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INVESTIGATING THE LEVEL OF MATHEMATICAL CONCEPTS DEVELOPMENT IN PRE-PRIMARY SCHOOLS IN OREDO LOCAL GOVERNMENT AREA

Imasuen Kennedy[1] and Dr. (Mrs.) Modupe P. Aibinuomo[2]

[1]Institute of Education, University of Benin, Benin City, Nigeria

Email: kennedy.imasuen@uniben.edu

[2]University of Benin, Benin City, Nigeria

Email: modupe.aibinuomo@uniben.edu

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ABSTRACT: *Mathematics is the building blocks on which other subjects (mostly the sciences) are laid on. But many pupils find it very difficult to comprehend. More so, a good mastery of the concept of mathematics at the pre-primary level will form a solid background for the pupils when they proceed to the primary and secondary level. This has been the reason why mathematics is given prominence in the school curriculum and timetable. For some time now, there has been a growing concern over the poor teaching and learning of mathematics with the resultant - poor and falling standard in secondary school student performance in mathematics. These failures may be caused by the little or no development of early childhood mathematics in schools. This study, therefore, investigates the level of mathematics concepts development of pre-primary school pupils in Oredo local government area of Edo state. The descriptive survey method was adopted, and the population comprises all public and private pre-primary school pupils and teachers in Benin Metropolis. Three hundred pupils and sixty teachers from thirty public and thirty private pre-primary schools in Oredo local government area were randomly sampled. The mathematics competency test was the instrument for data collection. The instrument was validated and the Kuder-Richardson reliability was estimated and it gave a value of 0.76. The data were analyzed using mean. The hypotheses were tested using the independent sample t -test. All the hypotheses were tested at 0.05 level of significance. Findings revealed that the development of mathematical concepts by pre-primary school pupils was moderate; and that a significant difference existed between male and female pupils, between public and private school pupils, and between pupils in rural and urban pre-primary schools. Considering the results of the study, provision of physical, instructional, learning, and human resources that will enhance pupils' development of mathematical concepts was recommended.*

KEYWORDS: Mathematics, Pre-primary school, Development, Concepts, Level.

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INTRODUCTION

Pre-primary education is the education of children before entering primary school. This happens when the child is between 5 and 6 years of age. During this period, cognitive, physical and emotional abilities are developed (Ogbeide et al., 2014). Also, this period is characterized by rapid and intense growth. This pre-primary period is part of early childhood. According to the Nigeria Policy on Education (2014), the education given to the children aged five, and is usually one year, is part of early childhood education. The basics of walking, talking and naming colors and shapes at home are visible signs in this period. Also, accompanying this period is the learning of the alphabet, how to count, which are the prerequisite to learning. The learning children acquired at home are usually exhibited at the pre-primary level of education. Children usually engage in a practical setting, interacting with other children who are outside of their family. Thus, the children in the early childhood classes are safe, thereby paving the way for nurturing an environment for interaction, and also stimulating social activities. It also provides guidance for the child. During this period, the development and function of the brain is achieved.

The Nigerian Government clearly saw the importance of pre-primary education; hence the National Policy on Education clearly outlined the objectives of pre-primary education. Also enshrined in the National Policy on Education (2014) is the role mathematics should play so as to develop the children's ability to understand and use mathematics by understanding its concepts. Physical facilities (classrooms, toilets, teachers and pupil chairs, electricity, and so on), instructional facilities (teachers' mathematics textbook, curriculum on mathematics for pre-primary, flash cards, and many more), quality teachers and pupils' learning materials (pupils exercise book, pupils mathematics workbook, pupils pencil, and others) were also well spelt out in the National Policy on Education. The availability and adequacy of these resources will lead to the development of mathematics. According to Clements and Conference Working Group (2004), children exhibiting mathematical skills will help develop dispositions, such as curiosity, imagination, flexibility, inventiveness, and persistence, which contribute to their future success in and out of school. So, the need for early childhood development has been brought to light due to the numerous challenges faced in the later years of learning. Young learner's early exposure to mathematics has given them a firm foundation upon which their future mathematics learning and applying mathematics lies. Also, the knowledge of mathematics enables young learners to develop critical thinking, and also develop skills needed for success in other areas of life.

Concept of Pre-primary School

The pre-primary education was given an official recognition by the Federal Government of Nigeria in the National Policy on Education. In the policy document, pre-primary education was defined as the one-year education given to children aged 5 before entering primary school. Hence, pre-primary education is an important aspect of an individual's education. It is the foundation stone that will enhance the smooth transition of the child to the formal school system at the primary school level. By implication, any wrong doing here will certainly affect the overall development of the child.

Some authors opined that pre-primary education has contributed immensely to the educational development of children in their later lives (Rolnick & Grünewald 2003; Barnett, 2006). The origin of pre-primary education can be attributed to the efforts of prominent educators which

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includes: John Amos Comenius (1590-1690), Rousseau (1782 – 1788), Johann Heinrich Pestalozzi (1748-1827) and Friedrich Froebel (1782-1751). These experts championed the right of children to early education. In Nigeria, scholars such as Maduewesi (1992) and Fafunwa (1967) facilitated the need for pre-primary education to achieve the desired goals.

Pre-primary education has become increasingly popular in Nigerian cities and urban areas. It is a place to keep the children while the parents are at work. Pre-primary education is the first education a child receives in a formal school setting. It is the actual foundation of the huge educational structure upon which the other levels are built. In spite of the importance of this form of education, only very few children have access to it in Nigeria. The need for this form of education therefore cannot be overstressed. Madueke (2003) stated that in comparing the academic performance of primary one pupil with and without pre-primary education, the result reveals that those who attended pre-primary schools "have better learning readiness, adjust better to formal school processes and are better equipped to succeed". He concluded that the government should therefore have a second look at the National Policy on Education and take urgent action to save our pre-primary children who have no access to this form of education.

Concept of Pre-primary Mathematics

The Sumerians were the ones that actually brought mathematics to bear over 5,000 years ago as they developed counting, arithmetic and also became the first accountants. Mathematics has been variously defined by various authors. It is said to be the queen of science, the science of size, and number that includes arithmetic trigonometry and geometry as branches. Selin et al. (2009) see mathematics as involving numbers and other measurable qualities, and that it is concerned with describing the relationship between numbers and these measurable quantities. Therefore, teaching mathematics at an early age is germane to further success in other areas of life. Hence, mathematics should be properly taught at the pre-primary stage.

A lot of studies have emerged which revealed that for children to develop and learn mathematical concepts, the play way method of teaching should be applied (Lindon, 2005; Haylock & Cockburn, 2008; Tucker, 2010). In the same vein, Wood and Attfield (2005) averred that the real-world mathematics comes as a result of the practical activities children experience. Also, Hughes cited in Anthony and Walshaw (2009) contended that numerous studies had advocated that young children had the potential to engage in developing mathematical skills and understandings. They excel in areas, such as enumeration, simple arithmetic, representation, problem solving, measurement and spatial skills, geometric knowledge and logic.

A lot of controversies have emerged on the development of mathematical concepts based on gender. For example, the study conducted by Pratiwil et al. (2019) showed that there was a difference in the distribution of pre-test scores of male pupils' and female pupils' mathematical understanding ability and it favored the male. Also, the results of other research showed that there was no difference between male and female pupils' mathematical understanding ability (Stoet & Geary, 2013; Lindberg et al., 2010). Mullis and Martin (2015) found that there were 18 out of 49 countries which showed more achievement from male pupils than female pupils. Eight countries showed more achievement from female pupils. Twenty-three countries proved that there was no significant difference of male and female pupils' achievement in Mathematics. On her part, Hastings (2013) opined that boys are far more often noted as being mathematically inclined and that girls more often face a mathematical challenge thereby giving

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the boys upper hand in mathematics.

The development of mathematical concepts by pre-primary school pupils varies with respect to the location of the school. In a study carried out by Acharya et al. (2013), it was revealed that pupils in urban cities had a better development of mathematical concepts than those in the rural area. In the same vein, pupils reported a remarkable rise in performance within the urban schools than the rural schools (Acharya & Metsämuuronen, 2014). These differences in development of mathematical concepts between the rural pupils and urban pupils was attributed to the availability of physical, instructional and human resources in the urban areas than the rural pre-primary schools.

Ownership of pre-primary schools means those that are directly responsible for the day to day running of the school. Those that have been financed by the government are regarded as public schools while those financed and managed by individuals are referred to as private schools. Ownership of school has been seen as a catalyst for the development of mathematical concepts by pupils. School context factors such as school location and type, school neighborhood conditions, and as well as the composition of pupils in a school have impacts on child learning (Carlson & Cowen, 2015; Fischer, 2013; Parcel & Dufur, 2001). Braun et al. (2006) and Lubienski and Lubienski (2006) also examined the effects of school type (public versus private) on learning achievement and concluded that private schools may not be as effective in delivering learning outcomes as commonly assumed. The number of pupils in a classroom can affect how much is learned in a number of different ways (Ehrenberg et al., 2001). According to the authors, the number of pupils in a classroom can affect how much is learned in a number of different ways. The interactions and social engagement of pupils in a classroom can result in for example, more or less noise and disruptive behavior, which in turn can affect the kind of activities the teacher is able to promote. It can also affect how much time the teacher is able to use in focusing on individual pupils and their specific needs rather than on the group as a whole. Also, the composition of pupils in a classroom can be a source of motivation, aspiration and direct interactions and learning for all pupils (Hanushek et al., 2003).

Teaching mathematics at the pre-primary school is mainly to prepare the child to learn, understand and apply mathematical skills and abilities when they enter the primary school. Therefore, this paper investigates the level of mathematics concepts development in pre-primary school pupils in Oredo local government area of Edo state.

Statement of the Problem

The importance of mathematics to the world and to a nation's technology cannot be overemphasized. It is the building blocks on which other subjects (mostly the sciences) are laid on. Hence, it is called the queen and language of the sciences. But many pupils find it very difficult to comprehend. More so, a good mastery of the concept of mathematics at the pre-primary level will form a solid background for the pupils when they proceed to the primary and secondary level. This has been the reason why mathematics is given prominence in the school curriculum and timetable. However, in Oredo local government area, the teaching and learning of mathematics have not been without problems. For some time now, there has been a growing concern over the poor teaching and learning of mathematics with the resultant - poor and falling standard in secondary school student performance in mathematics. The West African Senior School Certificate Examination and other related examination bodies recognized in Nigeria have always indicated a decrease in the number of passes. These failures

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may be caused by the little or no development of early childhood mathematics in schools. Could it be that pupils at the pre-primary school are not developing mathematics concepts? Could it also be that the pupils are not exposed to these mathematics concepts at the pre-primary school level? Thus, this study investigates the level of mathematics concepts development in pre-primary schools in Oredo Local Government area of Edo state.

Research Questions

1. What is the level of mathematics concepts development in pre-primary schools in Oredo Local Government?
2. Is there any difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on sex of pupils?
3. Is there any difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on location?
4. Is there any difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on ownership of schools?

Hypothesis

Research question 1 was answered, while question 2, 3 and 4 were hypothesized

1. There is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on sex
2. There is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on location of school.
3. There is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on ownership of school.

Rationale for the Study

This study will be of great benefit to parents, government bodies and the private sector, as it will reveal the level of mathematical concepts a child can develop even at the pre- primary level. It will also help parents and teachers including all stakeholders in early childhood education to plan and make available resources for the effective development of mathematical concepts.

METHODS

The study employed the descriptive survey research design. The population of the study consisted of all the pre-primary public and private schools and pupils in Oredo Local Government Area. A sample size of 360 respondents (300 pre-primary school pupils and 60 teachers) were used for this study. Using a simple random sampling technique, 30 urban schools and 30 rural schools were chosen. Ten pupils (five males and five females) and one teacher each were conveniently drawn from the sixty schools. The instruments used for the study was a mathematics competency test which was designed by the researcher. The

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instrument was divided into two sections. Section A contains demographic data of the respondents while section B contains items or questions on the mathematical concepts that the students were expected to be exposed to.

The face and content validity of the instrument were determined by experts in measurement and evaluation and pre-school teachers of mathematics. To determine the reliability of the instrument, thirty (30) copies of the instrument were administered to pupils in pre-primary school that were not used for the study. The Kuder-Richardson 20 reliability statistics was used and it gave the value of 0.76. The teachers rated the students and the scores were collected immediately by the researcher. The data gathered were analyzed using mean. For research question one, a mean score of between 1.00 and 49.00 was seen as low, between 50.00 and 69.00 was moderate while 70.00 and above was regarded as high. The independent sample t – test was used to test hypotheses one to three at 0.05 level of significance.

RESULTS

Table 1: Level of Mathematical Concepts Development in Pre-Primary Schools in Oredo Local Government Area

Mathematical concepts	Mean	Remark
Counting	84.00	High
Recognizing numbers	74.00	High
Number sense	63.90	Moderate
Serration/Ordering	63.67	Moderate
Sequencing /patterning	63.53	Moderate
Comparing	63.20	Moderate
Classifying	63.17	Moderate
Spatial relationship	62.53	Moderate
Measuring	63.07	Moderate
Time	63.63	Moderate
Predicting	63.30	Moderate
Problem solving	63.47	Moderate
Causes and effect relationship	42.27	Low
Grand mean	**64.13**	

The result in Table 1 showed the level of mathematical concepts development in pre-primary schools in Oredo local government area ranging from 42.27 to 84.00. It further revealed that pupils exhibited high mathematical skills in counting and recognizing numbers. They exhibited moderate skills in number sense, serration and ordering, sequencing/patterning, and time measurement, comparing, classifying, spatial relationship, measuring, predicting, problem solving. However, the pupils exhibited low skills in causes and effect relationships, which were not taught. The grand mean of 64.13 indicated that the level of mathematical concepts development in pre-primary schools in Benin Metropolis was moderate.

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Table 2: Independent sample t-test of the difference in the level of mathematics concept development in pre-primary schools based on sex of pupils

Location	N	Mean	Standard deviation	t	p value	Remark
Female	150	17.00	3.12	-2.120	0.043	Significant
Male	150	20.20	4.95			

Table 2 showed a t value of -2.120 and a p value of 0.043. Testing at alpha level of 0.05 the p value is less than the alpha level. Therefore, the null hypothesis which states that "there is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on sex of pupils" is rejected. Consequently, there is a significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government Area based on sex of pupils. Male pre-primary pupils seem to develop more mathematical concepts than the females.

Table 3: Independent sample t-test of the difference in the level of mathematics concept development in pre-primary schools based on location of school

on	N	Mean	Standard deviation	t	p value	Remark Locati
Rural	30	71.07	8.258	3.630	0.001	Significant
Urban	30	82.60	6.507			

Table 3 showed a t value of -3.630 and a p value of 0.001. Testing at alpha level of 0.05 the p value is less than the alpha level. Therefore, the null hypothesis which states that "there is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on location of schools" is rejected. Consequently, there is a significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government Area based on location of schools. Pre-primary pupils in the urban schools seem to develop more mathematical concepts than those in the rural schools

Table 4: Independent sample t-test of the difference in the level of mathematics concept development based on ownership of school

Location	N	Mean	Standard deviation	t	p value	Remark
Public	30	45.00	9.27	-4.00	0.000	Significant
Private	30	80.40	7.00			

Table 4 showed a t value of -4.00 and a p value of 0.000. Testing at alpha level of 0.05 the p value is less than the alpha level. Therefore, the null hypothesis which states that "there is no significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government based on ownership of schools" is rejected. Consequently, there is a significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government Area based on ownership of schools. Pre-primary pupils in private school seem to develop more mathematical concepts than those in the public schools

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DISCUSSION OF FINDINGS

The study revealed that the development of mathematical concepts by pre-primary school pupils was moderate. This implied that the pupils had a good foundation in mathematics for optimal performance in mathematics in primary and secondary level. This view was supported by Madueke (2003) who stated that pupils who attended pre-primary schools "had better learning readiness, adjusted better to formal school processes and were better equipped to succeed than those who did not".

On the issue of whether there was a difference in the development of mathematical concepts by male and female pupils, the study revealed that there was a significant difference in the level of mathematics concepts development in pre-primary schools in Oredo Local Government Area based on sex of pupils. Male pre-primary pupils seemed to develop more mathematical concepts than the females.

This was in correlation with the study of Pratiwil et al. (2019), which found that there was a difference in the distribution of pre-test score of male pupils' and female pupils' mathematical understanding ability and it favored the male. Also, Hastings (2013) opined that, boys were far more often noted as being mathematically inclined and that girls more often faced mathematical challenges thereby giving the boys upper hand in mathematics. However, the study was not in tandem with Stoet and Geary (2013) and Lindberg et al. (2010), who asserted that there was no difference between male and female pupils' mathematical understanding ability. Mullis and Martin (2015) found out that there were 18 out of 49 countries which showed more achievement from male pupils than female pupils. Eight countries showed more achievement from female pupils. Twenty-three countries proved that there was no significant difference of male and female pupils' achievement in Mathematics.

With regards to differences in mathematical concept development by pre-primary school pupils based on location, the study revealed that a significant difference existed between pupils in rural and urban schools, and pre-primary pupils in the urban seemed to develop more mathematical concepts than those in the rural schools. This was attributed to the availability of physical, instructional, learning and human resources in the urban areas compared to the rural pre-primary schools. This was in tandem with Acharya et al. (2013) who believed that pupils in urban cities had a better development of mathematical concepts than those in the rural area. In the same vein, Acharya and Metsämuuronen (2014) reported a remarkable rise in performance within the urban schools than the rural schools.

The study also revealed that a significant difference existed between pupils in public and private schools, and pre-primary pupils in the private schools seemed to develop more mathematical concepts than those in the public schools. This was corroborated with the study of Fehrler et al. (2009) who found that pupils in private schools showed higher overall performance, but this performance advantage vanished when socio-economic background and initial knowledge as measured in the pre-test scores were adequately controlled for. However, the study was not in agreement with Braun et al. (2006) and Lubienski and Lubienski (2006) who opined that private schools may not be as effective in delivering learning outcomes as commonly assumed.

What gave the private school an upper hand in this study was the demographic variables differences between pupils in public and private schools which accounted for the relatively

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high performance as observed by Lubienski and Lubienski (2006). Another factor was the number of pupils in the classroom. The number of pupils in a classroom can affect how much is learned in a number of different ways. In public school, the classes are filled with pupils compared to private schools with fewer pupils which make learning easier.

CONCLUSION

Mathematics is the bedrock for technological and social development in any society but many pupils find it very difficult to comprehend, there is therefore the need to start the development of its concepts from the early stages in life. A good mastery of the concept of mathematics at the pre-primary level will form a solid background for the pupils when they proceed to the primary and secondary level. Pupils start the development of mathematical concepts right from their early stages of life, as can be seen in this study where the pupils showed that they have a moderate development of mathematical concepts that they were taught by their teachers. In the light of this, gender differences existed, and also there were differences between pupils in public and private schools as well as between pupils in urban and rural pre-primary schools.

RECOMMENDATIONS

Based on the findings from the study, the following recommendations are made:

1. Government should make available adequate physical, instructional, learning and human resources for pre-primary schools to enhance the teaching and learning of mathematics. This will help encourage the teachers and the pupils for meaningful teaching and learning.
2. Government should provide equal adequate instructional facilities to both the urban and the rural areas, and improve the equity of distribution of educational facilities throughout Oredo Local Government Area.
3. Government should downsize the classes by building more classrooms so that the teachers can interact with the pupils effectively.
4. Teachers should be trained on the use of modern methods of teaching mathematics.

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