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IMPACT OF CLASS SIZE ON STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTRY AMONG SELECTED PUBLIC SENIOR SECONDARY SCHOOLS IN SABON GARI LOCAL GOVERNMENT AREA OF KADUNA STATE

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Abstract

The main purpose of this study is to examine the impact of class size on students' academic performance in selected public senior secondary schools in Sabon Gari Local Government Area of Kaduna State. In this study, the effect of class size on students' academic performance and instructional strategies were analyzed. Self-administered questionnaire was used as instrument of data collection for the study. A sample of two hundred (200) students in four selected public secondary schools was used. Senior secondary two (SS2) and three (SS3) students were used for the study. The students were selected randomly and one hundred and seventy (170) questionnaires was correctly filled and collected, thirty (30) questionnaires was either not collected or wrongly filled. The analysis was done using descriptive statistics, percentage and frequencies. It was found that large class size has negative effect on students' academic performance in chemistry. It was also observed that class size has implications on instructional strategy and students' academic performance. It is recommended that the class must be sizeable to encourage teacher-students interaction for effective teaching and learning, policy makers should consider as a matter of priority the issue of increased funding of secondary school education in Nigeria and also school supervisors and inspectors should concentrate more on the number of students in each class and avoid overcrowding in classes.

Introduction

As the world population continues to increase, the class sizes are also affected. Class size are often mentioned by experts in the educational literature as having effects n students' feelings and performance, quality of school budgets and administration as well (Ruffinn, *et al*., 2018). It is considered as one of the important determinants of academic performance over which teachers in schools have little or no control. Class size may be defined as the number of students per teacher in a given class or the population of a class (Ajayi, *et al*., 2017). The duo of chemistry and science are two areas, each requiring attention for its teaching and learning and the proper dissemination of the knowledge for the advantage of humanities and society at large. Teachers of chemistry who are the epicenter in the dissemination of the knowledge tend to find it uncomfortable in the process; which is attributed to a number of factors, emphasis had been made on class size especially because of the role it play in the process of teaching and learning chemistry because of the bearing to life entirely (Tsafe, 2014). Science teaching and learning in schools was in fact, a privilege. These laudable objective teachers who could not properly and adequately disseminate the concept to the students, chemistry is one of pivotal subjects in technology, its effective teaching must be handle with all seriousness (Hadiza, *et al*., 2021).

Chemistry is a science that involves a lot of practical activities Akanbi et al (2018) observed that the most important feature of effective chemistry teaching is to support

theoretical explanations with actual practices in the laboratory. It thus requires that adequate laboratory facilities needed to be provided for effective teaching and learning of practical chemistry but due to the class size many chemistry teachers abandon practical's but rather concentrate on theoretical explanations. Chemistry teachers have applied several instructional approaches in teaching chemistry yet the derive result in students' performance has not been achieved (Eriba, 2013). Hadiza *et al* (2021) further reported that poor performance of students in chemistry among others include teachers inadequate preparations, methods adopted in teaching this subject and class size, the pursuance of how improve the performance of the student in chemistry is concern for this investigation. 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 chemistry 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, teachers may find it difficult to control the students in class and there may be insufficient teaching and learning resources. Hence the quality of teaching, assessment of students and quality of learning may be affected. Basically, earlier one of the subjects in the Nigerian public senior secondary schools which requires demonstrations and much student attention is chemistry. Therefore, the present study seeks to use chemistry as baseline to revisit the issue of class size implications on quality of teaching and learning. Findings from this study would not only contribute to the educational literature but also educational planning and policy towards school infrastructure. The study focuses on two effects of class size: academic performance in chemistry and instructional impact of class size on students' performance in chemistry at public senior secondary schools in Sabon gari Local Government Area of Kaduna state.

In most of our secondary schools in Kaduna and Nigeria today, the teacher-student ration has gone far beyond the stipulation of the National Policy on Education. Students stay more than fifty in each class, seating arrangement are altered, thereby making teaching and learning more difficult. Educational planners in Nigeria have attributed the over bloated class size due to the explosion of population of children of school age.

Akiri and Nkechi (2009) are of the opinion that ineffectiveness of teachers in classroom interaction with the learners could be responsible for the observed poor performance of learners and the widely acclaimed fallen standard of education poor academic performance of learners can be linked to poor teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habit which have attribute to poor inactivation (Akiri & Nkechi, 2009).

However, in most schools, ineffective teaching is due to conditions such as lack of resources facilitating teaching and alarming and overcrowded classrooms (class size). That resulted in to negative influence on the instructional quality in schools, translated in to poor academic performance, attitude and values. The ways learners learn affect their academic performance.

The question therefore is does class size determine the academic performance of students in Chemistry? Is the fault entirely that of teachers or students or both of them? Or is it that students of today are non-achievers because they have low intelligent quotient and a good neutral mechanism to e babel to act purposefully, think rationally and deal effectively

with academic tasks. This problem as a phenomenon, calls for intensive investigation to know the root causes of this abysmal performance as to proofer a lasting solution to it.

Purpose of the Study

This study determines the impact of class size on students' academic performance in chemistry. The following specific objectives are the main issues of the study:

i. to determine the impact of class size on students' academic performance in chemistry;
ii. to find out how class size affect instructional strategies; and

Research Questions

i. To what extent does class size affect student on academic performance in chemistry?
ii. What is the effect of class size on instructional strategy in chemistry class room?

Literature Review

Academic achievement of students especially at the secondary school level is not only a pointer to the effectiveness of schools but a major determinant of the future of youths in particular and the nation in general. The medium through which the attainment of individuals and the nation's educational goals can be achieved is learning. Learning outcomes have become a phenomenon of interest to all and this account for the reason why scholars have been working hard to unravel factors that militate against good academic performance Nwankwo, (2019). The evident recurring failures in external examinations conducted by National Examination Council (NECO) and West African examinations Council (WAEC) and subsequent low performance of undergraduates in universities in Nigeria and West Africa in general are largely traced back to poor attitudes of the secondary school students. Various factors are suspected to be responsible for these ugly developments, one of such factors is class size.

Class size as defined by Adeyemi (2018), is an educational tool that can be described as an average number of students per class in a school, while Hoffman (2010) described it as the number of students per teacher in a class. Ogbu (2019) described it as a tool that can be used to measure performance of the education system. A lot of argument has gone on the impact of class size on performance, some fingering over-bloated class size as the main factor responsible for falling standard of education, most especially in the elementary or secondary level of education in Nigeria, however others see this as mere coincidence seeing other factors as being responsible. Effect of class size on the students' academic performance has been reported. However, it is expected that a strong relationship exists between students' attitudes and performance but the impact of class size on the former has not much been investigated hence, the purpose of this research.

Understanding if there is a relationship between the number of students in a classroom and the academic achievement of the students is vital to educators. Providing the best possible learning environment for all students while making informed decisions about how to best utilize limited funding is at the center of the class size debate (Gilman & Kiger, 2013). Stakeholders at all levels of education need empirical data regarding the

significance of the relationship between class size and academic achievement. This is especially true in rural, economically disadvantaged areas where funding is even more limited than in more affluent areas. Unfortunately, making the decision of whether or not to decrease the number of students within the classroom to increase academic achievement is one that is only confounded by the abundance of contradictory studies into the topic (Addonizio & Phelps, 2010; Biddle & Berliner, 2012; Milesi & Gamoran, 2016; Slavin, 1989). To provide a baseline understanding of the research that has been conducted regarding class size and academic achievement, historical data as well as a review of the major educational studies will follow.

Class Size and Classroom Management

Historical information about class size in this country helps educational leaders understand why the need to justify per-pupil expenditures became an issue. Previous research regarding class size focused on the relationship between class size and the instructional technique utilized by teachers within differing class sizes and provided data regarding how class size affects the instructional practices of teachers. To really understand how class size affects the instructional environment, educational leaders must also analyze the amount of time teachers have to spend on classroom management as this directly affects the amount of time teachers are able to devote to instruction.

From teacher survey and interview data, Blatchford, et al. (2017) and Cakmak (2019) found that larger classes are often cited as being harder for the teachers to maintain student discipline, resulting in the focus of the classroom environment being more on student behavior than on student academic achievement. Blatchford, Edmonds, and Martin (2013) observed that students in smaller classes (average of 19 students per class) exhibited more time being utilized for instructional purposes and less time being utilized for non-instructional purposes, such as talking to one's peers about non-academic topics, than students in larger classes (average of 32 students per class). Halbach, Ehrle, Zahorik, and Molnar (2011) found that larger classes prevented teachers from being able to provide in-depth content coverage due to the loss of instructional time occurring since the teachers were spending more time handling student behavior issues. Not only do teachers cite smaller classes as having less discipline problems than larger classes, but they also stated that the more intimate environment of smaller classes enabled them to prevent behavior management issues from developing through the personal relationships they were able to develop with their students (Egelson, Harman, & Achilles, 1996; Halback *et al*., 2011).

Methodology

Descriptive survey design was used in this study. The descriptive survey was used because it aims at primarily describing, observing and documenting a situation as they occur rather than explaining them. The design has the advantage of producing a good amount of responses from a wide range of people and it involves extracting information from a large number of individual using the same set of questions through personal contact, electronic mails and the phones. The target population was public senior secondary school students in Sabon gari Local Government Area of Kaduna state. The instrument used in this study was questionnaire. Two hundred (200) questionnaires were distributed to students in four selected public senior secondary schools. Senior secondary two (SS2) and three (SS3) students were used for the study since they have had a year or

two respectively of learning experience in secondary school studying chemistry, they will therefore be in the position to answer the questions accordingly. The schools were purposely selected based on the students population and secondly the accessibility. The students were however selected randomly and one hundred and seventy (170) questionnaires was correctly filled and collected, thirty (30) questionnaires was either not collected or wrongly filled and thereby rendered invalid by the respondent.

The questionnaire was developed based on the concerns, issues and arguments raised in previous literatures about the topic. The questionnaire was structured into four parts with close-ended questions. Part one was centered on direct impact of class size on students' academic performance, and part two contains questions on the impact of class size on instructional strategies. The questions required the respondents to answer thus; strongly agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD) respectively. The questionnaires were administered personally. Subsequent to the data collection, the data were analyzed using frequency and percentage. Statistical Package and Service Selection (SPSS) was used to analyze the data.

Table 1: Impact Class Size on Students' Academic Performance

Questions	**SA**	**A**	**U**	**D**	**SD**	**M** **S.D**
Students hardly see writings on the board when seated at the back in a large class?	32((18%)	41(24%)	12(7%)	38(22%)	36(21%)	18.4 6.12
Students have the opportunity to cheat during class exercises, test and examination in large class size?	62(36%)	31(18%)	6(4%)	36(21%)	24(14%)	24 13.12
Students can do other things like copying notes in large class when chemistry lesson is going on without the teacher noticing?	37(22%)	24(14%)	10(5%)	46(27%)	44(26	18.8 9.23
Smaller class sizes allow more time for teachers to help students with practical in chemistry and develop their skills which can increase student's achievement?	54(31%)	62(36%)	10(5%)	14(8%)	20(12%	18.4 14.12
Students are very active in large class size than in small class?	2(7%)	31(18%)	18(10%)	40(23%)	56(33%)	18.2 10.43

Decision: Significant

Table 1 presents detailed results on how class size affects the academic performance of the students in chemistry.

Table 2: Impact of Class Size on Instructional Strategies

Questions	SA	A	U	D	SD
	M	S.D			
The teaching of practical chemistry skills is neglected in large class size?	25(14%) 32(18%)	38(22%) 18.4	14(8%) 8.3		51(30%)
Teachers are likely to give more class exercise to students in smaller class size than larger class size?	65(38%) 26(15%)	44(25%) 18.6	9(5%) 13.13		18(10%)
The use of audiovisual aids in large class would make lessons more interesting?	15(8%) 62(37%)	41(24%) 17.2	9(5%) 13.22		21(12%)
The atmosphere in large class size is always teacher centered with passive students?	51(30%) 15(8%)	40(23%) 18.4	25(14%) 8.44		29(17%)

Decision: Significant

From Table 2, it could be observed that class size has some relationship with instructional strategy be it positively related or negatively related.

Discussion

The result in Table 1 shows that a good number of the students agree that there is a high possibility of cheating during examination in a large class; this was confirmed by 59 percent of the respondents. This means that the true performance of the students cannot be ascertained since poor students stand to benefit from the act of cheating. Also, 46 percent of the students indicated that they can hardly see the writings on the board in a large class. However, this figure was contradicted by 49% of them who indicate that they can clearly see writings on the board in a large class. Additionally, it can be observed that large class makes it difficult to be active in class. This was revealed from 68 percent of the students. Furthermore, 79 percent of the total respondents agreed that smaller class sizes allow more time for teachers to help students develop appropriate practical skills which can increase student's performance. This means that in large classes it would be difficult for teachers to help students to develop skills to increase their performance. The findings have largely demonstrated that large class size has negative effect on students' performance in chemistry. Surprisingly, 69 percent of the respondents disagreed that they can do other things like copying notes in large class when chemistry lesson is going on without the teacher noticing them. This may be attributed to the fear of being punished when caught and the desire to pay attention in chemistry class due to its perceived ambiguity of the subject.

There is a strong reason to conclude that large class size could negatively affect students' performance. Students are likely to lose concentration, focus and even attention from teachers. This confirms the assertion that some small class pedagogies which could include project work where students are individually monitored and provided with continuous feedback on investigative tasks are designed to develop higher order thinking skills (Altinok and Kingdon 2012; Bosworth, 2014) in Ruffin (2018). Consistent with some earlier studies, it has been established in this study that small class size provides learning experiences that facilitate increased collaboration and communication among students, provide helpful learning opportunities and foster student metacognitive skills through the development of information discovering and help-seeking behaviors, Altinok and Kingdon (2012); Bosworth (2014) in Ruffin (2018), through practical orientation and class participation. The results further confirmed the study by Azigwe et al (2016) which indicated that in a large class teacher find it difficult to teach effectively and efficiently leading to students not being able to also learn effectively since low participation in class activities were possible.

The result from Table 2 shows that teachers do not neglect the practical aspect of chemistry due to large class size. 64 percent of the students disagreed that the teaching of practical skills is neglected in large class size. This is consistent with the findings by Aturupane et al. (2013) in Ruffin (2018) which revealed that teachers are able to use teaching strategies that fit the large class size such as group work and working on projects rather than employing pedagogies like collaborative learning and the systems and structures needed for working effectively within the context of collaborative learning are embedded in the careful sequencing of activities that follow a specific design to promote learning. This means that in terms of instructional practicability and ways of teaching, class size has no significant relationship with respect to instructional strategy. The students revealed further that the use of audio-visual aids in large class size would not be appropriate and could not make lessons interesting and 66 percent of the students held this view.

The findings further showed that 75 percent of respondents held the opinion that teachers are more likely to teach with very little or no class exercise in a large class size. Regular exercise is an important instructional strategy which helps increase academic performance of students (Hattie, 2009) in Ruffin (2018). Also, 62 percent of the total respondents accepted that in large classes, the atmosphere is teacher centered with passive students. This is evidence that class size has implications on instructional strategy and students' academic performance but Stephens et al. (2014) stated that there is no guarantee that smaller classes will automatically lead to more productive works. Similar to the evidences found in this study, Amedahe (2016) noted that discussion time becomes scrappy among students in large classes and instructors may rely on passive lecturing, assign less written homework or fewer problem sets, and may not require written papers.

Conclusion

The study concludes that large class size contributes to poor academic performance, it results to poor teaching methods, instructional materials are not used properly in a large class size because, it is very hard for the teacher to show the students the instructional material especially those at the back. Also most times the teacher always get tired after walking around the class once, Classroom management is always hard, National policy on education approved 40 to 45 students per class, Merging two classes (A and B) is not

good and not be done in anyway, Supervisors are not interested in classroom size and number of students in the class, all they are after is the lesson note, inadequate learning environment and improper class size makes the students to lose concentration from the lesson.

Recommendations

The following recommendations were generated from the findings:

i. Policy makers in Sabon Gari L.G.A should consider as a matter of priority the issue of increased funding of secondary school education in Nigeria. Increased funding will help to ameliorate problems facing academic performance in secondary schools.
ii. School supervisors and inspectors in Sabon Gari L.G.A should concentrate more on the number of students in each class and avoid overcrowding in classes.
iii. The class must be sizeable to encourage teacher-students interaction for effective teaching and learning.

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