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Effect of Polya's Problem-Solving Approach on Upper Basic Education Students' Attitude towards Algebra in Makurdi Metropolis, Benue State, Nigeria

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Abstract

The study investigates the effect of Polya's problem-solving approach on Upper Basic Education students' attitude towards Algebra in Makurdi Metropolis, Benue State, Nigeria. Two research questions and two null hypotheses guided the study. The study adopted quasi-experimental design specifically non-randomized, pretest posttest control group design. The target population for this study was 4,843 (2,227 male and 2,616 female) Upper Basic two students in Makurdi Metropolis of Benue State. A sample size of 125 Upper Basic Education two students was selected for this study. The instrument for data collection was Algebraic Attitude Scale Questionnaire (AASQ) developed by the researchers for data collection. The data collected was subjected to a reliability test using Cronbach Alpha. The reliability value yielded 0.89 indicating that the instrument is reliable. The data collected were analyzed using mean and standard deviation to answer research questions and ANCOVA to test the null hypotheses at 0.05 level of significance.

The findings revealed that there is significant difference in the mean attitude ratings scores and difference in the mean attitude ratings of male and female students taught Algebra using Polya's problem solving approach and those taught using conventional method in faour of Polya's problem solving approach. The study recommends among others that teachers of mathematics should employ Polya's problem-solving approach in mathematics class to ensure effective teaching and learning so as to improve students' attitude towards algebra irrespective of gender.

Keywords: Mathematics, Polya's Problem-Solving Approach, Upper Basic Education, Attitude, Gender

Introduction

Education is essentially concerned with the growth and development of people throughout life. It is the bedrock upon which development revolves, and it is an invaluable tool for human growth and development. This development can be achieved only when individuals are equipped with essential knowledge, skills and attitudes for survival and societal progress. Thus, to achieve this goal, the knowledge of mathematics is essentially needed because mathematics trains the mind and fosters creative thinking in people in order to solve problems that often occur in everyday situations. Chinweoke (2015) provides support for this view when he stated that the importance of mathematics in the scientific, technological and economic development of any nation has made its teaching and learning at all levels very important. The author stated further that mathematics is not only considered important in its own right as a field of study and research, but also essential to almost every field of endeavour.

Similarly, Adetunde (2014) notes that mathematics forms the foundation of a solid education adding that the overall national development of any nation and the building of healthy, happy and prosperous nation cannot be successfully achieved without mathematics. The objectives of teaching Mathematics in secondary schools make it very important as a foundation subject for success in further academic endeavour and manpower development. The learning of mathematics in schools represents the basic preparation for adult life and also a gateway to a vast array of career choices. In this respect, Iji as cited in Musa (2014) maintains that any country that aspires for national growth in science, industries, and technology must not neglect mathematics. Therefore, the position of mathematics in our national curriculum, and its role towards technological and industrial development put it in compulsory position in primary and secondary levels of education. Despite the importance accorded mathematics in the educational system of Nigeria, many secondary school students still hate the subject. This dislike for mathematics may be attributed to the students' attitude, gender differences, teachers' personality and the method of teaching the subject especially in the area of problem solving.

From the 20th century to today, problem solving has never lost its importance in the teaching-learning process. Problem solving is the cornerstone of school mathematics. The main reason for learning mathematics is to be able to solve problems. Mathematics is a powerful tool that can be used to solve a vast variety of problems in technology, science, business and finance, medicine, and daily life. It is strongly believed that the most efficient

way for learning mathematics concepts is through problem solving. Many students believe that school is about learning basic skills. In reality, most courses require students to think through problems presented and give thoughtful answers. In mathematics, problem-solving skills help students apply principles to scenarios that are found in the real-life situations. In the same vein, the National Policy on Education (NPE) (2020) stresses the need for government to popularize the study of sciences and the production of adequate number of scientists to inspire and support national development.

The policy also indicates that the teaching of problem solving in the classroom is very essential in order to prepare the students for problem solving challenges outside the four walls of the classroom. The art of problem solving is the heart of mathematics. Hence, mathematics instruction should be designed to enable students appreciate mathematics as an instrument of problem solving. Mathematics problem solving is seen as a complex process that often threatens both the teachers and students. This implies that if the goals of education are to be achieved, problem solving skills and competencies of students in handling mathematics problem solving may be built or enhanced right from the Upper Basic school level by exposing them to Polya's problem solving approach. National Council for Teachers of Mathematics (NCTM) in Safiya (2018) describes problem solving based teaching as using interesting and well selected problems to teach mathematical lesson and engage students. Good problems can inspire the exploration of important mathematical concepts, nurture persistence, and reinforce the need to understand and use various skills, mathematical properties and relationship. This may be enhanced through the application of Polya's problem solving model which may boost the students' ability in solving problems in mathematics.

In 1945, Polya developed a framework for problem-solving that breaks down solutions to problem into four distinguishable steps and highlighted the use of process in solving problems rather than focusing on getting only the solution. In the process of solving a problem, teacher guides the students to break the problem down, creatively and mindfully approach each step of the problem toward the desired solution. The four-step process includes understanding the problem, devising a plan, carrying out the plan and look back. The first step is the understanding of the problem. This step requires the teacher to provide guidance to students to read carefully through the problem several times to obtain all the important information and ascertain exactly what the problem asked them to find, and then leads them to define terms and identify extraneous information and concentrate on certain basic elements of the problem. With the help of the teacher, students can make sketch or draw diagram, where necessary, to show connections and relationships and look for similarities with previous problems. Having read the problem and know what the students want to find, the teacher then leads them to make a plan by using the relevant information obtained from the first stage. During this stage, teacher encourages students to think about mathematical strategies and skills they have used previously in solving similar problems that could be helpful in solving the problem. At the third stage, carrying out the plan, the teacher asks the students to execute the plan made in the second stage. This involves them in computing and in explaining their procedure until the solution is obtained. At the final stage, look back, the students with the help of the

teacher, reflect back to see whether the problem has been correctly solved. These four stages are linked in a cyclical process.

Through an emphasis on effective instructional models such as the Polya's problem solving model, students can develop positive attitude and improve their performance of what they have learned by engaging in significant activities. The likely way to reduce the difficulty associated to learning Algebra by Basic school students is by teaching it in a systematic and step by step manner. According to Abari and Durodola (2022), the Polya model gives the learners the opportunity to actively participate in the processes involved in solving problems with an opportunity for feedback. This model depicts a complete cycle where looking back reflects on the feedbacks and another cycle is initiated until the problem is sufficiently resolved. The basic role of the teacher in this regard is to ensure that students participate actively in the learning process.

Students understand mathematical concepts and have higher performance when they actively participate in the lesson. Teachers should move away from "telling method" and select models that promote active learning in the classroom. One of the major roles of mathematics teacher is to teach mathematics effectively for their students to understand and perform maximally and at the end prove that they have learnt what their teachers has taught them. It is important to involve the students while developing mathematical concepts as students need to participate actively in learning process. Above all, teachers should provide opportunities for their students to think for themselves, so that learning for them is an active and creative process. The most important aspect of learning mathematics is to train a sort of individual who can be self-confident, curious, creative, critical thinking, innovative, and problem-solving ability.

The researcher has chosen Polya's approach among other approaches of problem solving because in the WAEC Chief Examiners' report (2021), the candidates that responded to the Algebraic question did poorly; most of them did the substitution correctly but could not find the common denominator to help them to do the simplification to come out with the correct answer. This may be because the candidates were not taught Algebra using the approach that will enable them evaluate themselves as provided by Polya which may have resulted to their poor achievement. Moreover, the approach will be used in this study because according to Aljaberi (2015), all recommendations and strategies in studies that deal with problem solving in mathematics are editable and can be accommodated one way or another to fit the Polya's approach. Many stakeholders such as the mathematics educators, researchers, governments, parents and the like have expressed their concern about students' poor attitude towards mathematics when the appropriate approach/model is not adopted in the learning process.

Attitudes are affective variable of paramount importance for the well-being of the individuals and the society. Individual have to acquire the right types of attitudes towards self, work, other people and object. There has always been an interest in the development of positive students' attitude towards mathematics. Atkinson, Atkinson and Hilgard as cited in Nasiru (2019) defines attitudes as, "likes and dislikes; affinities for and aversion to situations, objects, persons, groups; and other identifiable aspect of the environment, including abstract ideas and social policies." Thus, attitudes can simply be described as

expressions of one's taste and distaste about entities in the social world. Attitudes have been noted to be closely related to cognitive, behavioural and affective components which relate to beliefs, actions, and likes and dislikes respectively. The objectives of teaching and learning mathematics include fostering favorable feelings towards mathematics as well as imparting cognitive knowledge.

Attitude is a feeling that is either positive or negative and is exclusively dependent upon three components: Cognitive, Affective (emotional) and Psychomotor components. The cognitive component relates to people's beliefs; the affective component defines what a person likes or dislikes; and the psychomotor component refers to persons' tendencies to act towards these things in different ways. Notwithstanding, categorizing attitude into separate cognitive, affective and psychomotor characteristics does not mean that one component is not needed for attaining the other components. This indicates that the cognitive, affective and psychomotor responses are indeed interactive and interdependent. Attitudes are a state of readiness, a tendency to act or react in a certain way. More generally, attitudes are a learned disposition or tendency on the part of individual to respond positively or negatively to a situation or another person. Therefore, to develop the right type of attitude, teachers need to use variety of suitable techniques and procedures to arouse and maintain students' interest in mathematics in general and Algebraic problems in particular. In an excellent discussion of the principles of meaningful learning, Sidhu (2016) notes that failure to adopt appropriate methods of teaching would inevitably bring about setback in creating and maintaining among others motivation, proper attitude, interest, attention among students for achieving higher learning outcomes. Olarewaju and Popoola (2009) noted that through problem solving, students developed positive attitude and construct knowledge for themselves rather than simply receive knowledge from the instructor(s). Thus, to help students create positive attitude, it is desirable to structure lessons such that students become actively involved with content through manipulation of materials and social interactions requires an effective instructional model which will contribute immensely to students' understanding of Algebra.

Algebra (from Arabic "al- jabr" meaning "re-union of broken parts") is one of the broad parts of mathematics. Algebra is the study of mathematical symbols and the rules for manipulating these symbols. These letters are used as mathematical objects in problem solving which makes it difficult for students to understand what these objects represent and how they can be related to realistic situations. Algebra is a branch of mathematics most people who have gone through secondary school would have studied at some stage. It introduces symbols (such as x, y, z) and a series of mathematical operation like factorization, expansion and so on. It can be studied from a very elementary level (like addition and simplification of Algebraic fractions, solving simple linear and simultaneous linear equations up to the university levels and beyond. Algebra is a branch of mathematics upon which all other branches of mathematics are based. Without a doubt, algebra content encompasses the biggest portion of mathematics. The Common Core State Standards (CCSS) in Christopher (2015) identifies the following areas as what should be targeted in Algebra I: Using exponents and rational exponents; rational and irrational numbers; reasoning quantitatively; interpreting and writing linear, exponential, and quadratic expressions; performing arithmetic operations on polynomials; creating equations that

describe numbers and relationships; understanding and reasoning with equations; solving equations and inequalities with one variable; graphing and solving equations; understanding the concept of a function; interpreting and analyzing functions; and constructing and comparing linear, quadratic, and exponential models. This subject encompasses a wide range of topics, all of which engage the learner in critical thinking during problem solving.

Simultaneous linear equation is one of the several topics in Algebra that help students engage in critical thinking and model real-life situations. It is used to describe relationships between variables, for example, the relationship between distance, rate and time; length and width; principal, rate and time; plane, cost and demand; number of people engage in a job and number of days taken to complete the job. In spite of the numerous applications, research has shown that many students encounter difficulties in word problems involving simultaneous linear equations in two variables by substitution and elimination methods (Widyastuti, Mardiyana & Saputro, 2016). Therefore, to teach mathematics effectively, the teacher needs to employ teaching models that will engage students in significant activities in the class to make the subject more meaningful and understandable for the students. This will enable them to learn more and apply what is learned. In response to the deplorable situation, Agwagwah (2013) suggests that problem solving skills should be used in teaching mathematics to improve students' attitude and performance in knowledge and skills irrespective of gender.

Gender is a socio-cultural construct of ascribing some characteristics and roles to sex such as male and female with in a society. Gender as a variable is viewed by Achor, Kyado and Ityobee (2020) as having much impact on both teachers and students in the teaching and learning processes. Gender issue according to Ajayi, Achor and Otor (2020), refers to a term used to differentiate between males and females in terms of the position they occupy, the role they play and the social status they have. Gender inequality in education in general has remained a challenge globally, especially in Sub-Sahara Africa. In Nigeria, the issue of gender and gender stereotyping permeates every aspect of human endeavour including education. Okeke (2013) asserts that culture have strong influence on gender to produce sex role-stereotypes which cut across social, economic, political and educational developments especially in the areas of Science and Technology. In Most African and Asian societies, males and females differ in the activities they undertake, in access to and control of resources, and in participation in decision-making. In most societies, females have less access than men to resources, opportunities and decision-making (Abdul-Raheem, 2012).

Ehinola (2014) opines that there is gender stereotype arising from the perceived notion in societies which assigns to men the traits which supports hegemony. Thus, males are seen as more decisive, aggressive, logical and ambiguous than females. This is more obvious in societies like Nigeria where sciences are erroneously viewed as masculine and arts subjects as feminine (Onoh, 2018). Gender is a relevant issue in the society since social expectations prescribe how male and females think, act and feel differ (Jirgba, Eriba & Achor, 2018). Gender difference in science has generated debatable issues. Various studies have found that male dominate their female counterparts in performance (Okoro; Iweka,

2016; Kur & Amua, 2018), while authors like Okeke (2013) and Oludipe (2017) support the assertion that both male and females can achieve equally in science when given equal opportunities and facilities. Furthermore, Goswami and Dutta (2016) noted that gender acts as an influencing factor in technology adoption as male are more technologically skillful compared to females in public and private institutions of learning. Junaid and Ayinde (2018) thus observe that males and females show great differences in their interest and career choice.

These differences may be attributed to the psychological differences and cultural influences. Even parents generally encourage their daughters to opt for professions not masculine in nature. Ali, Tela and Saleh (2020) observes that local customs, values have been developing in girls, and they are so deeply ingrained that some of them find it difficult to cope in areas that are believed to be male dominated professions. Zember and Blume (2011) reports that, many comparisons show average scores of boys and girls to be the same on general intelligence test. The author said that, girls do a little better on most verbal tests and on tests involving rote memory than boys. Gender issues therefore remain unresolved as findings from some studies on gender have shown contradicting evidence in the attitude of students. So, there is the need to evaluate its effect on students' attitude in Algebra at the Basic School Level. It is against this background that this study therefore, examines the effect of Polya's problem solving approach on Upper Basic Education students' attitude towards Algebra in Makurdi Metropolis, Benue State, Nigeria.

Statement of the Problem

There are many sub-topics in Mathematics such as geometry, mensuration, statistics, and algebra amongst others in the Basic Education levels in Nigeria. The teaching of these topics in Mathematics at the Upper Basic level seems to have been dominated by conventional approach. In essence, conventional approach seems to be more convenient to most teachers, and as such, they are routinely used in teaching and learning Mathematics more than other approaches. The routine use of the conventional approach in teaching of Mathematics at the Upper Basic level may be the reason for the manifestation of the negative attitude in Mathematics by Nigeria students. Nonetheless, the Upper Basic Mathematics curriculum emphasizes the use of participatory and interactive strategies for teaching and learning. However, the most popular method of teaching adopted in teaching is the conventional method. Irrespective of the associated advantages of conventional method, it cannot be said to be comprehensive and adequate enough to take care of all the problems and exigencies of Mathematics classroom demand. This is particularly so in the teaching of Algebra as a sub-topic, the gender of the learners notwithstanding. Gender is another factor that could affect the attitude of students in concepts in Algebra. There is no consensus on the controversies on gender issues, which justifies its inclusion as a possible intervening variable in this study. The problem of this study therefore, is; what is the effect of Polya's problem solving approach on Upper Basic Education students' attitude towards Algebra in Makurdi Metropolis, Benue State, Nigeria?

Objectives of the Study

The main objective of this study is to investigate the effect of Polya's problem solving approach on Upper Basic Education students' attitude towards Algebra in Makurdi Metropolis, Benue State, Nigeria. Specifically, the objectives of this study are to:

i. Determine the effect of Polya's problem solving approach on the attitude of the Upper Basic Education students towards algebra.
ii. Determine the effect of Polya's problem solving approach on the attitude of male and female Upper Basic Education students towards algebra.

Research Questions

The following research questions were asked to guide the study:

i. What is the difference in the mean attitude rating of Upper Basic Education students taught algebra using Polya's problem solving approach and those taught without using the approach?
ii. What is the difference in the mean attitude rating of male and female Upper Basic Education students taught algebra using Polya's problem solving approach?

Statement of Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

i. There is no significant difference in the mean attitude rating of Upper Basic Education students taught algebra using Polya's problem solving approach and those taught without using the approach.
ii. There is no significant difference in the mean attitude rating of male and female Upper Basic Education students taught algebra using Polya's problem solving approach.

Methodology

The study employed quasi-experimental design. Specifically, the pretest posttest non-randomized control group design was adopted. This design is considered appropriate because it is a useful tool in a situation where true experimentation cannot be used for ethical or practical reasons as it has better external validity. Quasi-experimental design involves establishing cause and effect relationship. Another reason for the choice of the design is that due to some administrative constraints like restructuring of students in the class, distortion of school time-table among others in the school, intact classes were used for the study.

The target population for this study was 4,843 (2,227 male and 2,616 female) Upper Basic two Mathematics students in Makurdi Metropolis of Benue State in the 2022/2023 academic session (State Universal Basic Education Board, 2023). The sample size of this study was 125 upper basic two students from the study area. The sample size represents the number of students that are in the intact classes of the sampled schools.

The instrument for data collection is Algebraic Attitude Scale Questionnaire (AASQ). The Algebraic Attitude Scale was a four-point rating scale measuring the attitude level of students in Algebra. The instrument was divided into section A and B. Section A addresses bio-data information like name of school and gender of the respondents. Section B was made up of 30 items to which students were expected to tick the option that best suit their level of interest. The response options ranges from strongly agree (4 points), agree (3 points), disagree (2 points), strongly disagree (1 point) and in reverse order for negative items. Mean scores and standard deviation were used for answering the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of confidence. The choice of ANCOVA is due to the fact that it provides statistical control of the differential in the criterion scores attributed to covariate; that is, if experimental control of the covariate is not done.

Results

Research Question One

What is the difference in the mean attitude ratings of Upper Basic Education students taught algebra using Polya's problem solving approach and those taught using conventional method?

Table 1: Mean Attitude Ratings of Students taught Algebra Using Polya's problem solving approach and Conventional Method

Instructional strategy	Pre			Post			Mean gain
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	
Polya's problem solving approach	65	1.63	1.54	65	3.77	0.69	2.14
Conventional	60	1.47	0.75	60	1.60	0.39	0.13
Mean difference		0.16			2.17		2.01

Table 1 shows the mean attitude ratings of students taught algebra using Polya's problem solving approach and those taught using conventional method. The table shows that 65 students were taught using Polya's problem solving approach while 60 students were taught using conventional method. The table further revealed that the mean attitude ratings of students taught using Polya's problem solving approach is 1.63 with a standard deviation of 1.54 during pre-test and 3.77 with a standard deviation of 0.69 in posttest. While the mean attitude ratings of students taught using conventional method is 1.47 with a standard deviation of 0.75 during pre-test and 1.60 with a standard deviation of 0.39 in posttest. The table further shows that the mean gain for Polya's problem solving approach is 2.14 and conventional method is 0.13. The difference in the mean attitude ratings of students taught Algebra using Polya's problem solving approach and those taught using conventional method is 2.01 in favour of students taught algebra using Polya's problem solving approach.

Research Question Two

What is the difference in the mean attitude ratings of male and female students taught algebra using Polya's problem solving approach?

Table 2: Mean Attitude Ratings of Male and Female Students Taught Algebra Using Polya's problem solving approach.

Gender	Pre			Post			Mean gain
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	
Male	28	1.28	0.98	28	3.83	0.12	2.55
Female	37	1.13	0.60	37	3.74	0.51	2.61
Mean difference		0.15			0.09		0.06

Table 2 shows the difference in the mean attitude ratings of male and female students taught algebra using Polya's problem solving approach. The table shows that 28 male students and 37 female students were taught algebra using Polya's problem solving approach. The table reveals that the mean attitude rating scores of male students taught Algebra using Polya's problem solving approach is 1.28 with a standard deviation of 0.98 during pre-test and 3.83 with a standard deviation of 0.12 in posttest.

The mean attitude rating scores of female students taught Algebra using Polya's problem solving approach is 1.13 with a standard deviation of 0.60 during pre-test and 3.74 with a standard deviation of 0.51 in posttest. Table 2 further shows that the mean gain of male students that were taught Algebra using Polya's problem solving approach is 2.55 and those of female students taught Algebra using Polya's problem solving approach is 2.61 with a mean gain of 0.06 in favour of the female students.

Research Hypothesis One

There is no significant difference in the mean attitude ratings of Upper Basic Education students taught Algebra using Polya's problem solving approach and those taught using conventional method.

Table 3: ANCOVA of Mean Attitude Ratings of Students Taught Algebra Using Polya's problem solving approach and Conventional Method

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	221.718[a]	2	110.859	5.648	.005	.085
Intercept	38895.637	1	38895.637	1981.493	.000	.942
PRETEST	59.601	1	59.601	3.036	.084	.024
GROUP	**146.012**	**1**	**146.012**	**7.438**	**.007**	**.057**
Error	2394.794	122	19.629			
Total	263084.000	125				
Corrected Total	2616.512	124				

a. R Squared = .085 (Adjusted R Squared = .070)

Table 3 reveals that F (1, 124) = 7.438; p = 0.007 < 0.05. Since p-value is less than 0.05 level of significance, the null hypothesis is rejected. This shows that there is a significant difference in the mean attitude ratings of students taught algebra using Polya's problem solving approach and those taught using conventional method. This implies that students taught Algebra using Polya's problem-solving approach have a better attitude towards Algebra than those taught using the conventional method.

Research Hypothesis Two

There is no significant difference in the mean attitude ratings of male and female Upper Basic Education students taught algebra using Polya's problem solving approach

Table 4: ANCOVA of mean attitude ratings of male and female students taught Algebra using Polya's problem solving approach.

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	733.116[a]	2	366.558	9.979	.000	.244
Intercept	15897.095	1	15897.095	432.793	.000	.875
PRETEST	76.411	1	76.411	2.080	.154	.032
GENDER	**707.800**	**1**	**707.800**	**19.270**	**.000**	**.237**
Error	2277.346	62	36.731			
Total	127972.000	65				
Corrected Total	3010.462	64				

a. R Squared = .244 (Adjusted R Squared = .219)

Table 7 reveals that F(1,64) =19.270; p = 0.000 < 0.05. Since p-value is lesser than 0.05 level of significance, the null hypothesis is rejected. This shows that there is difference in the mean attitude rating of male and female Upper Basic Education students taught algebra using Polya's problem solving approach.

Discussion

Result from Table 1 revealed that there is difference in the mean attitude ratings of students taught Algebra using Polya's problem solving approach and those taught using conventional method in favour of students taught algebra using Polya's problem solving approach. This is further supported by table 3 which shows that there is a significant difference in the mean attitude ratings of students taught algebra using Polya's problem solving approach and those taught using conventional method also in favour of Polya's problem solving approach. This implies that students taught Algebra using Polya's problem-solving approach have a better attitude towards Algebra than those taught using the conventional method. This finding corroborates with Albay (2015) who found out that the utilization of the problem-solving approach in the delivery of instruction in College

Algebra had positively contributed to the development and reinforcement of a favorable attitude towards the subject.

Result from Table 2 revealed that there is difference in the mean attitude ratings of male and female students taught algebra using Polya's problem solving approach. The table further shows that the mean gain of male students that were taught Algebra using Polya's problem solving approach is lower than those of female students taught Algebra using Polya's problem solving approach in favour of the female students. Table 4 further shows that there is difference in the mean attitude rating of male and female Upper Basic Education students taught algebra using Polya's problem solving approach though not significant. This finding agrees with Rosemary and Anthony (2019) whose findings indicated difference in the performance of male and female students taught simple linear equation in one variable using Polya's problem solving model.

Conclusion

The main objective of this study was to investigate the investigated the effect of Polya's problem solving approach on Upper Basic Education students' attitude towards algebra in Makurdi Metropolis, Benue State, Nigeria. Specifically, it focused on the algebraic problems using Upper Basic Education Two (JSS II) students. A pretest and posttest quasi-experimental design were used and the data collected from the field were subjected to statistical test based on the objectives, research questions and hypotheses formulated.

The descriptive and inferential statistics were used in the data analysis. Therefore, the findings of the study showed that:

i. Students taught algebra using Polya's problem solving approach had better attitude than those taught using conventional method.
ii. Students taught algebra using Polya's problem solving approach had better mean attitude rating irrespective of gender.

Recommendations

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

i. Teachers from State Universal Basic Education Board (SUBEB) should adopt Polya's problem solving approach in teaching Algebra at the Upper Basic Education level in Benue State. This will assist teachers to improve their skills and methodologies in teaching algebra.
ii. Mathematics teachers should expose students sufficiently to algebraic expressions and word Problems using Polya's problem solving approach.
iii. Teachers of mathematics should teach word problems that relate to students' real-life situations or practical events to enhance their understanding and meaningful interpretation for successful problem solving.
iv. Workshops and seminars should be organized by government on Polya's problem solving approach for acquisition of problem-solving skills and knowledge for teachers at all levels of education in Nigeria. This will enable

teachers assist students to become proficient in solving word problems in mathematics in general and algebra in particular.

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