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# ASSESSMENT OF EFFECTS OF CLASS-SIZE ON STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS

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**Abstract**

*The study was aimed at finding out the effects of class-size on the academic achievement of students in mathematics. In conducting the study, three research questions were raised, and three hypotheses were developed from the research questions. One hundred JSS 3 students were used as population for the study, who also served as the sample. Two instruments were used: Test and Questionnaire. The psychometric properties of the instruments were also established. Chi-square and Z-test were used for the analysis of the data. The findings among others showed that class size affects the achievement of students. It also showed that female students are more affected in an overcrowded class. It further revealed that students develop negative perception in an overcrowded class. Based on the findings conclusion and recommendations were drawn.*

***Key Words**: Assessment, Effects, Class-Size, Academic Achievement*

## Introduction

Teaching is a two-way communication from the teacher to the learner and from the learner back to the teacher. The number of pupils in a class affects the attention they receive from the teacher. In pre-independence schools, there was hardly any class with more than forty students; these days especially in the urban areas, a class parades between seventy and one hundred students. (Itedjere, 2006). The liberalization of primary and secondary education in Nigeria in 1979 without adequate facilities to match with the sharp increase in enrollment of students led to overcrowded class-rooms in Nigeria. The situation got worse with the introduction of the Universal Basic Education (UBE) Programme (Ojonuban, 2010).

Science and Mathematics involve acquisition of knowledge while technology is the application of knowledge within the context of cultural and societal values (Olochukwu, 2002; Umeh, 2006). Science and technology play a major role as bases for estimating the strength or weakness of the nation and therefore an integral part of the people's culture. Developing countries suffer persistent mass failure in public examinations, electricity failure, poor drinking water, dilapidated structures in schools, indiscipline in schools, national insecurity, scarcity and high cost of domestic fuel and so on these indicate the low level of scientific and technological development.

Mathematics is an indispensable science subject that is the bedrock of any technological advancement (Ogunyemi, 2005). The importance of mathematics as a requirement for technological development has been recognized in recent years by many developing nations. Attainment of high level of academic achievement in particular is what every parent or guardian desires for his/her child. The teacher desires the same high achievement for his/her students. Schools and teachers are generally graded qualitatively by the achievement of their products. Parents, students and teachers like to associate themselves with schools that have records of high level of academic achievement.

Mathematics has made much impact on scientific and technological development (Oji, 2010). However, the continuous poor performance of students in the subject in primary and secondary schools is of great concern to stakeholders in the education industry. This may be traceable to overcrowded classes in our schools. The negligence of both government and private owners of schools has posed challenges to students, teachers

and school administrators. It is, therefore, the concern of this researcher to investigate the impact of class-size on students' learning-achievement in mathematics.

The National Policy on Education (2004) defines class-size as the population of a given class in terms of students and teacher ratio. Adeyemi (1998) reported that average class-size influences the cost of education while capital cost could be reduced by increasing average class size in schools. Nwadiani (2000) reported that the higher the class-size the lower the cost of Education but emphasized that over crowded class affects the quality of education. Ajayi (2000) also supported the report that though cost of education is reduced, it has adverse effects on quality of education. According to Igbokwe (2001), overcrowded classrooms are most manifest in mathematics classes because of the compulsory nature of the subject. Overcrowded class-rooms are class-rooms with large number of students; it is a situation of a high student teacher ratio and inadequate space for students.

Commeyas (2003) stated that effective teaching seems impracticable for teachers having large class-sizes of 50, 75, 100 or more. A study of overcrowded schools in New York City found that students in such schools scored significantly lower in both mathematics and reading examinations (Ojonuba, 2010). The recommended student-teacher ratio is 1:30 or a maximum of 1:35 (UNESCO 2000, FGN 2004). But Itedjere (2006), reported that most schools especially in urban areas have average teacher-student ratio of 1:70. He stated that during lessons it is practically impossible for the teacher to attend to students with difficulty. He compared the expected effectiveness of teacher of class ratio of 1:30 and 1:70 by giving a spoon to one child and another bucket to fill a drum with water. He concluded that the performance of children from both classes will not be same.

Dean (1994) comparing class-size in some countries such as Turkey, Norway and Netherland found that class-size ranges from 20 to 30 while UK, USA, Japan and Canada had a class-size ranging from 15 to 20. Ojerinde, (1998) and Eniayeju, (1999) stated that overcrowding in classrooms is one of the many factors that contribute to poor performance of students in mathematics. This was also the view of Adebogun (2001) who stated that a teacher in overcrowded class would eventually not be thorough in his teaching but rather add to the confusion of the learners.

**Statement of Problem**

Past and recent research works on the relationship between students' academic performance and class-size have not been able to give a clear conclusion on the effect of one on the other (Barber 1988, Talabi 1988, Correa 1993, O'connor 1994, Salau 1996, Ibrahim 1992, Shapson 2001, and Egumu 2009). While some studies have found no relationship between class-size and students' performance, others got a trend which showed that class-size has an effect on students' performance. Amidst these contradictions, it becomes necessary that more work should be done in ascertaining the effects of class-size on students' performance.

**Purpose of the Study**

The purpose of this study is to examine the effects of class-size on student's performance in mathematics and its implications on technological and educational development in Nigeria.

**Research Questions**

The following research questions was raised to guide the study

1. Is there a difference in achievement of students studying mathematics in a normal class and overcrowded class?
2. Is there a difference in achievement of boys learning mathematics in an overcrowded class and in normal class?
3. Is there a difference in the achievement of girls learning mathematics in an overcrowded class and in normal class?

**Research Hypotheses**

1. There is no significant relationship between performance of students studying mathematics in normal class-size and those in overcrowded class-size.
2. There is no significant difference between performance of boys learning mathematics in an overcrowded class and normal class.
3. There is no significant difference between performance of girls learning mathematics in an overcrowded class and normal class.

**Research Methodology**

The study adopted experimental research design. A stratified random sample was used in the study after a pre-test was administered to the students of the school chosen for the study. They were taught in evening lessons for a period of two months in a class of 35 students for normal class-size and 65 students for the overcrowded class-size. Both test and questionnaires were administered to the two sets of the students. A population of 100 JSS 3 students in 2011/2012 academic session in Ika South Local Government Area of Delta State was used. It comprises students in both private and public Junior Secondary Schools in the state. The 100 students were all selected as the sample since the population is not large.

Two instruments were used for the research; a test which comprises 30 objectives items and a questionnaire of 10 items. Both instruments were validated by experts in measurement and evaluation. While the reliability of the test was established using Kuder Richarson formular 20 (K – R20) which gave a reliability coefficient of 0.77, Cronbach Alpha was used in establishing the reliability of the questionnaire and reliability coefficient of 0.63 was obtained. To collect the data for the research, the test was administered to the two sets of students of normal class of 35 and overcrowded class of 65 students at the same time at the end of the two month's teaching exercise. The questionnaire was also administered to them. The questionnaire was duly completed. They were collected from the students for analysis. Research Question one and Hypothesis one were analysed together, using chi-square test, Z-test was used in analyzing Research Question two and Hypothesis two together, while Research Question three and Hypothesis three were also analysed using Z-test.

**Research Hypothesis One**

There is no significant relationship between performance of students studying mathematics in normal class-size and overcrowded class-size.

**Table I**

**Analysis of chi – square summary of students' performance in a normal class – size and overcrowded class – size**

| Variables | Performance of students | | | | | | |
|---|---|---|---|---|---|---|---|
| | Failed | Passed | Df | Xcal | Xcri | Level of Significant | Remark |
| **Normal Class Size** | 8 | 27 | 1 | 11.35 | 3.84 | 0.05 | **Reject** |
| **Overcrowded Class – Size** | 40 | 25 | | | | | |

From Table I, the calculated value of x is greater than the critical value hence we reject HO. It is therefore concluded that there is a relationship between performance of students and number of students in a class.

**Research Hypothesis II**

There is no significant difference between performance of boys learning Mathematics in a normal class and in overcrowded class.

**Table II**

**Analysis of Z-test summary of male student's performance in a normal and overcrowded class**

| Group | N | X | SD | $SD^2$ | df | Z-Cal | Z-cri. | Level | Rem. of sign. |
|---|---|---|---|---|---|---|---|---|---|
| Normal Class | 18 | 49.3 | 5.75 | 33.06 | | | | | |
| | | | | | 48 | 9.39 | 2.01 | 0.05 | Reject |
| Over-crowded Class | 32 | 32.12 | 6.94 | 48.16 | | | | | |
| **Total** | **50** | | | | | | | | |

From Table II above the calculated Z is greater than the critical value hence we reject $H_o$. It is therefore concluded that there is a significant difference between performance of boys learning Mathematics in a normal class and overcrowded class.

**Research Hypothesis III**

There is no significant difference between performances of girls learning Mathematics in a normal class and those in overcrowded class.

**Table III**

Analysis of Z-test summary of female students learning Mathematics in a normal class and those in overcrowded class

| Group | N | X | SD | $SD^2$ | df | Z-Cal | Z-cri. | Level | Rem. of sign. |
|---|---|---|---|---|---|---|---|---|---|
| Normal Class | 17 | 45 | 5.12 | 26.21 | | | | | |
| | | | | | 48 | 8.33 | 2.01 | 0.05 | Reject |
| Over-crowded Class | 33 | 31 | 7.21 | 51.98 | | | | | |
| **Total** | **50** | | | | | | | | |

From Table II above Z-calculated is greater than Z-critical value, hence we reject $H_o$. It is therefore concluded that there is a significant different between the performance of girls learning Mathematics in a normal class and those in overcrowded class.

**Discussion of Results**

From the analysis of data, it was observed that the number of students in a class plays a determinant role in the academic performance of students in mathematics. This was revealed in the analysis of question I and hypothesis I of the research study, students perform better when the class accommodates 35 to 40 students as compared to a class of 50 to 75. This is in agreement with Correa (1993), Babber (1988), Massey (1997), Itedjere (2006). It is also in line with the report of overcrowded class carried in New York City where it was discovered that students performed significantly poor in an overcrowded class (Ojonubu, 2010). The poor performance may be as a result of less attention paid to the students in an overcrowded class as observed by Itedjere (2006) and Ajayi (2000). However Ibrahim (1992) was not in agreement with these studies. He stated that students' performance and class – size are independent and that Class – size has nothing to do with effective teaching.

1. Students' performance in mathematics depends on the number of students in a class.
2. Students performed better in a normal class when compared to an overcrowded class.
3. That boys and girls perform differently in an overcrowded class.
4. Students develop negative perception when studying mathematics in an overcrowded class and when under tension.

**Recommendations**

From the above analysis, the following recommendations are made:

(1) Government, voluntary agencies and individuals in the education industry need to provide more infrastructure and human resources in order to reduce problem of overcrowded classes in both private and public schools.

(2) The Inspectorate Division of the Ministry of Education should ensure regular visits to both private and public schools to ensure that the minimum standards are met always.

(3) The guide lines spelt out in the National Policy on Education (2004) with regards to teacher/students' ratio for the pre-primary, primary, junior secondary and senior secondary schools should be strictly followed. Schools should be made to admit only the number of students they can accommodate for effective teaching and learning to take place in their various schools as it will enhance student's performance.

**Conclusion**

The following conclusions were drawn

1. Overcrowded class poses a great problem to students academically and socially hence there is need to address the problem for sustainable academic development and peaceful environment in our schools.

2. There is also need for provision of more infrastructures in our schools for conducive school environment which will bring about peace and development in the education sector in particular and the society in general.

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