

Influence of Class Size on the Teaching and Learning of Biology in Senior Secondary Schools in Mubi-North Local Government Area, Adamawa State

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Abstract

This study investigated the influence of class size on the teaching and learning of biology in Public Senior Secondary Schools in Mubi-North Local Government Area of Adamawa state. The population of the study comprised of all the senior secondary schools Biology students in Mubi-North Local Government Area. A sample of 100 students was involved in the study, 35 for small class and 65 for large class drawn from Senior Secondary Two (SS II) students. Random sample technique was used to select two intact classes. The research design was quasi-experimental. The instrument used for data collection was Biology Achievement Test (BAT). Mean and standard deviations were used to answer research questions. Analysis of Variance (ANOVA) was used for hypotheses testing at 0.05 level of significance using the Statistical Package for Social Science (SPSS). The findings showed that there is no significant difference between mean scores of students' achievement in small class size and large class size on teaching and learning of biology in senior secondary schools. The results also show that male students had higher mean score gain than their female counterparts. It was recommended that teachers should present their lesson using teaching aids in large class.

Keywords: Class size, small class size, large class size and Gender.

Introduction

As the world population continues to increase, the class sizes may also have affected. Class size is considered as one of the important determinants of academic performance over which teachers in schools have little or no control. Class size according to Ronald, (2001) refers to the actual number of pupils taught by a teacher at a particular time. Ajayi, Audu and Ajayi, (2017) defined it as the number of students per teacher in a given class or the population of a class. The class size could be small or large. Large class size in senior secondary schools has made the teaching and learning of biology ineffective which resulted to poor achievement of students (Sababa, 2011). This can be attributed in part to the fact that large class sizes do not give teachers the opportunity for individualized teaching. Every student has his/her own methods of learning and should receive individualized attention from the teacher in order to learn effectively. Individualized instruction keeps the curriculum the

same for every student and enhances the optimum learning out comes, this is difficult with large classrooms.

According to U.S Agency for International Development (2007) on top of being unable to understand the learning needs of each student, teachers in larger classes may have difficulties in getting to know their student as individual. Bourke (1988) supported that students' questions to teacher in a large class may not all be answered. This comes as a result of limited time it takes to instruct a large group of students; hence teacher do not often have enough time to attain all questions from students.

However, Sparks (2010) noted that class can be said to be large when the student number is more than 25. Consequently, debate has continued in the educational literature such as stakeholders, academics, policy makers and parents over the educational consequences

of class size. Some researchers have maintained that class size is a tool which can be adopted in measuring performance of educational system (Kedney, 2013). While a number of studies have found support for the importance of class size on student achievement, others strongly disprove this claim concluding that class size has little or no impact on objective student outcomes. It has been argued that increasing the intake of senior secondary school students in a large class has numerous benefits for the schools and the country as a whole. It helps to reduce the cost of building additional classrooms of which few schools as well as the country have the resources to fund additional classrooms and teachers. Also there is usually high energy, fun and excitement in large class size in public senior secondary schools. In addition, students learn to work well in groups since group work is a necessity in large class size (Azigwe, *et al.*, 2016; Owolabi, *et al.*, 2012).

In Nigeria public schools, the teachers' eye contact with the students in class has become so reduced that some of the poorly motivated students can form number of committees at the back of the class while teaching is going on to engage in non-school discussion. Regular assignments and home works are dreaded by teachers considering the staggering number of books to mark and to record. A research by Bosworth (2014) revealed that, the correlation between class size and student achievement is complex with many disagreeing results. The study concluded that class size has tiny impact on student achievement. The findings were inconsistent with the results of Rubin (2012) in that the later indicated that as the class size increases, student achievement declines.

Teachers and students often feel more comfortable when the class size is small. Students generally feel more comfortable because they can voice out their questions and opinions. Most teachers would agree that teaching a small class come with many benefits. Conversely, in small class there will be more opportunities to engage students and keep them on task or track. Teachers in small classes give more attention to students in terms of conducting biology practical, conducting test and examination and marking of assignment scripts. Afolabi, (2002), Hoxby, (2000) & Hanushek, (2003) found out from their studies concluded that small classes do not

improve student achievement. Another stream of recent evidence based on natural experiments found that smaller classes do not help at improving student performance (Weismann & West, 2006). Alebiosu, (2000) found out that students in small classes consistently make significant achievement gains in learning than their counterparts in large classes. In the same vein Monks & Schmidt, (2010) observed that smaller classes are most direct benefits to students.

Apart from teaching and learning, gender is also implicated in students' academic achievement in biology. Gender refers to the roles and responsibilities of men and women that are created in family, societies and culture. The concept of gender is the expectations held about characteristics, attitudes, and likely behaviour of both men and women (masculinity and femininity) in the society (Ezeh, 2013). There is a general belief among Nigerians that boys are superior to girls in terms of physical build up, intelligence and reasoning. According to Okeke (2007) gender and gender stereotyping have brought discrimination in academic achievement which is a matter of great concern to educationist. Agomuoh (2010) and Ukozor (2011) found that gender influences male students' conceptual in favour of the female. This finding is in agreement with Archer and Macrae in Iwuji (2012) who stated that males' students appear to be higher in achievement than the females and also reported that boys are better at activities requiring manipulation (psychomotor skills) than girls, and that boys are more aggressive towards laboratory and project work. The finding is also in line with the view of Iwuji (2012) who stated that boys also perform better than girls in process of measuring and experimenting. The finding of the study is also supported by Oakley in Iwuji (2012) who opined that right from the childhood, a boy traditionally receives more training and encouragement for achievement than girls.

There is still little consensus on whether and how teaching and learning is affected by small and large classes in Mubi-North Local Government Area, especially in the case of students in senior secondary schools. Effective learning refers to the extent to which a classroom teacher performs his instructional roles given the necessary facilities such that students will achieve a reasonable degree of learning. But in Mubi-North Local Government Area, teaching and

learning of Biology has become ineffective in urban and rural public secondary schools. Most Biology classes in the urban secondary schools are operated under large classes because of the population explosion where teaching and learning cannot be effective while in rural areas, most of them are having small classes, this occur as a result of the curriculum that has been reviewed which stated clearly that Biology is no longer a compulsory subject. School environment which include instructional, administrative, circulation, spaces for conveniences and accessories, the teachers as well as the students themselves are essential in teaching-learning process. The extent to which student's learning could be enhanced depends on their location within the school compound, the structure of their classroom, availability of instructional facilities and accessories. It is believed that a well-planned school will gear up expected outcomes of education that will facilitate good social, political and economic emancipation, effective teaching and learning process and academic performance of the students. But in most cases these common needs are not fund in either in the rural or urban in senior secondary schools in Mubi-North Local Government Area which leads to ineffective teaching and learning. One of the most essential parts of the teaching and learning process is assessment and evaluation of students. Large classes call for large volumes of marking to be done and feedback given to students. This is a major challenge, especially in Mubi-North Local Government Area public senior secondary schools. In the face of large classes, instructors are upset with the workload and resort to traditional teaching and assessment methods. Teachers are unable to finish marking assignments, exercises and examinations on time, and this delays the feedback given to students.

The Federal Republic of Nigeria as stipulated in the National Policy on Education (2004) stated clearly that class-size in a school should contain about 35-40 maximum number of students in a class. Despite what was stipulated in National Policy on Education, some class sizes are too large with 50-100 number of students per class which leads to poor performance of students.

In spite of all these benefits, large class size may generate a lot of controversy due to the difficulty of

teachers to work with large class size. These controversies may serve as thorns that crumble the performance of students in Biology at the senior secondary school level. Some of these problems may be; teachers may find it difficult to use varied teaching methodology in teaching, students may find it difficult to concentrate in the class, Class control may be a problem which may lead students' poor performance in biology. This study would therefore determine the Influence of Class Size on the Teaching and Learning of Biology in Senior Secondary Schools in Mubi-North Local Government Area of Adamawa state.

In view of the aforementioned problems, answers to the following research questions are paramount:

1. What is the difference in the mean scores of students' achievement in small class size and large class size on teaching and learning of biology?
2. What is the difference in the mean scores of male and female students' achievement in large class size on teaching and learning of biology?

The findings of this study it would be of immense benefit to; government, state ministry of education, other researchers and curriculum developers. To the government, the results it would draw the attention of government on the need to build more classrooms and employ more qualified teachers. The results of this study would also guide the state ministry of education, in formulating policies that will guide the implementation of the provision of the National Policy on Education.

To other researchers; the findings and suggestions by this study it would create an insight for researches by identifying the consequences of the effects of class size on teaching and learning of biology and suggest possible ways to overcome such problems. Finally, to the curriculum developers, the result from this study would provide bases for designers to decide on how to design or adjust the curriculum that will suit the teachers and students learning biology.

Materials and Methods:

A quasi-experimental design was used for this study. The study used pre-test and post-test with one experimental and one control groups. The population of the study consists of 5,631 senior secondary school

students (SS II) in Mubi Education Zone. Random sample technique was used to select two intact classes with 100 biology students as research sample. A 50 item Biology Achievement Test (BAT) was adopted from WAEC past question papers 2010-2017 was used as instrument for data collection. The instrument has four options with one correct answer and three distractors. The instruments were subjected to face and content validity by two experts. The reliability coefficient was determined by testing 17 students from GDSS Maiha outside the area of study. The reliability of the instrument was obtained using the Pearson Product Moment Correlation Coefficient. A split half reliability coefficient of 0.60 was obtained. The Pearson Product Moment Correlation Coefficient is a measure of the strength of a linear association between two variables and is denoted by r . The Spearman-Brown Prophecy Formula was used to obtain a reliability of the full test which gave a value of 0.73. The study was conducted in two different schools, one school for experimental group (small class size) and one for control group large class size). The experimental group was taught Supporting Systems using lecture method of teaching while the control group was taught the same topics using the same method. The study was conducted for a period of four weeks during which the topics selected were covered. Pre-test was administered in the first week of the

research exercise before the students were subjected to treatment. The significance of the pre-test is to ascertain students' entry behaviors' on the topics to be taught and control selection bias, to make sure that the groups are equivalent at the beginning of the administration. The post- test was administered at the end of four weeks. The pre-test and post-test contain the same items arranged in different order and form the data for the study. The research question was answered using descriptive statistics of mean and standard deviation while the two hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANOVA).

Results:

Two research questions were formulated and analyzed using descriptive statistics (mean and standard deviation) while the hypotheses were tested using ANOVA. The results are presented according to research questions in Tables 1 and 2 respectively while the hypotheses are presented in Tables 3 and 4. The research questions were raised and answered using mean and standard deviation.

Research Questions 1:

What is the difference in the mean scores of students' achievement in small class size and large class size on teaching and learning of biology?

Table 1: Summary of Mean and Standard Deviation of Students' Achievement in Small Class Size and Large Class Size on Teaching and Learning of Biology

Group	N	Pre-test		Post-test		Mean Gain
		Mean	S.D	Mean	S.D	
Experimental	35	26.69	5.96	32.35	5.57	5.66
Control	65	21.20	5.55	23.42	6.52	2.22
Total	100					

The descriptive statistics in Table 1 shows that 100 subjects participated in the study. Experimental group (small class) has 35 students with pre-test mean score of 26.69 and standard deviation 5.96. The post-test mean score of the group is 32.35 with a standard deviation of 5.57. The pre-test and post-test mean score difference of the group is 5.66. The control group (large class) has 65 students with the pre-test mean

score 21.20 and standard deviation of 5.55. The post-test mean score of the group is 23.42 with a standard deviation of 6.52. The pre-test and post-test mean score difference of the group is 3.44. This implies that there is difference of (5.66) in the mean scores of student when taught biology in small and large classes. The results show that the mean score gains of senior secondary school students when taught biology in

small class (experimental group) is higher than the mean scores gain of those taught biology in large class (control group) in Mubi-North Local Government Area.

Research Question 2

What is the difference in the mean scores of male and female students' achievement in large class size on teaching and learning of biology?

Table 2: Summary of Mean and Standard Deviation of Male and Female Students' Achievement in Large Class Size on Teaching and Learning of Biology

Gender	N	Pre-test		Post-test		Mean Gain
		Mean	S.D	Mean	S.D	
Male	35	25.28	5.24	35.78	7.50	10.50
Female	30	18.10	6.87	25.76	9.43	7.00
Total	65					

Table 2 show that large class has 35 males with the pre-test mean score of 25.28 and standard deviation of 5.24. The post-test mean score of the group is 35.78 with standard deviation of 7.50. The pre-test and post-test mean score gain is 10.50. They are also 30 females with the pre-test mean score of 18.10 and standard deviation of 6.87. The post-test mean score of females is 25.76 and standard deviation of 9.43. The pre-test and pot-test mean score gain difference of the group is 7.00. This implies that there is difference of (3.5) in the mean score gain of male students taught biology in

large class size compared with the females. The results show that male students had higher mean score gain than their female counterpart.

Hypotheses Testing

The hypotheses were tested using Analysis of Variance (ANOVA).

H₀₁: There is no significant difference in mean scores of students' achievement in small class size and large class size on teaching and learning of biology.

Table 3: Summary of Analysis of Variance (ANOVA) for the Mean Scores of Students' Achievement in Small and Large Class Sizes on Teaching and Learning of Biology

Source of Variance	Sum of Squares (SS)	Degree of Freedom (DF)	Mean Square	F-ratio	Critical value of F
Between groups	143.56	1	74.50	2.31	3.15
Within group	17080.04	100	32.24		
Total	17224.18	98			

The results of the analysis in Table 3 Show that, there is no significant difference in mean scores of students' achievement in large class size and small class size on teaching and learning of biology in senior secondary schools, f-calculated is 2.31 and f-critical value for the 1-degree of freedom at 0.05 level of significance is 3.15. Since, the f-ratio (2.13) is less than the f-critical (3.15). Therefore, the null hypothesis of no significant difference is not rejected, which means there is no

significant difference in mean scores of students' achievement in large class size and small class size on teaching and learning of biology in senior secondary schools.

H₀₂: There is no significant difference in male and female students' achievement in large class size on teaching and learning of biology.

Table 4: Summary of Analysis of Variance (ANOVA) for the Mean Scores of Male and Female Students' Achievement in Large Class Size on Teaching and Learning of Biology

Source of Variance	Sum of Squares (SS)	Degree of Freedom (DF)	Mean Square	F-ratio	Critical value of F
Between groups	123.50	1	65.06	3.22	2.05
Within group	16085.10	100	20.19		
Total	16208.60	98			

The results of the analysis in Table 4 Show that, there is significant difference in male and female students' achievement in large class size on teaching and learning of biology in senior secondary schools, f-ratio is 3.22 and f-critical value for the 1-degree of freedom at 0.05 level of significance is 2.05. Since, the f-ratio (3.22) is higher than the f-critical (2.05). Therefore, the null hypothesis of no significant difference is rejected, which means there is significant difference in male and female of students' achievement in large class on teaching and learning of biology in senior secondary schools.

Discussion

The findings of the research question imply that the subjects in the experimental group (small class size) achieved higher than those in the control group (large class size) 2.22. This in line with the findings of Bosworth, (2014), Evans & Popova, (2015) who found out that students' performance is higher in small classes. Alebiosu, (2000) agreed and found out that students in small classes consistently make significant achievement gains in learning than their counterparts in large classes. The result is contrast with that of (Azigwe, *et al.*, 2016; Owolabi, *et al.*, 2012) who found out that students learn to work well and perform better in groups since group work is a necessity in large class size. This support the findings of Owwoye and Yara (2011) who found no statistical differences in student achievement between large and small classes on teaching and learning of biology at the secondary school level. This finding agrees with those of earlier investigators Afolabi, (2002), Hoxby, (2000) and Hanushek, (2003) who from their studies concluded that small classes do not improve student achievement. Another stream of evidence based on natural experiments found that smaller classes do not help at improving student performance (Weismann &

West, 2006). The study similarly found out that, male students had higher mean score gain than their female counterpart in large class size on teaching and learning of biology in senior secondary schools. These findings agreed with Joseph, John, Yusuf and Olubunmi (2015) who found out that, even though male students had slightly better performance compared to the female students in the biology, but it was not significant. It also complies with the work of Okereke and Onwukwe (2001) which revealed that the male students achieved better than the female students. Yet the findings contradict those of Udousoro (2003), who stated that there is no significant difference in the academic achievement of male and female students in biology and Jegede (2007) who found that the female students show higher anxiety towards the learning of biology in secondary schools than male students.

The results showed that students who are taught biology contents in small class size achieved better than those in large class size as presented in Table 1, that the means score of students at post-test (32.35) is significantly better compare to pre-test means score (23.42). Students' achievement based on gender does not significantly differ when taught biology in large class size as presented in Table 2, that the means score of male students at post-test (43.78) is significant better compare to pre-test (25.28) means score of female students. Students taught biology contents in large class size of male and female is statistically significant.

Conclusion

From the result of this findings, the researcher concluded that large class size affect teaching and learning of biology in senior secondary schools in Mubi-Norht Local Government Area. Students in small class perform differently even though they have

acquired the same knowledge. Male students' achievement higher in learning of biology in large class size. Based on the findings of the research, it is recommended that teachers should present their lesson using teaching aids in large class. Students should listen attentively to their teachers whether in large or class sizes.

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