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# Paradigm Shift in Attitudes towards Mathematics Achievement of Students in Some Selected Secondary Schools in Ogun and Oyo States

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## Abstract

*The attitudes, interests, self-concepts and factors such as anxiety and frustration all of which influence and interact with student's motivation and which they carry to mathematics lessons affect the way they feel about mathematics. Most of these factors are either acquired by students while at the primary school levels or at home from their parents or siblings or from their seniors who had bad experiences from their mathematics teachers. This study looked at the paradigm shift in attitudes towards mathematics achievement of students in some selected secondary schools in Ogun and Oyo states with a view to ascertain which of the seven categories of these shifts are significant. Descriptive survey design was used with simple random sampling technique in getting the population of 183 students comprising 100 from Ogun States and 83 from Oyo state. Simple percentages and correlation statistics were used to analyse the data. The results showed that there is a significant relationship between how students explore other areas in problem solving in mathematics (0.74) and their confidence (0.68) followed by dependence on procedures (0.54) to how they perceive mathematics to the real world and its usefulness to them (0.48). It is recommended that teachers and mathematics educators should pay serious attention to attitudinal shifts of students in these areas in order to help them achieve better in mathematics. The teacher should motivate and employ other methods of catching the attention of students using various means like story-telling, folklores, use of local materials in the students' environment*

*and examples of mathematicians who are excelling in their chosen careers both locally and internationally to teach the subject to students.*

**Keywords:** Paradigm shift, attitude, confidence, mathematics achievement, dependence on procedures

## Introduction

The learning of mathematics at the secondary school level is predicated on the understanding of students' concepts of their ability to understand some basic concepts of arithmetic and simple elementary mathematics. These concepts must have been understood by students who had gone through the primary mathematics curriculum and are well-grounded. One other major requirement for the understanding of some basic concepts of secondary school mathematics is an adequate knowledge and understanding of the English language as a subject. This is because in Nigeria today, the language of communication at the secondary school level is English language and students who are deficient or do not understand English language will find it rather difficult to understand the basic concept of the mathematics that will be taught at this level. According to Kerlinger (1985), mathematics is the study of patterns and relations expressed in numbers or symbols. It is also the science of numbers, quantity and space. Mathematics as a subject is a very important tool that could be used for the understanding of science and technology and its application cuts across all areas of Human Endeavour (Butler, Charles and Lynwood, 1970).

Mathematics as a school subject has over the years attracted the interest of mathematics educators and researchers who are concerned about the teaching and learning of the subject especially at the early years of the students. It is fundamental to the understanding of basic science that is necessary for the understanding of most other school subjects (Fehr, 1996). The contributions that mathematical knowledge and skills have made to economic, industrial and technological growth of modern world are quite obvious to almost everyone. It enters into all areas of human activities. The importance of mathematics does not only lie in its contributions to scientific and technological development but also in its utility in day-to-day interactions at the market places,

transportations, business of all sorts by both literate and illiterate members of the society (Smith, 2004). Hence we cannot escape mathematics because there is real value in and real life applications for mathematics. Mathematics is a tool and is a language even as it has many uses (Okebukola, 1992). For students to be effective in the present age there is need for them to be properly prepared and equipped to face the challenges ahead and this should start from the early years of our pupils. According to Toumasis (1993), mathematics knowledge is essential not only for living effectively in the society but also for making useful contributions towards the development of one's environment. Mathematics teaching can only be result-oriented when students are willing and the teachers are favourably disposed, using the appropriate methods and resources in teaching the students (Aiken, 1998). According to Udegbe (2009), interest in the subject of mathematics serves as a significant factor that enhances the learning of mathematics which ultimately improves students' achievement in the subject. Research studies have indicated that low interest of students in mathematics may be due to lack of understanding of the technical language associated with the subject (Nurudeen, 2007), teachers' strategies of teaching (Habor-Peters, 2001; Abakporo, 2005), inadequate instructional resources/materials (Ukpebor, 2006). Suggestions as to how to solve some of these problems have been given by researchers some of which are teachers' use of tangible/visual representation such as sketch/models to concretize ideas (Habor-Peters, 2002), mathematical recreation (Adetula, 2001), amusement and pleasure combined with instruction (Ukeje and Obioma, 2002), the use of games with materials that are readily available in the child's environment (Abubaka and Bawa, 2006). An atmosphere that is conducive to the learning process, which is more than just a physical space with good lighting, can help to solve some of the anxiety student experience in mathematics test (Xin, 1999). Learning is maximized when students and teachers have a good rapport, when students are safe, trusted and respected and when students believe in themselves (Aiken, 1998). The teacher should help students discover their potentials and thereby improve their self-confidence and hence test anxiety will become a thing of the past. To be an effective

mathematics teacher, one needs to encourage creativity by helping students discover the basic ideas, laws or principles of mathematics using things/materials that are familiar to the students. One of the aims of a good mathematics teacher is to lead students to understand the principles and methods and concepts ahead of skills of operation and seek to give students the stimulation that comes from accepting and realizing worthwhile goals and the usefulness of such concepts.

The attitudes, interests, self-concepts and factors such as anxiety and frustration all of which influence and interact with student's motivation and which they carry to mathematics lessons affect the way they feel about mathematics. Most of these factors are either acquired by students while at the primary school levels or at home from their parents or siblings or from their seniors who had bad experiences from their mathematics teachers. Young children tend to indicate their feelings of enjoyment, interest and enthusiasm openly. The same goes with their dislikes. Studies have been done concerning children's attitudes towards mathematics but most of the findings have difficulty in measuring attitudes when dealing with young children. This is because children's attitude differs from day to day. It is important to know how children feel because it seems reasonable to assume that the way children feel about and react to mathematical content and ideas are related to the quantity and quality of their learning. This will also lead us to know what motivation has to do in making children really feel good about learning mathematics. Motivation here involves whatever the teacher does to increase children's interest in learning.

Various studies have shown how games, materials and techniques that teachers have used successfully have greatly increased interest in children. What teachers say and how they say it has been found to be particularly important. Praise has been found to be a highly effective way to motivate children to learn mathematics. Teachers and mathematic educators generally believe that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics. This means that we should continually pay attention towards creating, developing, maintaining and reinforcing positive attitudes in children. Most studies carried out by various mathematics and mathematics educators have conflicting evidences on whether boys like mathematics better than girls

or vice versa but generally, teachers find that the attitudes of children in early childhood are positive towards school.

A relationship will seem to exit between the teacher's attitude towards mathematics and his pupils' attitude towards mathematics and this will go a long way to determine whether the child will learn mathematics in future or not. If the morale of the child at the early childhood level is dampen by the negative attitude of the teacher, the child may grow with such ideas and will tend to hate mathematics throughout his/her lifetime. Children learn to acquire mathematical ideas almost from the time they become aware of the world around them.

Some psychologists of Gessel Institute in Unites States of America in 1989 did a study on how children develop and the implications of these for the school. They proposed that a thorough analysis of the child's developmental level would aid teachers in providing an individualized programme for each child. Their studies are designed to ascertain developmental factors including the development of mathematical ideas rather than knowledge acquired from school instruction with respect to the child's level of growth, the child as a unique individual and the child in a certain environment.

Students' attitude towards mathematics seems to be shaped by how students define mathematics, and what they consider the role of mathematics in their life. This is why some students would claim that they have no need of mathematics in their chosen career as they would not be using mathematics in such career. These assertions by students have been doused by the Federal Government of Nigeria by making it compulsory to have at least a credit pass in English Language and Mathematics in order to undertake any course of study in any tertiary institutions in Nigeria now. It is therefore imperative and compulsory for students to have a credit pass in mathematics to study any course in any Nigerian tertiary institution. There is therefore a need for students to have a change of attitude towards mathematics in order to have a better performance in it. From the foregoing, we found out that the developmental stages of children affect the way they learn mathematics. The attitude of the teacher also has great influence on the attitude of students hence the need for the study to ascertain the paradigm shift in

attitudes towards mathematics of students at the secondary schools in Ogun and Oyo states, Nigeria.

## Methodology

**Research Design:** The study employed the use of descriptive survey design.

**Research Question:** The study was guided by the question postulated thus: What are the significance differences in attitude shifts of students among the seven categories of paradigm shift questionnaire?

## Sample and Sampling Technique

The population for the study comprised students drawn from some secondary schools in Ogun and Oyo states of Nigeria. A total of 183 students of both sexes (100 from Ogun and 83 from Oyo states) were selected for the study using simple random sampling technique.

## Instruments

The only instrument used for the study was adapted from the "Mathematics Attitudes and Perceptions Survey" which is comprised of 39 items and grouped into seven categories of different perceptions in attitude shits of A: Relations to real world; B: Need to understand formulas or procedures; C: Dependence on procedures; D: Confidence; E:Exploration in problem solving; F: Independence in learning and NA: Statements that do not belong to any of the categories above. The calculated reliability index of the instrument was 0.741 using Cronbach alpha index.

## Data Analysis

The data collected were analysed using simple percentages and correlation statistics.

## Results and Discussion

The tables below show the number, percentage and correlation coefficients response in each of the categories.

A. Relations to real world: Statements that corresponds to this category are 12, 22, 23, 25, and 32.

Table 1: Relations to real world

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 12 | 6(3.3) | 15(8.2) | 44(24.0) | 73(39.9)* |
| 22 | - | 15(8.2) | 51(27.9) | 73(39.9)* |
| 23 | 8(4.4) | 28(15.3) | 57(31.1) | 46(25.1) |
| 25 | 8(4.4) | 10(5.5) | 46(25.1) | 74(40.4)* |
| 32 | 28(15.3) | 45(24.6) | 36(19.7) | 30(16.4) |

N.B: SD – Strongly Disagree, D – Disagree, A – Agree, SA – Strongly Agree
* Important

B: Need to understand formulas or procedures: Statements that correspond to this category are 9, 20, and 26.

Table 2: Need to understand formulas or procedures

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 9 | 26(14.2) | 38(20.8) | 45(24.6) | 29(15.8) |
| 20 | 6(3.3) | 10(5.5) | 55(30.1) | 68(37.2)* |
| 26 | 50(27.3) | 38(20.8) | 26(14.2) | 24(13.1) |

N.B: SD – Strongly Disagree, D – Disagree, A – Agree, SA – Strongly Agree
* Important

C: Dependence on procedures: Statements that correspond to this category are 8, 19, 24 and 38.

Table 3: Dependence on procedures

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 8 | 41(22.4) | 47(25.7) | 26(14.2) | 24(13.1) |
| 19 | 37(20.2) | 52(28.4)* | 30(16.4) | 20(10.9) |
| 24 | 23(12.6) | 37(20.2) | 39(21.3) | 40(21.9)* |
| 38 | 43(23.5) | 33(18.0) | 33(18.0) | 30(16.4) |

N.B: SD – Strongly Disagree, D – Disagree, A – Agree, SA – Strongly Agree * Important

D: Confidence: Statements that correspond to this category are 1, 4, 5, 11, 17, 18, 35, 37 and 39.

Table 4: Confidence

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 1 | 13(7.1) | 17(9.3) | 53(29.0) | 55(30.1) |
| 4 | 14(7.7) | 42(23.0) | 49(26.8) | 33(18.0) |
| 5 | 17(9.3) | 36(19.7) | 50(27.3) | 33(18.0) |
| 11 | 43(23.5) | 37(20.2) | 39(21.3) | 20(10.9) |
| 17 | 8(4.4) | 18(9.8) | 59(32.2)* | 54(29.5) |
| 18 | 12(6.6) | 46(25.1) | 43(23.5) | 38(20.8) |
| 35 | 27(14.8) | 49(26.8) | 40(21.9) | 22(12.0) |
| 37 | 43(23.5) | 40(21.9) | 35(19.1) | 21(11.5) |
| 39 | 41(22.4) | 32(17.5) | 27(14.8) | 38(20.8) |

N.B: SD – Strongly Disagree, D – Disagree, A – Agree, SA – Strongly Agree

* Important

E: Exploration in problem solving: Statements that correspond to this category are 13, 21, 27, 28, 30, and 36.

Table 5: Exploration in problem solving

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 13 | 3(1.6) | 12(6.6) | 50(27.3) | 74(40.4)* |
| 21 | 7(3.8) | 18(9.8) | 39(21.3) | 74(40.4)* |
| 27 | 8(4.4) | 20(10.9) | 64(35.0) | 47(25.7) |
| 28 | 9(4.9) | 23(12.6) | 63(34.4) | 44(24.0) |
| 30 | 2(1.1) | 8(4.4) | 58(31.7) | 71(38.8) |
| 36 | 8(4.4) | 16(8.7) | 53(29.0) | 62(33.9) |

N.B: SD – Strongly, D – Disagree, A – Agree, SA – Strongly Agree * Important

F:Independence in learning: Statements that correspond to this category are 6, 10 and 15.

Table 6: Independence in learning

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 6 | 4(2.2) | 4(2.2) | 55(30.1) | 76(41.5)* |
| 10 | 22(12.0) | 29(15.8) | 39(21.3) | 49(26.8) |
| 15 | 6(3.3) | 26(14.2) | 63(34.4) | 44(24.0) |

N.B: SD – Strongly, D – Disagree, A – Agree, SA – Strongly Agree * Important

NA: Statements do not belong to any of the categories above.

Statements that correspond to this category are 2, 3, 7, 14, 16, 25 and 31.

Table 7: Statements do not belong to any of the categories above

| Statement No | SD(%) | D(%) | A(%) | SA(%) |
|---|---|---|---|---|
| 2 | 11(6.0) | 21(11.5) | 50(27.3) | 57(31.1) |
| 3 | 1(0.5) | 9(4.9) | 45(24.6) | 84(45.9)* |
| 7 | 5(2.7) | 17(9.3) | 53(29.0) | 64(35.0) |
| 14 | 4(2.2) | 10(5.5) | 58(31.7) | 67(36.6) |
| 16 | 8(4.4) | 18(9.8) | 62(33.9) | 51(27.9) |
| 25 | 8(4.4) | 10(5.5) | 46(25.1) | 74(40.4)* |
| 31 | 13(7.1) | 29(15.8) | 50(27.3) | 47(25.7) |

N.B: SD – Strongly Disagree, D – Disagree, A – Agree, SA – Strongly Agree * Important

Table 8: Calculated Correlation coefficients among various categories

| Category | Statement | Correlation coefficient |
|---|---|---|
| A | Relations to real world | 0.48 |
| B | Need to understand formulas or procedures | 0.40 |
| C | Dependence on procedures | 0.54* |
| D | Confidence | 0.68** |
| E | Exploration in problem solving | 0.74*** |
| F | Independence in learning | 0.34 |
| NA | Statements that do not belong to any of the categories above | 0.30 |

Note: (i) * significant (ii) ** good significant (iii) *** very significant

In table 1, on relations to real world, the results showed that 74 (40.4%) respondents strongly agreed that “reasoning skills used in understanding mathematics can be helpful to them in their everyday life” while 73 (39.9%) of the respondents also strongly agreed that “they study mathematics to learn things that will be useful in their life outside of school” and “mathematical formulas express meaningful relationships among measurable things or amounts”. The correlation coefficient of 0.48 also indicates that the paradigm shift in attitudes of students to the other categories was good. This result showed that there is a relationship between how students perceive mathematics to the real world and its usefulness to them. This is supported by Smith (2004) who said that the importance of mathematics does not only lie in its contributions to scientific and technological development but also in its utility in day-to-day interactions at the market places, transportations, business of all sorts by both literate and illiterate members of the society.

In Table 2, on the need to understand formulas or procedures, the result showed that 68 (37.2%) of the respondents strongly agreed and 55 (30.1%) agreed that “in mathematics, it is important for them to make sense out of formulas and procedures before they can use them correctly”. The correlation coefficient of 0.40 revealed that there is a relationship between the different categories.

From Table 3, on dependence on procedures, the result showed that 52 (28.4%) disagreed that “in doing a mathematics problem, if my calculation gives a result very different from what I’d expect, I’d trust the calculation rather than going back through the problem” while 40 (21.9%) strongly agreed that “to learn mathematics, I only need to memorize solutions to sample problems”. The correlation coefficient of 0.54 revealed that there is a significant relationship between the different categories. This is also supported by Kerlinger (1985) who opined that mathematics is the study of patterns and relations expressed in numbers or symbols.

From Table 4, on confidence, the result showed that 59(32.2%) agreed and 54 (29.5%) strongly agreed that “if I am stuck on a mathematics problem for more than five minutes, I will give up or get help from someone else”. The correlation coefficient of 0.68 revealed

that there is a good relationship between the different categories and a good significant relationship. The result showed that for a student to perform well in mathematics there is the need to have the confidence that he/she can solve mathematics problems and not give up when they are stuck in solving problems. There is therefore the need for a paradigm shift from losing hope and giving up to being dogged in solving mathematical problems.

In Table 5, on exploration in problem solving, the results showed that 74 (40.4%) of the respondents strongly agreed that “if I get stuck on a mathematics problem on my first try, I usually try to figure out a different way that works” and “I enjoy solving mathematics problems”. The correlation coefficient of 0.74 revealed that there is a strong relationship between the different categories and so very significant. The result is very significant because there is the need for students to have an attitudinal shift in exploring other areas of solving mathematical problems. This assertion is corroborated by what teachers and mathematics educators generally believe that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics.

From Table 6 on independence in learning, the results showed that 76 (41.5%) strongly agreed that “when I solve a mathematics problem, I find an example that looks like the problem given and follow the same steps” while 63 (34.4%) agreed that “understanding mathematics means being able to recall something you’ve read or been shown”. The correlation coefficient of 0.34 revealed that there is relationship between the different categories but not too strong.

In Table 7, on other statements that does not belong to the remaining categories, 84 (45.9%) strongly agreed that “it is useful for me to do lots and lots of problems when learning mathematics” while 74 (40.4%) also strongly agreed that “reasoning skills used to understand mathematics can be helpful to me in my everyday life”. The correlation coefficient of 0.30 revealed that there is a relationship between the different categories. From Table 8, the results showed that exploration in problem solving (0.74) followed by confidence (0.68) and dependence on procedures (0.54) had significant relationships among the seven categories of

paradigm attitudinal shifts variables under consideration. The result is significant in the sense that there is a need for students to have an attitudinal shift in exploring other areas of solving mathematical problems than building on their old memories of what they know of mathematics. There is also the need for students to build good confidence in themselves that they can do well in mathematics in whatever situation they may find themselves. This is why Dogan-Dunlap (2002) posited that low self-esteem and mathematics phobia in mathematics learning could result to confused thinking, disorganization, avoidance behaviour, and passivity (Conte, 1991; Zentall & Zentall, 1983). He went further to say that students' attitude towards mathematics may be shaped by how students define mathematics, and what they consider the role of mathematics is in their life. To him, a student who considers mathematics as a bunch of symbols and procedures will tend to treat his/her mathematics concepts as a set of memorization of facts. For this student, he/she will not put any effort to understand why some formulas or proofs or concepts are what they are. If any student does not think mathematics is important such a student will not consider his/her mathematics course worthy enough to spend time on. This may lead to low motivation of the students which will lead to difficulty in understanding of some mathematical concepts which ultimately lead to low learning. This means one needs to address students' attitudes and behaviours before introducing mathematical concepts and expecting meaningful learning in the class.

## Conclusion

From the results of the findings, we can conclude that there is a significant relationship between how students explore other areas in problem solving in mathematics and their confidence followed by dependence on procedures to how they perceive mathematics to the real world and its usefulness to them.

## Recommendations

In view of these, it is recommended that:

- Teachers and mathematics educators should pay serious attention to attitudinal shifts of students in these areas in order to help them achieve better in mathematics.

- The teacher should motivate and employ other methods of catching the attention of students using various means like story-telling, folklores, use of local materials in the students' environment and examples of mathematicians who are excelling in their chosen careers both locally and internationally to teach the subject to students.

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