



Influence of Mathematical Skills on Junior Secondary School Students' Achievement in Mathematics in Delta State

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ABSTRACT

This study examined the influence of mathematical skills on students' performance in mathematics in junior secondary schools in Delta State. The sample size used for the study was 225 respondents (150 students and 75 teachers) randomly selected from three (3) Senatorial Districts in Delta State. Four (4) objectives and four (4) research questions were formulated to guide the study. Data were collected from respondents (teachers and students) using sets of questionnaires titled Influence of Mathematical Skills on Students Performance in Mathematics (IMSSPM). The instrument was structured in 4 point rating scale of agreement. The data were analyzed using mean and standard deviation. The finding of the study shows that problem-solving skills enable students develop thinking ability, enhance students' ability in choosing appropriate computation in mathematical problems, enable students to understand and develop more effectively in classroom tasks, enable students to individually practice arithmetic problems, The findings also show that critical thinking skills improve students' reasoning ability in mathematics, enable students to understand logical connections in solving mathematical problems and enable students to take reliable and valid procedures in solving mathematical problems. The study also find out that estimation skills enable students to conceptualize and mentally manipulate numbers, improves students' efficiency in calculating different quantities, provides an insight into students' understanding of mathematical concepts and number sense and enable students have strong understanding of place value and use numbers flexible. Finally, the study revealed that computational skills enable students to calculate basic arithmetic problems quickly and accurately, improves foundation for students' success in future mathematics learning such as algebra and geometry, enable students to select and apply arithmetic operations and enable students to calculate figuratively with ease. The study recommended that teachers should be retrained so as to emphasize the development of basic computational skills in mathematics; teachers should ensure students actively engaged in doing mathematics by given task that will make them develop thinking skills. Finally, students should be made to investigate meaningful real-world problems whenever possible.

Keywords: Mathematical skills, students, teachers, secondary schools

INTRODUCTION

For every Country to grow technologically there is need for the popularization of Mathematics and mathematical skills among students. The students' performance and interest in this respect have to be raised. Mathematics is seen as the language used to describe the problems arising in most branches of sciences and technology. It is a subject that is related to other school subject in areas like number and numeration, variation, graphs, fractions, logarithms and indices algebraic processes, solution of equation and also in area and volume. However, the performance of students in mathematics and mathematical skills has been a great concern to the society. Therefore for any nation to be relevant; it must not overlook the importance of mathematics skills in her educational system.

Ihejietdo (2009) identified mathematical skills as the ingredient for the effective articulation of the abstract element of science that impetus to the development of technologies. However, events of the past

decades have shown that many Nigeria Junior Secondary students neither perform well in the subject nor show a positive feeling towards the subject due to low acquisition of mathematical skills.

The acquisition of mathematical knowledge through problem-solving has long been considered a crucial instruction strategy to improve the cognitive processing of mathematical word problems and to enhance students' academic achievement (Erbas & Okur, 2012; Pape & Wang, 2003). Problem solving is a skills needed by students so that they can understand and develop more effective classroom activities and tasks. Learning mathematical facts and contents is important but is not enough, students should learn how to use these facts to develop their thinking and solve problems skills. Adedayo, (2006) stated that mathematics educators have accepted the idea that the development of problem solving ability deserves special attention. One of the most important components in any mathematics curriculum or program is genuine mathematical problem solving skills. Walkington, Clinton, Ritter, and Nathan, (2015) stated that problem-solving skills enables students have the ability to comprehend the conception of a mathematical word problem. Bassey, Joshua and Asim, (2008) stated that if these skills is well facilitated, may help students develop and improve the generic ability to solve real life problems, reasoning and gain deep understanding of concepts. Problem-solving is considered as the heart of mathematic learning because the skill is not only for learning the subject but it emphasizes on developing thinking skill method as well. Students can apply their knowledge and problem solving skills to be useful in daily life since the processes of solving the mathematic problem are similar to the general problem solving.

Critical thinking is quality of mathematics learning that requires one's effort to collect, interpret, analyze and evaluate information for the purpose of arriving at a reliable and valid conclusion. In teaching mathematics, critical thinking skills needs to be integrated and emphasized in the curriculum so that students can learn the skills and apply it to improve their performance and reasoning ability. Critical thinking may also involve logical reasoning and ability to separate facts from opinion, examine information critically with evidence before accepting or rejecting ideas and questions in relation to the issue at hand. In other words, it makes individuals to think, question issues, challenge ideas, generate solutions to problems and take intelligent decisions when faced with challenges (Semil, 2006). In applying critical thinking in school settings, it is necessary to develop thinking skills because students who think critically would be able to understand the logical connections between ideas construct and evaluate arguments, detect common mistakes in reasoning and solving problems systematically.

Facione (1990) identified six cognitive skills as central to the concept of critical thinking. These were: Interpretation, Analysis, Explanation, Evaluation, Self-regulation and Inference. Critical thinking skills therefore, are skills that enable one to analyze and synthesize information to solve problems in broad range of areas (Facione, 1990). The intellectual skills of critical thinking (analysis, synthesis, reflection, etc.) must be learned by actually performing them. Therefore, the teacher should emphasize students' active intellectual in teaching mathematics. Osarenren and Asiedu (2007) also submitted that the reason for the continued poor performance of students in mathematics could, among others, be attributed to the students' inability to think critically and analyze mathematical concepts systematically. More so, Fisher, (2003) highlighted that the critical thinking skills training had helped in stimulating students intellectual capability and make them engaged more in classroom activity. This further shows that critical thinking is an essential concept that is required to enhance performance in any subject especially in mathematics.

Estimation is a higher-level mathematics skill that requires students to be able to conceptualize and mentally manipulate numbers. Instead of just adding or subtracting columns, they actually have to analyze each number in the problem and make a determination as to round up or down depending on that "magic number" (Johnston, 2014). Van de Walle, Karp and Bay-Williams, (2012) stated that estimation skill is the interaction of mental computation, number concepts, arithmetic skills including rounding, place value and mental compensation that consistently result in answers that are reasonably near to a correctly computed result.

Estimation is an important skill for students, it enable students to be able to determine the reasonableness of their answer (Hope & Sherrill, 2009). Without estimation skills, students are not able to determine if their answer is within a reasonable range. In illustration, if a student is asked to multiply 322×22 and arrive at a product of 17,828, estimation skill will enable the student to independently recognize that

17,828 could not possibly be a reasonable answer and that the work needs to be redone (Johnston, 2014). This skill helps students to be able to use mental math to quickly arrive at a reasonable ballpark solution. Also, estimation skill enables students to look at data and mentally compute estimates that will be sufficient for any mathematical problems. Van de Walle (2005) contends that estimation skills used by individuals will provide an insight into their understanding of mathematical concepts, relationships, and number sense. Lefevre, Greenham, and Waheed (1993) reported that an understanding of place value and how the number system works, and the ability to work with powers of 10 and size comparisons require estimation competence.

Computational skills are defined as the abilities to calculate basic addition, subtraction, multiplication, and division problems quickly and accurately using mental methods, paper-and-pencil, and other tools, such as a calculator. Specifically, students with computational skills have the abilities to calculate basic addition, subtraction, multiplication, and division problems quickly and accurately (Varol & Farran, 2007). Even with the continuation of modern technology, however, math computation skills remain an integral part of students' math education because they lay the foundation for success in future math learning such as algebra, geometry, trigonometry and calculus.

Purpose of the Study

This study was carried out to examine the influence of mathematical skills on Junior Secondary School Students' Performance in Mathematics in Delta State. Specifically, the study sought to:

1. Determine the influence of problem-solving skills on Junior Secondary School Students' Performance in Mathematics.
2. Examine the impact of critical thinking skill on Junior Secondary School Students' Performance in Mathematics.
3. Ascertain the influence of estimation skill on Junior Secondary School Students' Performance in Mathematics.
4. Determine the impact of computational skills on Junior Secondary School Students' Performance in Mathematics

Research Questions

From the objectives of the study, the following research questions guided the study.

1. What is the influence of problem-solving skills on Junior Secondary School Students' Performance in Mathematics?
2. What is the impact of critical thinking skill on Junior Secondary School Students' Performance in Mathematics?
3. What is the influence of estimation skill on Junior Secondary School Students' Performance in Mathematics?
4. What is the impact of computational skills on Junior Secondary School Students' Performance in Mathematics?

Research Hypothesis

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

Ho₁: There is significance difference in the mean score of students and teachers on influence of problem-solving skills on Junior Secondary School Students' Performance in Mathematics.

Ho₃: There is no significance difference in the mean response of students and teachers on influence of estimation skill on Junior Secondary School Students' Performance in Mathematics.

METHODOLOGY

Delta State is located between latitude 5⁰⁰ North and latitude 6³⁰ North and longitude 5⁰ East and longitude 6⁴⁵ East. It is situated in the southern part of Nigeria, and with three (3) Senatorial Districts (Delta North, Delta Central and Delta South). The design of the study was descriptive survey. The target population was all teachers and students in junior secondary schools in three (3) Senatorial Districts in Delta State. The sample size was 225 rural women (150 students and 75 teachers) randomly selected. Instrument for data collection was structured questionnaire in a 4-point rating scale of agreement. Data

collected were analyzed using mean and standard deviation, with mean value of 2.50 established as the criterion mean for acceptance, while z-test was used to test the hypotheses at significance level of 0.05%.

RESULTS

Research Question 1: *What is the influence of problem-solving skills on junior secondary school students' achievement in mathematics?*

Table 4.1: Mean Responses of Teachers and Students on Influence of Problem-Solving Skills on Junior Secondary School Students' Achievement in Mathematics.

Variables	Teachers = 75			Students =150		
	\bar{X}_1	SD	DECISION	\bar{X}_2	SD	DECISION
1. Problem-solving skills help students develop thinking ability	2.89	1.06	Agreed	2.99	0.92	Agreed
2. Develop students' basic skills of solving daily life problems	3.08	0.95	Agreed	3.27	0.77	Agreed
3. It enhances students' ability in choosing appropriate computation in mathematical problems.	2.58	0.97	Agreed	2.56	0.89	Agreed
4. Enable students interpret data, select and control variables in mathematical equation	3.41	0.81	Agreed	3.13	1.01	Agreed
5. Problem-solving skills enable students to understand and develop more effectively in classroom tasks	3.41	0.79	Agreed	2.67	0.76	Agreed
6. It improve students' cognitive processing of mathematical word problems	3.29	0.87	Agreed	2.70	1.12	Agreed
7. Problem-solving skills enable students to individually practice arithmetic problems	3.27	0.95	Agreed	2.99	0.99	Agreed
8. Provide students with correct knowledge and elaborated explanations of misconceptions in mathematical problem	3.77	0.86	Agreed	3.29	0.89	Agreed
9. Problem-solving skills enhance students' cognitive processing of mathematical word problems	3.35	0.80	Agreed	3.20	0.71	Agreed
10. Minimize difficulties by allowing students to individually access interactive materials	3.07	0.93	Agreed	3.39	0.84	Agreed
Grand Mean	3.21	0.89	Agreed	3.01	0.89	Agreed

Source: Field survey, 2018.

Result in Table 4.1 shows the mean response of teachers and students on influence of problem-solving skills on junior secondary school students' achievement in mathematics in Delta State. The respondent agreed positively that problem-solving skills help students develop thinking ability (2.89 & 2.99), develop students' basic skills on solving daily life problems (3.08 & 3.27), enhance students' ability in choosing appropriate computation in mathematical problems (2.58 & 2.56), enable students interpret data, select and control variables in mathematical equation (3.41 & 3.13), enable students to understand and develop effectively in classroom tasks (3.41 & 2.67), improve students' cognitive processing of mathematical word problems (3.29 & 2.70), enable students to individually practice arithmetic problems (3.27 & 2.99). This study is in agreement with Sim, et al, (2004) who opined that problem-solving skills help students to provide suggestions on how to develop in solving problems. The study also revealed that problem-solving skills provide students with correct knowledge and elaborated explanations of misconceptions in mathematical problem (3.77 & 3.29), enhance students' cognitive processing of mathematical word problems (3.35 & 3.20) and also minimize difficulties by allowing students to individually access

interactive materials in different mathematical problems (3.07 & 3.39). The finding is in line with Maier et al., (2016) and Walkington, et al, (2015) who stated that problem-solving skills provide students with correct knowledge and elaborated explanations of their misconceptions and confusion when they generate errors in different steps of mathematical problem.

Research Question 2: *What is the impact of critical thinking skills on junior secondary school students' achievement in mathematics?*

Table 4.2: Mean Response of Teachers and Students on Impact of Critical Thinking Skills on Junior Secondary School Students' Achievement in Mathematics.

Variables	Teachers= 75			Students=150		
	\bar{X}_1	SD	DECISION	\bar{X}_2	SD	DECISION
1. Critical thinking skills improve students' reasoning ability in mathematics	3.41	0.92	Agreed	3.35	0.79	Agreed
2. Enable students to understand logical connections in solving mathematical problems	3.44	0.76	Agreed	3.16	0.91	Agreed
3. Improve students' ability to detect common mistakes and solving mathematical word problems systematically	3.22	0.93	Agreed	3.21	0.72	Agreed
4. Enable students to take reliable and valid procedures in solving mathematical problems	3.04	0.99	Agreed	3.23	0.62	Agreed
5. Enhance students' ability to collect and interpret mathematical equations	3.25	1.04	Agreed	3.09	0.93	Agreed
6. Improve students' ability in analyzing and evaluating data before arriving at a reliable and valid conclusion	3.13	0.96	Agreed	3.45	0.83	Agreed
Grand Mean	3.24	0.93	Agreed	3.24	0.80	Agreed

Source: Field survey, 2018.

Result in Table 4.2 shows the mean response of teachers and students on impact of critical thinking skills on junior secondary school students' achievement in mathematics in Delta State. The respondent agreed positively that critical thinking skills improve students' reasoning ability in mathematics (3.41 & 3.35), enable students to understand logical connections in solving mathematical problems (3.44 & 3.16), improve students' ability to detect common mistakes and solving mathematical word problems systematically (3.22 & 3.21). This study is in line with Mansoor, et al, (2012) who opined that critical thinking skills would enable students to understand the logical connections between ideas construct and evaluate arguments. The study also revealed that critical thinking skills enable students to take reliable and valid procedures in solving mathematical problems (3.04 & 3.23), enhance students' ability to collect and interpret mathematical equations (3.25 & 3.09) and also improve students' ability in analyzing and evaluating data before arriving at a reliable and valid conclusion (3.13 & 3.45). This finding is in line with Facione (2010) who identified interpretation, analysis, explanation, evaluation, self-regulation and inference as six cognitive skills as central to the concept of critical thinking.

Research Question 3: *What is the influence of estimation skills on junior secondary school students' achievement in mathematics?*

Table 4.3: Mean Responses of Teachers and Students on Influence of Estimation Skills on Junior Secondary School Students' Achievement in Mathematics.

Variables	Teachers= 75			Students=150		
	\bar{X}_1	SD	DECISION	\bar{X}_2	SD	DECISION
1. Estimation skills enable students to conceptualize and mentally manipulate numbers	3.43	0.86	Agreed	3.30	0.81	Agreed
2. Improves students' efficiency in calculating different quantities	3.50	0.78	Agreed	3.20	0.98	Agreed
3. Enable students to determine the reasonableness of their answer in any mathematical problem	3.01	1.03	Agreed	3.17	1.03	Agreed
4. Enables students to look at data and mentally compute estimates that will be sufficient for any mathematical problems	3.31	0.86	Agreed	2.99	0.99	Agreed
5. Provides an insight into students' understanding of mathematical concepts, relationships, and number sense	3.44	0.70	Agreed	3.13	0.87	Agreed
6. Enable students understanding of place value and use numbers flexible	3.45	0.88	Agreed	3.29	0.79	Agreed
7. Enable students to be able to reasonably estimate time and distances	3.39	0.83	Agreed	3.37	0.72	Agreed
8. Develop students' thorough and flexible understanding number comparisons	3.34	0.78	Agreed	3.21	0.86	Agreed
9. Enable students demonstrate a high tolerance for errors	3.24	0.96	Agreed	3.05	0.90	Agreed
Grand Mean	3.34	0.85	Agreed	3.19	0.88	Agreed

Source: Field survey, 2018

Result in Table 4.3 shows the mean response of teachers and students on influence of estimation skills on junior secondary school students' achievement in mathematics in Delta State. The respondent agreed that estimation skills enable students to conceptualize and mentally manipulate numbers (3.43 & 3.30), improves students' efficiency in calculating different quantities (3.50 & 3.20), enable students to determine the reasonableness of their answer in any mathematical problem (3.01 & 3.17), enables students to look at data and mentally compute estimates that will be sufficient for any mathematical problems (3.31 & 2.99), provides an insight into students' understanding of mathematical concepts, relationships, and number sense (3.44 & 3.13), enable students have strong understanding of place value and use numbers flexible (3.45 & 3.29). This finding is in line with Van de (2005) who contends that estimation skills used by students will provide an insight into their understanding of mathematical concepts, relationships, and number sense. The study also revealed that estimation skills enable students

to be able to reasonably estimate time and distances (3.37 & 3.39), develop students' thorough and flexible understanding of basic facts, number operation properties and number comparisons (3.34 & 3.21) and also enable students to demonstrate a high tolerance for errors (3.24 & 3.05). This finding is in agreement with Lefevre, et al (1993) who reported that an understanding of place value and how the number system works, require estimation competence.

Research Question 4: *What is the influence of computational skills on junior secondary school students' achievement in mathematics?*

Table 4.4: Mean Responses of Teachers and Students on the Influence of Computational Skills on Junior Secondary School Students' Achievement in Mathematics.

Variables	Teachers = 75			Students=150		
	\bar{X}_1	SD	DECISION	\bar{X}_2	SD	DECISION
1. Computational skills enable students to calculate basic arithmetic problems quickly and accurately	3.12	0.76	Agreed	3.00	0.69	Agreed
2. Improves foundation for students' success in future mathematics learning such as algebra, geometry, etc	2.96	0.88	Agreed	2.89	0.98	Agreed
3. Students with computational skills are able to select and apply arithmetic operations	3.21	1.00	Agreed	3.12	1.00	Agreed
4. Computational skills enable students to calculate figuratively with ease	2.98	0.84	Agreed	3.01	0.92	Agreed
5. Expands students' ability to flexible application to calculation strategies	3.23	0.58	Agreed	3.32	0.77	Agreed
6. Enable students to execute the steps to solve mathematical problem	3.24	0.79	Agreed	3.33	0.98	Agreed
Grand Mean	3.12	0.80	Agreed	3.11	0.89	Agreed

Source: Field survey, 2018

Result in Table 4.4 shows the mean response of teachers and students on influence of computational skills on junior secondary school students' achievement in mathematics in Delta State. The respondent agreed that computational skills enable students to calculate basic arithmetic problems quickly and accurately (3.12 & 3.00), improves foundation for students' success in future mathematics learning such as algebra, geometry, (2.96 & 2.89), students with computational skills are able to select and apply arithmetic operations (3.21 & 3.12). This finding is line with Varol and Farran, (2007) who posited that students with computational skills have the abilities to calculate basic addition, subtraction, multiplication, and division problems accurately. The study also revealed that computational skills enable students to calculate figuratively with ease (2.98 & 3.01), expands students' ability to flexible application to calculation strategies (3.23 & 3.32) and also enable students to execute the steps to solve mathematical problems (3.24 & 3.33). Also, to buttress these findings, Baroody (2003) ascertained that computational skills enable students to execute the steps to calculate the solution of a mathematical problem.

Hypothesis 1

There is no significant difference in the mean responses of teachers and students on influence of problem-solving skills on junior secondary school students' achievement in mathematics.

Table 4.5: Z-Test on Influence of Problem-Solving Skills on Junior Secondary School Students' Achievement in Mathematics

Categories	M	SD	N	z-cal	z-crit	Decision
Teachers	3.21	0.89	75			
Students	3.01	0.89	150	1.58	1.96	Accepted

Table 4.5 shows that teachers had mean and standard deviation score of 3.21 and .89 respectively, while students had mean and standard deviation scores of 3.01 and .89 respectively. The z-cal value was 1.58, while the z-crit was 1.96 at 0.05 level of significance. This result shows that z-cal was less than z-crit, which means that the null hypothesis was accepted. Thus, there was no significant difference in the mean responses of teachers and students on influence of problem-solving skills on junior secondary school students' achievement in mathematics.

Hypothesis 2

There is no significant difference in the mean responses of teachers and students on influence of estimation skills on junior secondary school students' achievement in mathematics.

Table 4.7: Z-Test on Influence of Estimation Skills on Junior Secondary School Students' Achievement in Mathematics.

Categories	M	SD	N	z-cal	z-crit	Decision
Teachers	3.34	0.85	75			
Students	3.19	0.88	150	1.21	1.96	Accepted

Table 4.7 shows that teachers had mean and standard deviation score of 3.34 and .85 respectively, while students had mean and standard deviation scores of 3.19 and .88 respectively. The z-cal value was 1.21, while the z-crit was 1.96 at 0.05 level of significance. This result shows that z-cal was less than z-crit, which means that the null hypothesis was accepted. Thus, there was no significant difference in the mean responses of teachers and students on influence of estimation skills on junior secondary school students' achievement in mathematics.

CONCLUSION

Based on the findings of the study, it was deduced that problem solving skills, estimation and approximation skills, critical thinking skills and computational skills are some mathematical skills required to improve students' performance in mathematics. The study conclude that problem-solving skills enhance students' ability in choosing appropriate computation in mathematical problems, enable students interpret data, improve students' cognitive processing of mathematical word problems, select and control variables in mathematical equation, enable students to individually practice arithmetic problems, provide students with correct knowledge and elaborated explanations of misconceptions in mathematical problem. The study also conclude that junior students in Delta State need critical thinking skills as it improve students' reasoning ability in mathematics, enable students to understand logical connections in solving mathematical problems, and also improve students' ability in analyzing and evaluating data before arriving at a reliable and valid conclusion. Estimation skills enable students to manipulate numbers, improves students' efficiency in calculating different quantities, provides an insight into students' understanding of mathematical concepts, relationships, and number sense as well as enabling students have strong understanding of place value and use numbers flexible.

RECOMMENDATIONS

Based on the findings and conclusion, the following recommendations were made:

1. Teachers should be retrained so as to emphasize the development of basic computational skills in mathematics.
2. Teachers should constantly build students' sense of efficacy and instill in the students a belief that not only is the goal of "doing mathematics" attainable, but also they are personally capable of reaching that goal.
3. Mathematics is not a stagnant field of textbook problems; rather, it is a dynamic way of constructing meaning about the world around us, generating new knowledge and understanding about the real world every day. Therefore, students should be made to investigate meaningful real-world problems whenever possible.
4. Teachers should ensure students actively engaged in doing mathematics themselves, not watching others do it.
5. Students should be given tasks that will make them develop thinking skills.
6. Government should employ qualified mathematics teachers.

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