

Attitude of Students towards Solving Problems in Algebra: A Review of Nigeria Secondary Schools

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Abstract: Solving problems in algebra depicts the ability of students to be able to understand, plan, execute the plan in any given routine and non-routine algebraic problems. Algebra as one of the most important aspect of mathematics is very fundamental for success in secondary school mathematics. This paper discuss attitude of secondary school students towards solving algebraic problems. It is recommended that these negative attitude needs to be overcome, so that later in life these students will not suffer lack of algebraic problem solving skills which is very important and fundamental in their future employment success and everyday life.

Keywords: Attitude, Solving Problems, Algebra, Secondary Schools

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I. Introduction

Mathematics is a very fundamental subject in the education system of every country in the world. Mathematics is known as one of the gate keepers for success in all fields of life. It is its importance that makes it a mandatory subject in the education system of Nigeria at both primary (basic) and secondary school levels. Adeniji and Salman, (2016) describe it as the backbone of science and technology and a tool inevitable for human survival in everyday life. Phonapichat, Wongwanich and Sujiva, (2014) opined that mathematics is an instrument that can be applied to train students to be able to solve problems, and also to build their thinking ability that leads to further solving of non-mathematical problems. Mathematics both in the world and Nigeria, has many branches which mainly include simultaneous equation, arithmetic, analysis, quadratic equation, combinatory, Euclidean and non-Euclidean geometries, game theory, number theory, numerical analysis, optimization, probability, set theory, statistics, topology, construction, small and great circles, trigonometry, mensuration number and numeration, geometry and algebra. Algebra as one of the major branches of pure mathematics concerns itself with the study of the rules of operations, relations, constructions, and the concepts arising from them, including terms, polynomials, equations, and algebraic structures (Morris, 2009).

Algebra according to Usman and Musa, (2015) is an aspect of mathematics which involves the use of letter and numbers. These letters combine with figures bring a lot of confusion to the students more so, with the letters changing values or one letter replacing another letter at intervals. Although, algebra is considered as one of the most important aspect of school mathematics; it does not only play an important role in mathematics but function as a gatekeeper to future educational and employment opportunities (Silver, 1997). For students to understand and possess the mathematical skills of problem solving, communication, reasoning and making connections that are necessary in human daily living they need algebra. . This is so, because algebra is the language through which most of the mathematics is communicated (Iji, Abakpa & Takor, 2015). Ebras, (2004) opined that without algebra advancement into most aspect of mathematics the study of other discipline requiring mathematical abstraction and modelling will suffer loss of relevance. Thus, knowledge of algebraic concepts and skills are considered as providing a foundation for developing higher order thinking as well as providing needed problem solving skills in real life situations among learners. All mentioned aspect of mathematics involves the application of problem solving skills.

Problem solving according to Mayer & Wittrock, (2006) is a cognitive process directed at achieving a goal when no solution method is obvious to the problem solver. Furthermore, Problem solving is a component of mathematics that is refers as a goal directed sequence of cognitive, affective and conative operations geared towards finding the unknown for bridging the gap between the present and a goal state (James & Adewale, 2015). National Council of Teachers of Mathematics (2012) postulate that, the sole aim of mathematics teaching is to equipped students to solve daily live problems. Problem solving has been observed to be one of the principal causes of scholastic failure in areas of science such as mathematics, chemistry and physics (James & Adewale, 2015). This is so because pupils do not learn how to solve problems but merely memorize solutions explained by teachers in line with the traditional method of teaching. Problem solving transcends all scientific

disciplines and it constitutes an integral part of mathematics programs at all level of studies, almost everything that an individual does involves problem solving which is directed toward achieving a goal. Thus, the key anticipation of teaching and learning of mathematics subject is for the development of problem solving skills.

Attitude is vital for human existence, it is the feelings individuals have towards a particular object, events, phenomenon, people or places. Attitude of a person to an object, place, event or another determines their relation to such object, phenomenon, event or people at different point in time (Memnun & Akkaya, 2012; Anwer, Iqbal, & Harrison, 2012). Attitude based on the words of Ubom, (2001) refers to an individuals' perception and reaction to a task, which is expected to be carried out or executed in a group, institution, school setting or an organization. Research studies have indicated that students attitude towards solving algebraic problems are very much correlated to their attitude towards problem solving in general (Effandi & Normah, 2009; Tezer & Karasel, 2010; Bala & Shaafiu, 2016; Lai, Zhu, Chen, & Li, 2015).

II. Conceptual Clarification

It is important to give the clarification of the concept under study in the context of the study. Attitude is a concept that is concerned with an individuals' way of thinking, acting, and behaving (Dalha, 2015). According to Mcleod, (2014) attitude is a relatively enduring organization of beliefs, feelings and behavioural tendencies towards socially significant objects, groups, events or symbols. Attitude is a hypothetical construct that represents an individuals' likes or dislikes. Furthermore, Rosemund (2006), views attitude as favourable or unfavourable evaluative reaction towards something, events and programs exhibited in an individuals' beliefs, feelings, emotions or intended behaviours. Algebra is a gatekeeper and language of higher level math and science, it a prerequisite for courses such as calculus, chemistry, and physics. As such attitude towards solving algebraic problems are likes and dislikes, feelings of wanting to participate or avoid solving problems in algebra and the beliefs that students have in the importance of solving algebraic problems to them and their future endeavor. However, the liking, favouring, agreeing or otherwise responses of students towards problem solving defines their attitude towards solving algebraic problem. According to Brian (2010), algebra is the branch of mathematics which is concerned with structure, relation, and quantity.

III. Components Of Attitude

Research suggests that attitude has three dimensions. It comprises of affective, behavioural and cognitive component (Maio & Haddock, 2010). Furthermore, According to Multicomponent model of Attitude by (Eagly & Chaiken, 1993), attitudes are influenced by three components. They are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioural information (past events, and present experiences) (Maio, & Haddock, 2010). The affective component denotes feelings or emotions about one's attitude towards an object, person, event or place, The behavioural (operational) component of attitude is the tendency to respond in a certain way to the attitude object, place, event or another person and the cognitive component of attitude is what the individual thinks or believes about an object, event place or another person. Attitudes in an individuals may be simple or complex, stable or unstable, implicit or explicit, temporary or permanent, and superficial or fundamental. It is best expressed when an individual makes statement about his/her feelings or opinions about certain objects, issues or things.

IV. Attitudes Towards Solving Algebraic Problems

In an attempt to unravel the attitudes of students towards solving algebraic problems many scholars have conducted different studies. For instance, Tolar, (2007) opined that many students lack proficiency in algebra as a result they commit a lot of errors in trying to solve algebraic problems and this limits their access to educational and economic opportunities. Furthermore, a survey conducted in the Maldives in 2012 and 2013 showed that student performance in algebra is the lowest compared to any other area of mathematics (UNICEF & NIE, 2014) as a result of this they lacked algebraic knowledge, which is believed to be caused by their poor attitude towards solving algebraic problems. Similarly, studies conducted in Nigeria, reveals that problem solving in algebra is the chief cause of failure in mathematics as a result leads to students having a negative attitude towards solving algebraic problems (Adeleke, 2007; Egodawatte, 2011; Banerjee & Subramaniam, 2012; James & Adewale, 2015), and this has been found to be so because students don't normally learn how to solve problem but just memorize solution that has been explained by teachers in the same way with the traditional methods of teaching. It has also led to a scenario where the powers of thinking and understanding are not developed in Nigeria secondary school students.

Salman, Yahaya and Adewara, (2011) reported that Nigerian students have negative attitude towards solving algebraic problems, which they buttress could be attributed to the negative attitude of Nigeria students to mathematics which is considered to be a difficult and abstract subject (Ajai et al., 2013). However a great majority of students believe that solving algebraic problems is for a selected few (Okafor & Anaduaka, 2013) as such it is left for the few selected ones. Moseley & Brenner, (2009) postulates that most students normally get

confused when they are confronted with algebraic problems to solve such as using a variable to represent an unknown quantity, also students often get confused about how to interpret equations that are now comprised of letters and number sitting side by side. Many secondary school students find difficult to learn algebra (Martin, 2000; Brain, 2010; Anthony et al, 2012). These students due to the difficulties they encounter in solving algebraic problems has resulted to so many of them developing negative attitudes towards solving any algebraic problems. Mathematics is a very important subject and adequate performance in it is usually considered fundamental to school success, and algebra remains a core branch of mathematics (Anthony et al., 2012).

Quite a number of literature have been published on attitudes of students in relation to their problem solving ability in mathematics (Effandi&Normah, 2009; Kandemir&Gür, 2009; Mapolelo, 1998). In education generally, attitude is a vital element which determine students' success. According to Cetingöz and Özkal (2009) attitudes affect how students' interact with people around them like, friends, families, class mates and even lessons. Therefore, students' attitude towards solving algebraic problems will add to their success or otherwise. Effandi&Normah (2009) add that negative attitudes need to be overcome, so that later in life, students will not suffer from poor problem-solving skills. Therefore, it implies that students must have positive attitude towards solving algebraic problem if they are to succeed (O'Connell, 2000).

Furthermore, Martin (2000) in a research he conducted, had also observed that even when some students managed to perform well in other aspects of mathematics, they always performed poorly in algebra. It becomes then understandable why in some other studies earlier conducted indicated that large numbers of students require remedial assistance, especially in algebra, since many of them experience learning difficulty in it. Brian (2010) maintained that algebra, which is a major branch of mathematics, is important for the cognitive, critical, and analytical skills of the brain. It sharpens the critical thinking skills of the students and enables them to solve real life problems logically as well. Also, studying algebra creates mental discipline. It teaches people to think and reach solutions to various problems in a well-structured and logical way. Furthermore, it helps students to learn how to sustain reflection. Yet, many Nigerian secondary school students are observed to have problems with mathematics, especially in the area of algebra (Amoo, 2001).

Attitudes towards solving algebraic problems include enjoying, liking and having interest in algebraic problems, or the opposite (Sunzuma et al., 2013). This implies that students must like algebra, enjoy the activities performed in it and also have interest at heart for algebraic problems. On the other hand, attitudes play an important role on students' algebraic achievement. Those who lack confidence in solving algebraic problems envision a low grade before they begin an examination (Pajares, 2002).

V. Causes of Negative Attitudes towards Solving Algebraic Problems

Pre-Conceived Ideas from Personal Experiences: Majority of these students have a pre-conceived ideas about what algebraic equations are supposed to represent, and often base their interpretations on these experiences, falsely assuming that all algebraic equations and its symbolic notations used are related. Kirshner and Awtry (2004) give evidence that students' working with algebraic expressions often respond spontaneously to familiarity with visual notational patterns when making decisions instead of relying on mathematical rules. Students' often do not reason about an overall goal or the concepts involved in a problem, but instead look for an implied procedure inherent in the equations and directly apply it (Peter &Olaoye, 2013). Furthermore, Algebraic equations usually in letter form is seen as representing a range of unspecified values and a systematic relationship is seen to exist between two such sets of values. However, these equations are what often cause a great confusion for students (Peter &Olaoye, 2013; NCTM, 2000).

Teachers Lack of In-depth Content Knowledge of Algebra

Teachers who introduce algebra to students are responsible for helping students build a solid foundation on which these students later construct a more sophisticated algebraic understanding (Strand & Mills, 2014). Numerous studies have been conducted to identify the difficulties and misconceptions students have in learning algebra (Welder, 2012; Naseer, 2016). However, it has been found that many students fail to achieve basic algebraic literacy, and that can prove to be a barrier to entry into careers in the sciences, engineering, technology, and business (Brown et al., 2011; Massey & Riley, 2013; Strand & Mills, 2014; Welder, 2012). Research indicated that students face numerous difficulties in understanding algebra due to lack of understanding of symbols and letters and of manipulation of algebraic expressions and equations (Booth; Kieran; Kuchemann; MacGregor& Stacey, as cited in Banerjee, &Subramaniam, 2012; Strand & Mills, 2014). Welder (2012) pointed out that these difficulties could be due to the existing knowledge students have that may be incomplete or misunderstood. Research indicated that at times students incorrectly interpreted letters as objects and incorrect interpretation of letters is as a result of the approach used by teachers in introducing early simplification of algebra that is influenced by the algebraic content which in turn frustrate them into breeding negative attitude.

Heavy Reliance on what have been taught

These three foundational understandings of abstract reasoning, language acquisition and mathematical structure, are often unique challenges for students in solving problems in algebra. Although each in itself can serve as a unique obstacle to solving algebraic problems, the interaction of all three forms a much more formidable impediment to mastering algebra for many Nigerian secondary school students. As a result, these students have a poor initial experience with algebra and therefore fail to gain an adequate foundation for future learning which in turns result to them having a negative attitude towards solving algebra. Students often fail to recognize the differences between expressions and equations (Carraher and Schliemann, 2007). The difficulties of achieving competence in abstract reasoning, language acquisition, and mathematical structure within the learning of algebra require teaching strategies that purposefully target the needs of learners (Rakes et al., 2010). Most times instrumental understanding of algebra as a way of learning is what leads to students to rely on memorization and prescriptions (Skemp, 2006; Kieran, 2007). A person with an instrumental understanding of the city may have a number of ways to get from Point A to Point B. For instance, students may learn a set of prescriptions for solving equations of the form $ax + b = c$; when they encounter equations of the form $ax + b = cx + d$, their prescriptions are unable to accommodate the new form (Rakes et al., 2010). Students who acquire only procedural knowledge often “get lost” when subjected to unfamiliar situations and are unable to apply important mathematical concepts and structure in those situations (Skemp, 2006)

Difficulty Encountered in Solving Algebraic Problems

A study conducted in Malaysia, shows that students had difficulty in mathematics especially in solving problem because, they had difficulty in understanding and retrieving basic concept, formulas, facts and procedure, they also lack the ability to visualize mathematics problems and concepts, which make them inefficient in logical thinking and lack strategic knowledge in algebraic problem solving (Tambychik, Subahan, Meerah, & Aziz, 2010). However, (Salman et al., 2011) also conducted a study that shows Nigerian secondary school students have negative attitude towards solving problem in algebra. Which they said is as a result of the difficulty these students encounter when confronted with problems to solve in algebra. Yet, it is considered as an aspect of mathematics that students find difficult due lack of understanding of symbols and letters and manipulation of algebraic expressions and equations and also its abstract nature (Naseer, 2016; Egodawatte, 2011; Gurbuz&Toprak, 2014; Welder, 2012; Banerjee &Subramaniam, 2012). Most students lack the knowledge of the process involve in solving problems, as such they are faced with difficulty when it comes to applying these skills in solving problems. . It is most likely that majority of students have some algebraic knowledge but they have almost no understanding of the basic structure of mathematics (Adeleke, 2011).

Refusal to be Patience on the side of the Students in Solving Algebraic Problems

Research has shown that students with high level of perseverance will not stop trying until they manage to get the answer and they will continue to work on a problem until they succeed in solving it. Fridah, (2004) reported that most students immediately make an attempt to work out the problem without first planning any strategies to do so which resulted only moderate number of students are able to solve the algebraic questions. In Nigeria, majority of the students lack the patience to solve algebraic problems on their own for the fear of “I will not solve it correct or the equation is not a familiar one”. This attitude always leave them with a negative thought towards solving algebra. Furthermore, the study of Farida (2004) indicates that the students that have lack of patience to carefully read and understand the questions given find it difficult to achieve success in algebra.

Absence of Confidence in the Students to Solve Algebraic Problems

Most of the secondary school students in Nigeria do not have confidence towards solving problems in algebra: According to Education Matters, (2008), students’ commitment in algebra refers to students’ motivation to solve algebraic problems, their confidence in their ability to succeed in algebra and their emotional feelings about algebraic problems. Students’ commitment in solving algebraic problems plays a key role in the acquisition of math skills and knowledge (Education Matters 2008). Therefore, confidence towards algebraic problem solving is believed to play a significant role in mathematics achievement and might be one of the factors that influence students in general mathematics achievement. It implies that the amount of effort they will expend and their level of perseverance in the face of unanticipated difficulties will boost their confidence (Mohd&Mahmood, 2011). Which is not always found among the Nigeria secondary school students.

Unwillingness of students to solve algebraic problems

Students who have high level of positive attitude in solving algebraic problems usually high level of success in life (Took & Lindstrom 1998). But, secondary school student in Nigeria are not willing to solve

problems in algebra which is believed to play a significant role in their general mathematics achievement. A study conducted by Mahmud, (2001) found that excellent students have high level of willingness to solve algebraic problems compared to average and weak students (Mahmud, 2001). Andrew, Salamonson and Holcomb (2009) further highlight that an individuals' expectation of their ability to successfully and willingly perform a given task is a reliable predictor of whether or not they will attempt the task, the amount of effort they will expend and their level of perseverance in the face of unanticipated difficulties. But the secondary school students in Nigeria are not even willing to try solving the problems presented to them, which make them believe it is difficult and as a result influence their having negative attitude towards solving any algebraic problems.

VI. Research Methodology

Having the main goal of this research in focus, a reasonable number of scholarly articles was reviewed extensively to investigate the attitudes of Nigeria secondary school students towards solving algebraic problems. Heralding this research process was the systematic, exhaustive and comprehensive review of attitude related literature, particularly articles on solving problems in algebra, covering journals like: Review of Educational Research, International Journal of Education in Mathematics, Science and Technology, A thesis on Algebraic Content and Pedagogical Knowledge of Sixth Grade Mathematics Teachers, The Journal of Mathematical Behavior, Australian Journal of Basic and Applied Sciences, Educational studies in mathematics, Journal of procedia and mathematical behaviour. The reviewed journals are loaded with inputs and corrective efforts of peer-reviewers. However, in searching and identifying the relevant previous studies, the study keywords included Attitudes, Algebra, Nigeria secondary schools, Attitudes of students towards algebra were used. The study was based on how Nigeria secondary school students react to solving algebraic problems.

VII. Discussion

This study was able to uncover and examine the attitudes of the Nigeria secondary school students towards Algebra. It was discovered that they are not having favourable attitudes towards algebra at the secondary school level. Majority of the students have a negative attitude towards solving algebraic problems due to reasons such as heavy reliance on teachers on every concept and solutions to every given equations, misunderstanding of concepts and structures in algebra, finding it difficult to connect past experience with present situations. However, it was also found that this students holds a negative attitude as a result of inability of their teachers to use the appropriate teaching approach that will encourage active participation of the students in solving problems themselves, more so, some of the teachers do not have the knowledge content of algebraic problems and there by finding it difficult to transmit the knowledge to the students. In addition, some teachers don't always start from simple to complex stages while presenting their lessons.

In addition it has been noticed that some of this students can solve algebraic problems but they lack the will power to do so. Because they rely on what is being taught in the class, they fail to try solving the algebraic problems themselves. Consequently, this has result to them developing a negative attitude towards solving algebraic problems. Furthermore, unwillingness of the students to be involve in solving non-routine algebraic problems were among what has been discovered to contribute to leading these students into having a negative attitude towards solving most of the algebraic problems given to them to solve. In addition Nigeria secondary school students demonstrated lack of patience to follow and apply the steps involve in solving problem, according to Polya, (1973) that opined that any students that want to be successful in solving any problem should be able to understand the problem, plan how to solve it, execute the plans to solve the problem, and look back and the process in making sure that all the necessary steps are taken but on the contrary it was evident that most of the secondary school students in Nigeria lack the patience to do so , and instead of following the steps they in most cases apply direct method of solving algebraic problems. However, some of this students were also discovered to face some difficulty in attempting to solve algebraic problems and as a result they get frustrated and their frustrations breeds a negative attitude in them.

From the above, it can be deduced that most of the secondary school students have what it takes to succeed. Just as postulated by Carl Rogers (1987) that every individual have what it takes to achieve the highest level of success in life once there is a conducive environment to do so.

VIII. Conclusion And Recommendations

In conclusion, it has been established that majority of the secondary school students in Nigeria have a negative attitude towards solving algebraic problems. It is therefore, recommended that these negative attitude needs to be overcome, so that later in life these students will not suffer lack of algebraic problem solving skills which is very important and fundamental in their future employment success and everyday life. The government should see to the employment of qualified mathematics teachers who have adequate understanding of all the branches of mathematics in order to ensure an in-depth and successful transfer of the content knowledge of algebra. Furthermore teachers are encourage to develop a positive attitude in their students so as to enhance their

performance in school generally. In addition teachers should cultivate the habit of delivery their lessons from the simple to the complex topics in algebra.

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