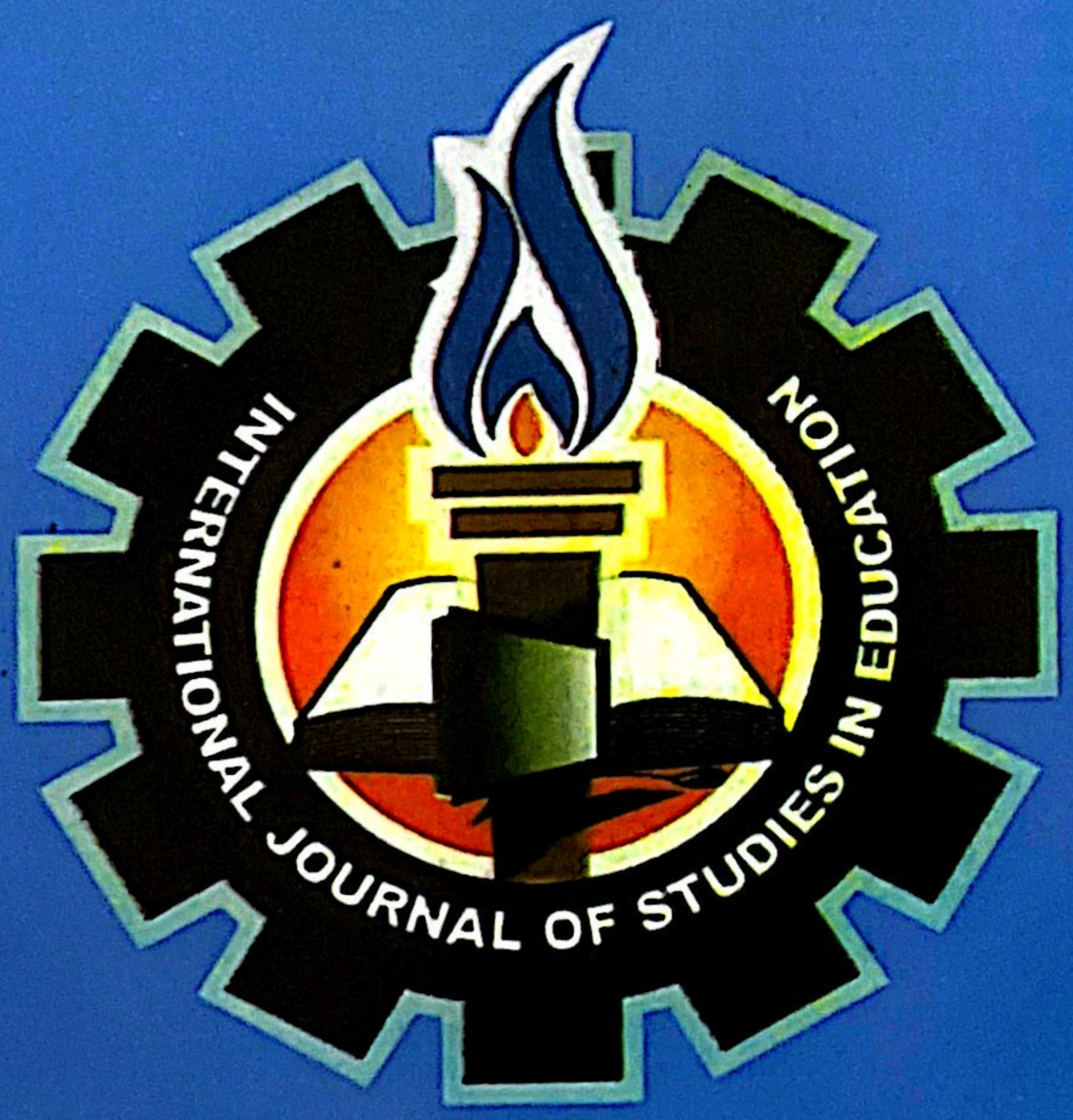

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DEVELOPING SECONDARY SCHOOL STUDENTS' INTEREST IN BEARING THROUGH POLYA'S PROBLEM SOLVING STRATEGY.

By

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Abstract

Quasi-experimental design was adopted in this study. Pretest-posttest, non- equivalent control group was used. Six intact classes, three of which were randomly assigned to experimental and the other three to control groups are used for the study. Sample of the study consisted of 284 SSII secondary school students from Enugu Education Zone. Two research questions and two hypotheses guided the study. Bearing Interest Scale (BIS) was used for data collection. BIS was constructed by the researcher and validated by three research experts. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at .05 level of significance using Analysis of Covariance (ANCOVA). Experimental groups were taught using Polya's Problem Solving Strategy (PPSS) while control groups were taught the same topic using expository method. Major findings of the study revealed that students taught bearing with PPSS showed higher interest than those taught with expository method. There was no significant difference between the mean interest scores of male and female students in the study. It was recommended that Mathematics teachers should adopt PPSS for teaching Bearing and distances in senior secondary schools.

KEY WORDS: Interest, Bearing, Polya's Problem Solving Strategy

Introduction

Mathematics is a human invention borne out of human resolve to solve human problems (Kolawole and Oluwatayo, 2005). It is the significant key factorin the development of any nation (imoko and Agwagah, 2006). Also mathematics according to Ugboduma and Egbele (2006) is a vessel to achieve greater means essential for survival and continual co-existence, making the individual to know how to think effectively, and enriching one's personal life positively.

The National Policy on Education (FRN, 2013) clearly states the objectives of Science, Technology and Mathematics (STM) as;

- ✓ Laying a sound basis for scientific and reflective thinking.
- ✓ Acquisition of the rudiments of numbers, letters, colours, shapes, forms etc.
- ✓ Developing a kind of competence in the basic skills and understanding for dealing with numbers and forms.
- ✓ To equipstudents to live effectively in our modern age of science and technology.
- ✓ To promote interest in mathematics and to provide solid foundation for everyday living.

- ✓ To provide trained manpower in applied science, technology and commerce particularly at sub-professional grades.

In spite of all these important roles of mathematics in the society, secondary school students' continue to develop phobia of mathematics and also show less or no interest in the subject. Obodo (2004) observed that Bruner stated that after 10 years of teaching experience in the classroom, an average mathematics teacher can go a long way in helping his students to discover mathematical ideas for themselves. Education cannot be made more effective without effective teaching, and an effective technique can ensure effective learning.This calls for the need to promote activity – types and analytical kinds of teaching and learning such as the problem solving strategy. According to (Polya, 1957) and (Motter, 2011), problem solving strategy empowers students of all learning styles to better comprehend word problems in mathematics. Hence, problem solving strategy can enable students acquire mathematical/ analytical skills to solve word problems. Obviously, interest is a very strong factor in the teaching and learning of mathematics in secondary schools. The degree and direction of attitude towards mathematics are largely determined by the kind of interest developed by students of mathematics. Onuorah (2002) observed that interest is indispensable for learning and many hold the view that there can be no real education without interest. It is equally gathered that the degree and direction of attitude towards mathematics are largely determined by the kind of interest developed by students for mathematics. A student with positive attitude studies mathematics because he/she enjoys or likes it; satisfaction is gotten from acquiring mathematical ideas. This is because, students are likely to work diligently and most effectively at task in which they are genuinely interested in. Despite the inevitable importance and usefulness of mathematics, it remains one "subject" in school curriculum which majority of students has negative interests and attitude towards (Ezeugo and Agwagah, 2000). This worrisome situation has grown to the level that needs critical evaluation and revitalization of the methodologies adopted by the teachers of this subject in other to improve and redirect the students' interest and perceptions towards mathematics.

Research evidence (Ameen, 2007 & 2013) respectively also has shown that word problems involving bearing has been identified as a topic students perceived difficult which as a result leads to low or no interest during teaching and learning. Several researches have further implicated teaching methods as one of the factors inhibiting students' interest, achievement and retention in mathematics. There exist several methods and strategies for teaching mathematics in this present time. Such include; discovery, expository, laboratory, programmed instruction, target-task, delayed formalization and the computer aided instruction in mathematics (CAIM) with its approaches of Drill and practice, tutorial and Problem solving. Each of these has its own advantages and disadvantages in teaching mathematics. (Obodo, 2004). Roberts (1995), stated that problem solving strategy is a process designed to teach students how to think, not what to think. Global Institute for Corporate Education (2013) defined it as the mental process one follow when one has a goal but cannot immediately understand how to achieve it. It consists of a sequence of sections that fit together depending on type of problem to be solved. Mathematics problem solving in particular requires specialized skills which are practical and which involve a unique linkage between mathematics, communication and the environment. Funkhouser (1992) defined problem-solving as a multiple step process where the problem solver must have had relationship with past experiences (schema) and the problem at hand and then set up a solution. In other words, students need to learn this process if they are to deal successfully with problems

in real life situations and those they may come across in schools. By learning problem solving in mathematics, students should acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that will serve well outside the mathematics classroom, in everyday life and in the workplace.

Furthermore, many models have been advanced for the teaching and learning of problem solving. Some of the models are those of Polya (1957), Roberts (1995), Global Institute for Corporate Education, (2013), Bransford and Stein (1993). Amongst these models, that of George Polya is clearly defined and sequenced in the sense that it incorporates the other mathematics problem solving models into four-phase strategy, which include; understanding the problem, devising a plan, carrying out the plan and looking back (Polya, 1957). Apart from variables like teaching method that can affect students' interest in learning, evidences (Etukudo 2002, Nneji 2011) abound in literature that gender also has tremendous influence on students' interest in mathematics. The issue of gender differences in students' achievement, interest and retention in mathematics has been a source of worry to mathematicians, mathematics educators and researchers. However, it is worthy to note that opinions and findings about the issue have been diverse. This work therefore, investigated the interaction between teaching strategy and students' and students gender as it affects their interest in bearing and distances with an aim to correct some gender-based misconceptions in teaching and learning of mathematics.

Purpose of the Study

The main purpose of this study was to investigate the effect of Polya's Problem Solving strategy (PPSS) on secondary school students' interest in bearing. Specifically, the study investigated the effect of PPSS on senior secondary School II (SSII) students interest in bearing and interest in bearing with regards to their gender

Research Questions

The following research questions guided the study;

2. What are the mean bearing interest scores of students taught using Polya's Problem Strategy(Experimental Group) and those taught using expository method (Control group) in both pre-test and post-test?
3. What are the mean bearing interest scores of male and female students in the Experimental and Control groups in both pre-test and post-test?

Research Hypotheses

The following research hypotheses were tested at .05 level of significance.

1. There is no significant difference between the mean bearing scores of students in the experimental and control groups in the post-test.
2. There is no significant difference between the mean bearing interest scores of male and female students in the experimental and control groups in the post-test.
3. There is no significant interaction between teaching strategy and students' gender on students' interest scores in bearing.

Method

The research design adopted in the conduct of this investigation was quasi-experimental design, thus, a pretest-posttest, non-equivalent groups was used. Six intact classes randomly assigned to

experimental and control groups were used. The area covered in this study was Enugu Educational Zone of Enugu State. The population for the study consisted of all senior secondary two (SSII) students in the area numbering four thousand seven hundred and sixty-seven (4767) as at the time of the study. The sample for this study is made up of 284 Public Senior Secondary Two (SS2) students consisting of 142 students in the experimental group and 142 students in the control group. In other to study the effect of gender, one boys' school, one girls' school and one co-educational secondary schools were sampled by balloting. In each of the three sampled schools, two streams of SS2 were sampled by balloting. In each school, one stream was assigned to experimental group while the other was assigned to the control group by balloting. Hence, the sample for the experimental group was 142 students while the sample for the control group was142 students. The instrument used for data collection was Bearing Interest Scale (BIS). The BIS was developed by the researcher. There are two sections of BIS (section A and B). Section A contained personal data of the respondent and section B contained twenty (20) items on interest. The response options are; Very Much Interested (VMI), Much Interested (MI), Uninterested (UI), and Very Uninterested (VUI). They were scored 4, 3, 2 and 1 points for positive items, and 1, 2, 3, and 4 points for negative items. The scales addressed students' interest in bearing. The instrument was validated by two research experts. BIS was trial-tested by administering it to SS II students in a different school outside the schools sampled for the study; the scores obtained were used to obtain a reliability index of 0.76 for the instrument using Cronbach's Alpha reliability method.

A research assistant was trained for three days on the use of Polya's Problem Solving Strategy in teaching bearing. The lesson plans and procedures for presentation were discussed extensively with the research assistant. The research assistant was then required to trial teach an equivalent group of students using the lesson plan for the experimental group only. After the trial teaching, the researcher held discussions with the research assistant on the mode of final presentation. For the control group, the three research assistants (regular Mathematics classroom teachers in the three sampled schools) were trained separately on the use of lesson plans and administration of BAT for two days. Foremost, the BISwas administered to all the students for the study as pre-test. Thereafter, the treatment was administered for a period of six weeks. The experimental group in each school was taught bearing using PPSS while the control group in each school was taught the same topic using expository method. After six weeks of treatment, the BIS was re-arranged and administered to all the students as post-test. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at .05 level of significance.

Results

Research Question One.

What are the mean Bearing interest scores of students in the experimental and control groups in pretest and posttest? The results for research question 1 are shown in table 1.

Table 1: Mean Interest Scores and Standard Deviations of Experimental and Control Groups in Bearing Interest Scale (BIS)

Group	N	Pre-interest		Post-interest	
		Mean	SD	Mean	SD
Experimental	142	15.62	9.28	88.12	11.06
Control	142	16.98	7.88	35.81	16.24

Table 1 shows that the experimental group had mean interest scores of 15.62 and 88.12 respectively in pre-and post-interest scales. The control group had mean interest scores of 16.98 and 35.81 respectively in pre-and post-interest scales. This means that the experimental group obtained a higher mean score in the post-interest scale than the control group.

Research Question Two.

What are the mean Bearing interest scores of male and female students in the experimental and control groups in both pretest and posttest?

The results for research question 2 are presented in table 2.

Table 2: Mean interest Scores and Standard Deviations in Experimental and Control.

Group	Pre-test				Post-test			
	MALE		FEMALE		MALE		FEMALE	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
Experimental	14.18	10.21	17.06	9.01	90.66	12.11	85.58	10.81
Control	17.94	7.42	16.02	8.93	36.70	17.22	34.92	15.98

Table 2 shows that the male and female experimental group students had mean scores of 14.18 and 17.06 in the pre-interest scale respectively. Both genders obtained mean scores of 90.66 and 85.58 respectively in the post-interest scale. The male and female control group students had mean scores of 17.94 and 16.02 respectively in the pre-test scale and 36.70 and 34.94 respectively in the post-interest scale. This means that male experimental group students had higher mean interest score than their control counterparts.

Research Hypothesis One

There is no significant difference between the mean Bearing interest scores of students in the experimental and control groups.

Table 3 shows the results for research hypothesis 1

Table 3: One-way ANCOVA results on mean interest scores of experimental and control groups

Source of variation	Df	Sum of squares	Mean squares	F	Sig	Decision
Between groups	1	2.6143	2.6143	5.21	0.00	S
Within groups	282	141.5922	0.5021			
Total	283	144.2065				

Table 3 shows that the F-calculated value of 5.21 was found significant by the SPSS statistical software at 0.00. This level of significance (0.00 is less than 0.05 level set for the study). Therefore, there is a significant difference between the mean interest scores of students in the experimental and control groups in favour of the experimental group.

Research Hypothesis 2

There is no significant interaction between teaching methods and gender on students' mean interest scores in bearing.

Table 4 shows the results for this research hypothesis.

Table 4: Two-way ANCOVA Results on Mean Interest Scores of Experimental and Control Groups due to Gender

Source of variation	Sum of squares	df	Mean squares	F	Sig	Decision
Corrected model	11.298	3	3.768	9.556	0.000	
Intercept	3001.344	1	3001.344	7617.624	0.000	
Method	2.189	1	2.189	0.480	5.556	S
Gender	0.900	1	0.900	2.284	0.067	NS
Method * gender	0.358	1	0.358	0.908	0.342	NS
Error	109.926	279	0.394			
Total	4283.000	283				
Corrected total	156.331	281				

Table 4 shows the results for sex and interaction (method * Gender). For gender, the F-calculated value of 2.284 was found significant at 0.067 using SPSS statistical software. This means that there is no significant difference between the mean scores of male and female students. For interaction, the F-calculated value (0.908) was found significant at 0.342 which is greater than the 0.05 level set for this study. Hence, the null hypothesis is not rejected. This means that there is no significant difference between the mean interest scores of male and female students in the experimental and control groups.

Discussion

Table 3 shows that there is a significant difference between the mean interest scores of students in the experimental and control groups in favour of the experimental group. Table 1 shows that the mean interest scores of experimental and control groups are 88.12 (SD=11.06) and 35.81 (SD=16.24). This means that the use of Polya's problem solving strategy in teaching mathematics enhanced students' interest better than the use of the expository method. It is a known fact that once students have high interest in mathematics, they will definitely achieve better. The four-stage process of solving any mathematical problem using Polya's problem solving strategy may have developed high interest in students taught with the technique. This finding is in agreement with the findings of Alio and Harbor-Peters (2000) and Annie (2013).

Table 4 shows that there is no significant difference between the mean interest scores of male and female students in experimental and control groups. This shows that Polya's problem solving strategy had equal effect on male and female student's interest in mathematics. In other words, the strategy is capable of causing both male and female students to increase their interest in mathematics. This finding agrees with the findings of Ale and Adetula (2005) and Ameen (2013)

that problem solving models in mathematics enhance the interest of male and female students in mathematics.

Conclusion

The findings of the study show that Polya'sproblem solving strategy can arouse students' interest in mathematics. Again, male and female students benefit equally when taught mathematics using Polya problem solving strategy.

Recommendations

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

i The state ministry of education or its agency should organize seminars/workshops for secondary school mathematics teachers on how to use the Polya's problem solving strategy.

ii Curriculum planners should include the Polya's problem solving strategy in secondary school mathematics curriculum.

iii Tertiary institutions for teacher's preparation should include the Polya's problem solving strategy in their curriculum with a view to teaching students how to use the strategy in teaching mathematics.

iv Authors of secondary school mathematics textbooks should use the Polya's problem solving strategy in solving some problems in their textbooks.

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