Impacts and Solutions of Overcrowded Mathematics Class on Students’ Achievements in Schools

By

JAMES OMAIYE OJONUBAH
Department of Mathematics,
Federal College of Education,
Okene.

Abstract

This study focused on the impact of overcrowded mathematics class on students achievements in schools. The population for the study consisted of both teachers and students of mathematics in federal and state schools; including tertiary institutions, secondary schools and primary schools in Kogi state. A sample of sixty two (62) students and four (4) mathematics teachers each were drawn from tertiary institutions, secondary and primary schools. Test questions and questionnaires were the instruments used to obtain information from the students and their teachers. Statistical tools such as mean, t-test and chi-square ($\chi^2$) at 5% level of significance were used to analyze the data collected. The results of the analyses showed that overcrowded mathematics class negatively affects students in mathematics learning and Information, Communication and Technology (ICT) integration in mathematics learning improves students’ achievements in mathematics in overcrowded class-size (OCS). It was therefore recommended that ICT knowledge should be made compulsory for both mathematics teachers and the students.

Research has shown that one of the Nigeria’s educational problems is overcrowded classrooms (Ojonubah, 2004). The observed large number of students in the classes and the agitation of the teachers at all levels of education for excess workload is a justification that large class-size exists in our schools. Overcrowded classrooms are classrooms with large number of students; a situation of high student-teacher ratio and inadequate space for the students. The National Policy on Education
(FGN, 2013) defined class size as the population of a given class in terms of students and teacher. Sometimes, students are found standing outside the class in order to receive their lectures.

Unlike other parts of the world, many members of Nigerian societies still believe in and practice polygamy and then given birth to so many children as much as a woman can bear. The result of these practices is geometric increase in national population. The public awareness for education and the liberalization of primary and secondary education by the government without adequate resource to match with the sharp increase in the class size had led to overcrowded classrooms in Nigeria. The situations got worsen with low budget for education and unemployment of teachers. Mathematics is almost compulsory at all level of education, leading to high teacher-student ratio (Igbokwe, 2001). There is a general consensus among the researchers and educators that large populated cities lead to overcrowded classrooms, as there is very little classroom blocks in school to accommodate the large number of students attending school.

UNESCO (2000) and FGN (2013) recommended that student’s population in a single classroom should not exceed 1:30 or at most a maximum of 35 (teacher-student ratio; 1:35). In view of this principle which is generally affirmed by many people, one might expect strict adherence to this. But statistics from Federal Ministry of Education show that in 1994, there are 782 teachers and 18,296,202 pupils, given teacher-pupil ratio of about 1:50 in 39221 primary schools; this keep escalating annually. For public secondary schools in Nigeria as at 2005, students enrolment was 5,422,611 and 122,477 teachers; given teacher-student ratio of about 1:45. The situation is still the same till now. As a result, Dean (1994) compare class-sizes in some countries and found that Turkey, Norway and Netherland had class-sizes of 20 or more; UK, USA, Japan, Canada and Ireland had class-sizes of between 15 and 20 while France, Sweden, Demark, Austria, Italy, Luxembourg and Belgium had class-sizes below 15. He argued that few pupils per class are uneconomical as they do not make full use of space, teachers and teaching materials. Nwadiani (2000) reported that the higher the class-size the lower the cost of education but emphasized that most classrooms are overcrowded; thereby affecting the quality of education. Ajayi (2002) supported the report and stated that, cost of education can be reduced by increasing class-size.

Commeyras (2003), stated that effective teaching seems impracticable for teachers having large class-size of 50, 75, 100 or more. According to the U.S. Department of Education, “A study of overcrowded schools in New York City found that students in such schools scored significantly lower on both mathematics and reading exams than did similar students in underutilized schools.” It was also noted by Eniayeju (2001) that overcrowding in classrooms is one of the many factors that contribute to the poor performance of learners in mathematics. This was supported by Adebogun (2001) where he said that a teacher in overcrowded class would eventually
Impacts and Solutions of Overcrowded Mathematics Class on Students’ Achievements in Schools

not be thorough in his teaching but adding to the confusion of the learners. Overcrowding creates so many other problems: Students are not able to get the proper attention they needed, teachers are being overworked with the added weight of extra students to teach, more papers to grade, as well as a strain on resources. The higher student-teacher ratio, the less likely students are to be attentive. Students who need help may need to wait several minutes before the teacher can aid them and by implication, they may not get the individual attention they needed. Students who have to wait for help from a teacher would also suffer. This waiting period could lead to frustration and disruptive behaviour. A more disturbing issue is that students in overcrowded schools are more likely to experience violence. With so many students to look after, bullying and other violent act may go unnoticed for longer periods of time.

Both governments in the past and present are aware of some of these problems associated with overcrowded class-size. As such, several efforts are carried out by the governments in order to proffer solutions to the problems of overcrowding in schools; yet class-size continued to get larger. Teachers need new sets of skills in order to cope with large class-size.

Statement of the Problem
It has been observed that the development of infrastructures and subject teachers are not growing commensurate to the rising enrolment of students in our schools. As a result, large class-size at all levels of education has become part of us. Ojonubah (2004) has indicated problems associated with large class-size on students’ achievements. However, little or no attention has been paid to the co-operative study of the impacts of overcrowded class-size on students’ achievements at various levels of education and gender differences. These are gaps in literature of which form part of the problems of this research.

Several strategies for coping with large class-size have been introduced and practiced in our classrooms. Yet, there is no significant improvement in students’ achievements especially in mathematics. Information, Communication and Technologies (ICT) is one of the strategies that are rarely integrated in mathematics learning due to lack of knowledge (Ojonubah, 2011). This is the problem which this research work intends to address.

Purpose of the Study
The main purpose of this study is to:
- Ascertain the impacts of large class-size on students’ achievement in mathematics at various level of education and gender difference.

Specifically, the study tried to:
- ascertain the obstacles in ICT integration in mathematics teaching by the teachers
- Sensitize and impact knowledge and skills of ICT to mathematics teachers and students.
- Ascertain the impacts of ICT on students’ achievements in mathematics in overcrowded class-size.

**Research Questions**

The following research questions were raised to guide the study:

1. Is there difference in the mean performance of the students who learnt mathematics in Normal Class-Size (NCS) and those in Overcrowded Class-Size (OCS)?
2. Is there difference between boys and girls mathematics performance in OCS?
3. What are the effects of OCS on students in mathematics learning?
4. Is there perceived obstacles in integrating ICT in mathematics teaching by the teachers?
5. Is the number of students who failed or pass mathematics independent of ICT integration in OCS?
6. Is there difference in the mean performance of the students who integrate ICT and those who did not integrate ICT in mathematics learning in OCS?

**Research Methods**

The research is an explorative and intervention study of the impacts and solutions of overcrowded mathematics classroom using ICT in mathematics learning; among mathematics teachers and students in schools in kogi state. The research design used for this study is quasi-experimental design. This is because the groups upon which the variables were tested were selected without random pre-selection process.

**Population and Sample**

The target population for this study consisted of both teachers and students of mathematics in federal and state schools; including tertiary institutions, secondary schools and primary schools in kogi state. Thus, the population for the research consisted of all the teachers and students in the schools.

Samples were drawn from all government universities, polytechnics, colleges of education, highly populated secondary and primary schools across the state. In order to ensure a representative sample of the entire population, three schools were selected each from tertiary institutions, secondary and primary schools across the three senatorial zones of the state for the study. Thus, sixty two (62) students were selected from tertiary institutions, sixty two (62) students from secondary schools and sixty two (62) pupils from primary schools. The same samples were chosen because the
respective schools are independent of one another. In the samples, 50% were boys or girls.

**Instrument**

There were two types of instruments used for this study. The first instrument was test questions for the students. The test questions consisted of two sections. The sections were categorized as section A (easy questions) and section B (objective questions). Section A was made up of five (5) questions to answer four (4) and section B was made up of thirty (30) questions to answer all. The questions were validated by professional colleagues in mathematics. The questions were designed to compare mathematics achievements of students in NCS and OCS; and as well, mathematics achievements of students in OCS who integrated ICT in mathematics learning and those who did not.

The second instrument was a 10-item questionnaire each for the students and the teachers. The questionnaires were developed by the researcher, validated by experts in educational research and then used to collect data for this study. The first part of each questionnaire was used to collect demographic data. Following this were sections about the impacts of OCS on the students and ICT integration barriers in mathematics teaching on the part of the teachers. Respondents were asked to indicate their level of agreement on the items using a four-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree).

**Procedure for Data Collection**

The researcher assembled the three categories (i.e tertiary, secondary and primary schools) of the students and their teachers sampled for the study. Each category was separated into two groups of NCS and OCS. The NCS and OCS groups consisted of ten (10) and fifty two (52) students respectively. The OCS group was further separated into two groups named as OCSA and OCSB groups. The OCSA and OCSB groups were made up of twenty six (26) students in each group. Notably, all the groups consisted of equal number of boys and girls.

Out of the three groups created, only the OCSA group and all the sampled teachers were trained on ICT integration in mathematics teaching and learning. All the groups were then taught same topics in mathematics by the researcher and the team of the sampled teachers. NCS group was taught in a separate class while OCS group (i.e OCSA + OCSB) was taught in another class. However, only OCSA group who was trained on ICT was given the opportunity to integrate ICT in mathematics learning. At the end of the training, all the groups were examined using the same test questions. The mean scores for each group of the students were computed and noted. Also, those who failed or passed were also noted. These records were then used for the analysis.
Also, questionnaires were administered to all the students in the groups and the teachers at the end of the training and examination. The questionnaires administered were duly and adequately completed and retrieved from the respondents. Their response then form part of the data used for the analysis.

Data Analysis

The data collected were organized and analyzed using statistical tools such as mean, t-test and chi-square ($\chi^2$) at 5% level of significance for the research questions.

Research Question 1

Is there difference in the mean performance of the students who learnt mathematics in normal class-size (NCS) and those in overcrowded class-size (OCS)?

Table 1: Difference in the mean performance of the students who learnt mathematics in normal class-size (NCS) and those in overcrowded class-size (OCS)

<table>
<thead>
<tr>
<th>Group in school</th>
<th>No. of student</th>
<th>Mean score</th>
<th>degree of freedom(df)</th>
<th>$t_{cal}$</th>
<th>$t_{a=0.05}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCS in tertiary institution</td>
<td>10</td>
<td>68.00</td>
<td>34</td>
<td>2.84</td>
<td>2.04</td>
</tr>
<tr>
<td>OCS in tertiary institution</td>
<td>26</td>
<td>52.50</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NCS in secondary school</td>
<td>10</td>
<td>77.80</td>
<td>34</td>
<td>3.15</td>
<td>2.04</td>
</tr>
<tr>
<td>OCS in secondary school</td>
<td>26</td>
<td>59.20</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NCS in Primary school</td>
<td>10</td>
<td>74.50</td>
<td>34</td>
<td>3.22</td>
<td>2.04</td>
</tr>
<tr>
<td>OCS in Primary school</td>
<td>26</td>
<td>55.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(Note: s in the table indicates significant)

Table I revealed that $t_{cal} = 2.84$, 3.15 and 3.22 for students in tertiary, secondary and primary schools respectively are all greater than $t_{a=0.05} = 2.04$. Thus it can be concluded at 5% level of significance that a difference in mean performance exist for students who learnt mathematics in NCS and those who learnt the subject in OCS across all levels of education. This implies that there is significant evidence that the mean performance of students who learnt mathematics in NCS group is not the same and better than those who learnt the subject in OCS group.

Research Question 2

Is there difference between boys and girls mathematics performance in OCS?
Table 2: Difference between boys and girls mathematics performance in OCS

<table>
<thead>
<tr>
<th>Group in school</th>
<th>No. of student</th>
<th>Mean score</th>
<th>df</th>
<th>t&lt;sub&gt;cal&lt;/sub&gt;</th>
<th>t&lt;sub&gt;α=0.05&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys in tertiary institution</td>
<td>13</td>
<td>54.80</td>
<td>12</td>
<td>2.47</td>
<td>2.18</td>
</tr>
<tr>
<td>Girls in tertiary institution</td>
<td>13</td>
<td>50.10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Boys in secondary school</td>
<td>13</td>
<td>61.70</td>
<td>12</td>
<td>2.65</td>
<td>2.18</td>
</tr>
<tr>
<td>Girls in secondary school</td>
<td>13</td>
<td>57.20</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Boys in Primary school</td>
<td>13</td>
<td>53.90</td>
<td>12</td>
<td>-1.91</td>
<td>2.18</td>
</tr>
<tr>
<td>Girls in Primary school</td>
<td>13</td>
<td>56.40</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(Note: ns in the table implies not significant)

From table 2, t<sub>cal</sub> = 2.47 and 2.65 for students in tertiary and secondary schools respectively are both greater than t<sub>α=0.05</sub> = 2.18. Similarly, t<sub>cal</sub> = -1.91 > t<sub>α=0.05</sub> = -2.18 for pupils in primary school. Thus, it can be concluded at 5% level of significance that a difference in mean performance exist for boys and girls who learnt mathematics in OCS for only students in tertiary and secondary schools but no difference exist in mean performance for boys and girls who learnt mathematics in OCS for pupils in primary school. This means that mean performance difference in mathematics is significant for boys and girls in tertiary and secondary schools but not significant for boys and girls in primary school in OCS.

Research Question 3

What are the effects of OCS on students in mathematics learning?

Table 3: Effects of OCS on students in mathematics learning

The items in table 3 below were used to assess the impacts of OCS on students in mathematics learning. The students at all levels of education in OCS were asked to respond to the variables in the questionnaire and the mean values of their responses were presented in table 3 below:

<table>
<thead>
<tr>
<th>Perceived impacts of OCS</th>
<th>Tert. institution’s mean response</th>
<th>Sec. Sch.’s. mean response</th>
<th>Pri. Sch’s mean response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low maths achievement is likely OCS</td>
<td>3.00</td>
<td>3.30</td>
<td>2.80</td>
</tr>
<tr>
<td>There is lack of concentration on a task in OCS</td>
<td>4.00</td>
<td>3.50</td>
<td>3.00</td>
</tr>
<tr>
<td>In maths OCS, motivation is lacking</td>
<td>3.80</td>
<td>4.00</td>
<td>3.50</td>
</tr>
<tr>
<td>Individual attention is lacking in maths OCS</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Effective teaching is not possible in maths OCS</td>
<td>3.00</td>
<td>2.50</td>
<td>2.50</td>
</tr>
</tbody>
</table>
Table 3 revealed that all the items used to investigate the impacts of learning mathematics in OCS on students at all levels of education have mean value response greater than or equal to 2.50. This is an indication that students in respective of their educational level are negatively affected but to varying extent in learning mathematics in OCS. From the table, item 4 (i.e lack of individual attention in mathematics OCS) has the highest mean value across the three levels of the students. However, items 6, 8 and 9 have the lowest mean values for only students in tertiary institutions; items 5 and 7 have the lowest mean values for students in secondary schools and only item 5 has the lowest mean value for pupils in primary schools.

**Research Question 4**

Is there perceived obstacles in integrating ICT in mathematics teaching by the teachers?

**Table 4:** Perceived obstacles in integrating ICT in mathematics teaching by the teachers.

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Tert. institution’s mean response</th>
<th>Sec. Sch’s. mean response</th>
<th>Pri. Sch’s mean response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of awareness of the usefulness of ICT to maths</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Lack of knowledge of ICT integration in maths learning</td>
<td>2.00</td>
<td>3.30</td>
<td>4.00</td>
</tr>
<tr>
<td>Lack of training for ICT integration in maths learning</td>
<td>3.00</td>
<td>3.70</td>
<td>4.00</td>
</tr>
<tr>
<td>Lack of interest to integrate ICT to maths</td>
<td>1.00</td>
<td>2.00</td>
<td>2.30</td>
</tr>
<tr>
<td>Inadequate time in a period to integrate ICT in maths</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Unavailability of ICT facilities</td>
<td>3.00</td>
<td>3.70</td>
<td>3.70</td>
</tr>
<tr>
<td>Lack of technical support in ICT integration</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Poor funding for ICT integration in maths</td>
<td>3.30</td>
<td>3.70</td>
<td>4.00</td>
</tr>
<tr>
<td>Poor power supply in the schools</td>
<td>3.00</td>
<td>3.00</td>
<td>3.30</td>
</tr>
</tbody>
</table>
From table 4, it is cleared that the teachers across the three levels of education both agreed that lack of training, inadequate time in a period, unavailability of ICT facilities, lack of technical supports, poor funding and power supply are barriers to ICT integration in mathematics by teachers. However, the table also showed that the teachers at all levels are aware of the usefulness of ICT to mathematics learning. As well, they are generally interested to integrate ICT to mathematics learning. On item 2, tertiary institutions’ teachers disagreed with the item and differed from secondary and primary schools teachers who agreed that they lack knowledge in integrating ICT to mathematics.

Research Question 5

Is the number of students who failed or pass mathematics independent of ICT integration in OCS?

Table 5: Number of students who failed or pass mathematics in OCSA and OCSB groups.

<table>
<thead>
<tr>
<th>No. of students/pupils in group</th>
<th>OCSA</th>
<th>OCSB</th>
<th>df</th>
<th>$\chi^2_{0.05}$</th>
<th>$\chi^2_{cal}$</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of tertiary students passed</td>
<td>20</td>
<td>13</td>
<td>1</td>
<td>3.84</td>
<td>5.06</td>
<td>s</td>
</tr>
<tr>
<td>No. of tertiary students failed</td>
<td>6</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of secondary students passed</td>
<td>24</td>
<td>15</td>
<td>1</td>
<td>3.84</td>
<td>8.32</td>
<td>s</td>
</tr>
<tr>
<td>No. of secondary students failed</td>
<td>2</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of primary pupils passed</td>
<td>18</td>
<td>9</td>
<td>1</td>
<td>3.84</td>
<td>6.24</td>
<td>s</td>
</tr>
<tr>
<td>No. of primary pupils failed</td>
<td>8</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of table 5 showed that $\chi^2_{cal} = 5.06, 8.32$ and $6.24$ for students/pupils in tertiary, secondary and primary schools respectively. Thus, since each $\chi^2_{cal}$ is greater than $\chi^2_{0.05} = 3.84$, we conclude that the number of students/pupils who passed or failed mathematics depends on their ICT integration to the learning of subject.

Research Question 6

Is there significant difference in the mean performance of the students who integrate ICT and those who did not integrate ICT in mathematics learning in OCS?

Table 6: Difference in the mean performance of the students who integrate ICT and those who did not integrate ICT in mathematics learning in OCS.
The results of table 6 revealed that the OCSA groups from primary school to tertiary institution who integrated ICT to mathematics learning performed significantly better than OCSB group who did not. That is, the mean scores of OCSA groups at all levels are higher than the mean scores of OCSB groups.

**Findings**
1. The students who learnt mathematics in normal class-size (NCS) performed better than the students in overcrowded class-size (OCS).
2. In an overcrowded mathematics class, boys performed better than girls in tertiary institution and secondary school while in primary school there is no significant difference in the mathematics performance between boys and girls.
3. Overcrowded mathematics class negatively affects students in mathematics learning.
4. There are perceived barriers to ICT integration in mathematics teaching by the teachers.
5. Students’ mathematics achievements in OCS depend on ICT integration by the students.
6. ICT integration in mathematics learning improves students’ achievements in mathematics in OCS.

**Discussion**

The findings of this research revealed that students who learnt mathematics in normal class-size (NCS) performed significantly better than the students in overcrowded class-size (OCS). The significant difference in performance obtained in NCS group was in agreement with Barbar (2002) who reported that large class-size is capable of reducing students’ level of achievement and that small class-size or NCS favors better achievement of students. These are possibilities, since it was revealed by the students at all levels in these research that there are lack of concentration on a task by the students, lack of motivation and individual attention for the students, ineffective teaching by the teachers, existence of bully on the students except in tertiary institution,
stress, noise and frustration in learning mathematics, decline interest by the students in mathematics learning and insufficient learning materials for the students in OCS.

The impacts of these are more on the girls than the boys in OCS as it was clearly shown in the girls’ mathematics mean achievement which was relatively lower than that of the boys. The noticeable difference in their performances can be attributed to girls’ feminine nature; such that OCS with its associated problems is likely to hinder girls’ performance than the boys. The only exception is at the primary school level where the difference between mathematics mean performance of boys and girls was insignificant. This is because girls at this stage may have not discovered themselves.

In recognition of the associated problems of overcrowded mathematics class, mathematics teachers at all levels agreed on the awareness of the usefulness of ICT integration to mathematics learning. This finding is in agreement with the report of Elwood and Maclean (2009) when they stated that the problems of ICT integration in mathematics learning are beyond the awareness of the importance and interest. Their reports also tally with the report of this research where teachers at all levels indicated interest in ICT integration in mathematics; yet ICT integration in mathematics learning at all levels of education is still a mirage. A number of challenges was revealed in this research which were as reported by Ottevanger, Van den Akker and De Feiter (2007) when they stated that lack of knowledge of ICT integration in mathematics learning (except in tertiary institution in the case of this research), lack of training for ICT integration, inadequate time in a period to integrate ICT, unavailability of ICT facilities, lack of technical support in ICT integration are reasons for not integrating ICT in mathematics. Other major reasons are poor funding for ICT integration in mathematics and poor power supply in schools. By implication, mathematics teachers may prefer to continue to teach mathematics using lecture method which is more familiar with teachers (Ottevanger, Van de Akker, and De Feiter, 2007; Ampiah, Akyeampong and Leliveld, 2004).

However, it was revealed in this research that ICT integration in mathematics learning has a positive impact on students’ achievements in mathematics. In overcrowded mathematics class, students who integrated ICT to mathematics learning recorded less failure and performed better than those who did not. It is on this note that curriculum placed a lot of emphasis on ICT as a tool for teaching mathematics (Moess, 2007). This is because, the use of ICT creates a powerful learning environment and it transforms the learning and teaching process in which students deals with knowledge in an active, self directed and constructive way (Volman & Van Eck, 2001).

Conclusion

As long as birth control is not institutionalized in this country, large class-size most especially in mathematics will continue to be on the rise and a problem for education stakeholders. Poor mathematics achievements will be a common feature in
the schools if this is not checkmated. However, ICT integration in mathematics learning is an identifiable solution to improve students’ mathematics achievements in schools.

**Recommendations**

Based on the findings of this research, the following recommendations were made in order to overcome the problems associated with overcrowded mathematics class-size.

There should be special orientation programme for girls in schools in order to boost their morals.

More schools should be established so as reduce large class-size in mathematics to NCS.

ICT knowledge should be made compulsory for both mathematics teachers and the students.

ICT facilities should be made readily available and accessible to both mathematics teachers and the students.

There should be free training opportunities on ICT integration in mathematics learning for the teachers and the students.

Mathematics curriculum should be re-structured so as to accommodate ICT integration.

**References**


Impacts and Solutions of Overcrowded Mathematics Class on Students’ Achievements in Schools


