CLASS SIZE AS PREDICTOR OF MATHEMATICS ACHIEVEMENT AMONG JUNIOR SECONDARY SCHOOL STUDENTS OF CHANCHAGA LOCAL GOVERNMENT AREA NIGER STATE

BY

USMAN Abdullahi

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ABSTRACT

The study was undertaken to investigate class size to predict the effectiveness of teaching and learning of Mathematics and also students' achievement in the study of Mathematics using some selected public and private junior secondary schools within Chanchaga local government Area of Niger state. Six research questions were raised to guide the study. The study employed multimethod research design (one-week observation and three-weeks experimental exercise). The population of the study comprised of 7600 junior secondary students and 107 junior secondary school Mathematics teachers. 4 schools were randomly selected and used as sample for the study. Two instruments were used for collection of data, a well-structured observation assessment sheet was constructed to evaluate rate of class room management and control, rate of attention and supervision received from teachers by their students and the rate of individual student involvement and participation during classroom instructions in overcrowded and reduced class sizes, and the second instrument used was a Mean Achievement Test administered to students of the four selected schools in order to ascertain the rate of students achievement in overcrowded and reduced class sizes. The data from the two instruments were collected and analyzed using mean, mean percentage and standard deviation. The findings of the study revealed that a strong relationship exists between class size, effective teaching and learning and also students' achievement in the study of Mathematics. The researcher recommended that governments, the ministry of education, policy makers, parent/teachers association and other non-governmental organizations should contribute respectively in renovating schools, building more classes, employing more teaching staff and providing schools with necessary facilities needed to make learning environment conducive as well as make teaching and learning effective.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

For many years, educators, politicians and people in general have debated on the number of students a teacher can work with, effectively to ensure students adequate learning. Although most people would agree that having few students to teacher ratio would benefit the students academically, many will also argue that it does not guarantee success and would cost school a great deal or more money. Prior to reviewing the research, a clarification of terms associated with the research context is necessary. Students achievement applies to making sure all students have the necessary skills and knowledge to function in school so that they may also succeed as adult (National Education Association, 2002).

The increase in population in a school affects the class size. The performances of students become an issue. There is still little consensus on whether and how teaching is affected by small and large classes, especially in the case of students in the early secondary schools. Class size is almost an administrative decision over which teachers have little or no control of, much less the students.

Class size refers to an educational tool that can be used to describe the average number of students per class in a school (Ajayi & Audu, 2017). Class size is also known to be the number of students in a given course or classroom, specifically either the number of students being taught by an individual teacher in a course or classroom or the average number of students being taught by a teacher in a school or educational system. The term may also be the number of students participating in learning experience. There exist large and small class sizes in schools.

Since the twenties, scholars, teachers and experts in the domain of education, have been concerned with the investigation of the factors associated with the teaching and learning processes. One of the main issues has been the impact of class size on learner achievement.

According to Messineo et al. (2007) “Interest in the impact of class size on teaching and performance has resulted into rather controversial notions, definitions and opinions. The intersection of the factor of class size with a variety of other factors was one of the reasons behind such a controversy. There was not a consensus among researchers about the definition of large class. Kerr notes that the definition differs according to the discipline, the level and nature of the class and the perceptions of teachers and individual students. He argues that a large class may include an introductory class of 700 students or an upper year seminar with fifty. Similarly, in some countries, 25-30 students per one teacher could be considered large, while in other countries this is seen to be normal or even quite small. Mulryan-Kyne (2010) admits that it is not that easy to determine exactly what constitutes a large class, mainly in a tertiary level education context.

Opinions have then varied across disciplines and education levels. In addition to the number of students, other factors such as the teacher competency, the availability of adequate and proper resources have been associated to the investigation of the impact of class size on student learning. Class size, according to Blatchford, Moriarty, Edmond and Martins (2002), is a very important environmental factor that influence teachers and pupils in a number of ways, however, the other contextual factors should not be ignored. In the same vein, Mulryan-Kyne (2010), argues that there are several factors that should be considered as relevant such as the nature of the program or course being taught, the accommodation and facilities that are available and the resources needed. For example, meeting the needs of a class of 50 in a science laboratory designed for 30 is likely to be more challenging than presenting a history lecture to 220 students in a lecture room designed for

200. “The great challenge to experts, scholars and teachers were to provide sufficient evidence to identify the connection between class size and student achievement” (Mulryan-Kyne, 2010).

The relationship between class size and academic performance has been a perplexing one for educators. Studies have found that the physical environment, class overcrowding and teaching methods are all variables that affects student achievement (Molnar, 2000). Other factors that affects student achievement are school population and class size (Gentry & Swift, 2000). The issue of poor academic performance of students in Mathematics in Nigeria has been of much concern to all and sundry. The problems are so much that it has led to the decline in standard of education. Since the academic success of students depends largely on the school environment, it is imperative to examine the impact variables of class size and school population on the academic performance of students in Mathematics in secondary school. Large class size, quality of teaching and instructional delivery, overcrowded classrooms have increased the possibilities for mass failure and make students to lose interest in Mathematics. This is because large class size does not allow individual students to get attention from teachers which invariable lead to low reading scores, frustration and poor academic performance. In order to better understand the skill levels of students, it might be necessary to evaluate factors affecting their performance. These factors can include; school structure and organization, teacher’s quality, curriculum and teaching philosophies (TIPS, 2003).

The idea that school population and class size might affect student performance is consistent with the growing literature on the relationship between public sector institutional arrangement and outcomes (Han & Ryu, 2017). The purpose of this study is to further examine the relationship of class size, school population and student academic achievement.

The National Policy on Education (Revised 2004) states that mathematics is one of the core curriculum which every student must take in addition to his/her specialties. Continuing, the policy stated that those core subjects are basic subjects which will enable a student to offer arts or science in Higher Education. The implication of the compulsory nature of the subject demands much especially from the teacher. Despite of the importance of Mathematics, there is a general low-level of student performance in Mathematics in examination, therefore the class-size has been identified as the cause of this low performance.

As class size increase, achievement decreases, students who would score at about 63rd percentile on a math test when taught individually, would score at about 37th percentile (when taught) in a class of 40 students. A follow-up study by the Educational Research Development Council using meta-analysis was published in 2000. Non-achievement effects on class size such as effects on students, effect on teachers, and effects on the instructional environment and processes ever investigated.

The results indicated that decreasing class size had a beneficial effect on the classroom environment. In the review, class size was shown to have a more "substantial effect" on teachers than on students or the instructional environment. The effect of class size was more significant for students below the age of twelve (NERDC 2002).

Filby published "what happens in smaller classes?" A summary report of a field stud" in 2008 they reported that teacher attitudes improved in smaller classes. Teachers in reduced class size environments were able to reach a child and help him/her when the help was needed, in larger classes the teachers felt that they could not get there to help. These teachers stated that with large class assignment, the workload was heavy and overburdened. When such overloading decreases into smaller classes, the teachers were able to relax more, feel less frustrated, and were able to

create a more positive learning climate that also discourage classroom disruptions. They found that the attention rates for students increased as class size decreased. The range of those paying attention increased from 56 percent in large classes to 72 percent in the smaller classes.

Some researchers suggested that class size reductions alone do not necessarily bring about change, however, teachers experience improves conditions, and this development brings about greater enthusiasm on the part of teachers. Such enthusiasm can lead to changes that benefits everyone. Teachers usually do what they are inclined to do anyway however, smaller classes allow them to do a better job. This was supported by an earlier teacher survey. The Nigeria Research Council Conducted a teacher opinion poll in 2000. It reported that more teachers named lowering class size than any other item as the one improvement that would create better teacher morale and jobs satisfaction. Teachers also saw improvement in the behavior of students, increased productivity, and more hand-on participation learning.

The National policy on education revised (2004) stipulates the maximum number of students per class to be 30-40 students. For effective teaching, teacher/students ratio should conform to this stipulated order. Today class size has bloated due to explosion of population of children of school age. There is a limit to which a teacher can effectively control and manage, if the limit is been exceeded, it will affects the achievement of the school objectives. And this spurs the researcher into carrying out this project on "class-size as predictor of mathematics achievement among some selected Junior secondary school students in Chanchaga Local Government Area of Minna, Niger State".

1.2 Statement of the Research Problem

Several scholars have proposed various factors responsible for the poor performance of students in mathematics, few researches have been dedicated to the correlation between class size, school population and academic achievement of students in mathematics due to the geometrical increase in student enrollment in our secondary schools with corresponding arithmetic increase in the staff strength. Thus, this researcher seeks to explore and find answer to the following questions:

1. How teachers manage and teach a class with many students of about 40-60.

2. whether teachers in large and small class sizes differ in time spent on teaching, individual or group attention or instructional activities overall.

3. How teachers cope with proximity i.e does the teacher goes with the students individually.

4. How teachers in large and small classes differ in more qualitative dimensions of teaching and concentration.

1.3 Aim and Objectives of the Study

The main aim of the study is to investigate class-size in order to predict the effectiveness of teaching and learning of Mathematics and also student academic achievement in our Junior secondary schools in Chanchaga Local Government Area of Niger State. Specially, the objectives of this study among others includes the following;

i. Determine the average class size of Junior secondary school students in Chanchaga Local Government Area.

ii. Ascertain the extent to which class size affects the teaching and learning of mathematics in junior secondary schools in Chancghaga Local Government Area of Minna, Niger State.

iii. Find out if students learn more in a reduced class size of about (25-30) students or If they learn more when the class size is above (25-30) students.

iv. Find out if teachers teach more effectively when the class-size is between (25-30) students or above.

v. Find out if the students receive maximum attention and supervision from the teachers when the class-size is between (25-30) students or above.

vi. Identify the policy guiding teacher-student ratio in Junior secondary school in Chanchaga Local Government Area.

These, are with a view to identifying the problems of large class-size i.e (40-60) students and to possibly provide necessary suggestion for improvement.

1.4 Research questions

These research questions were formulated in other to guide the course of investigation in the study. Thus, the researcher seeks to ascertain answer to the following questions;

1. What is the total number of junior secondary schools in Chanchaga local government area of Niger State?
2. What is the average total number of junior secondary school Mathematics teachers and students in Chanchaga local government area of Niger state?
3. Do teachers in reduced class sizes differ from teachers in high populated classes in terms of classroom management and control?

4. Do students in reduced class sizes differ from students in high populated classes in terms of maximum attention and supervision received from teachers during classroom instructions?
5. Do students in reduced class sizes differ from students in high populated classes in terms of rate of involvement, participation and attainment of instructional objectives?
6. Does class size has any impact or effect on junior secondary school students' achievement?

1.5 Significance of the Study

The findings of this study will be beneficial to the students, teachers, educational policy makers and future researchers. The study will be of immense benefit to the teachers as its findings will enable them to know their students' problems as well as helping in solving the problems. At the same time give their students the maximum attention as at when the need arises. It will also expose the teachers of the needs to follow the stipulated policy of student per teacher ratio. (i.e student/teacher ratio) as stipulated in the national policy on Education.

This study is also important such that its findings will help teachers in identifying the reasons for the low academic performances of students in Mathematics in classes with high population and how they can address the problems. It will provide comprehensive information for educational planners, educators, and parents on how they can assist students to cope in large classes.

This study has the potential to guide educational policy makers in realizing the present situation of the educational system in other to make provisions and create necessary strategies that may improve the situation through adopting better policies. The study is also likely to guide in developing the educational standard for student/teacher ratio.

This research work will lead to further in-depth study on the impact of class size and school population on the academic performance of students in Mathematics and other subjects. It will serve as a contribution to knowledge in the subject area. In this regards, it will be useful for upcoming researchers who might want to carryout research in related area.

1.6 Scope of the Study

The study will focus on the effect of class-size on junior secondary school students' achievement in mathematics in Chanchaga Local Government Area. The scope of the study will be very wide if it has to be carried out in all the junior secondary schools in Chanchaga Local Government. Based on this, the researcher will therefore conduct a random sampling method in selecting the participants of this study i.e (junior secondary school students & teachers).

1.7 Operational Definition of Terms

Class-Size: refers to an educational tool that can be used to describe the average number of students per class in a school or in an educational setting.

Mathematics: implies the science that deals with the logic of shape, quantity and arrangement.

Academic Achievement: This is regarded as the display of knowledge or skill attained by student over a given period of time or interval.

CHAPTER TWO

2.0 LITERATURE REVIEW

This researcher is reviewing previous research that has been done that implicates that class size has an effect on student achievement. Numerous research pieces were examined. Throughout existing years, various studies and methods have been used to investigate whether or not there is a true correlation between class size and students' academic achievement.

After reviewing these various studies, this researcher has been able to use them as factors in discovering the extent to which class size effects or affects students' achievement. Thus, this chapter therefore focuses on reviewing related literatures to the study, which throws more light on the problem under investigation. It is categorized into these sections:

Conceptual Framework,

Theoretical Framework,

Empirical Study, and

Summary of Literature Review.

2.1 Conceptual Framework

In the conceptual framework, the researcher desires it necessary to explain some relevant terms in the topic under investigation. These are: concept of class size; predictor; concept of mathematics; concept of academic achievement, **c**lass size and student/teacher ratio in correlation with student achievement and junior secondary school student.

2.1.1 Concept of Class-Size

A formal teaching of mathematics takes place in the classroom. Mathematics teaching audience could vary from one to several people. In order words, a mathematics class could be small, normal, or large. A mathematics class is large when its membership swallows up the available resources and creates immediate management problems for the teacher and impairs the learning process.

Mathematics is one of the most phobia generated subjects in the school curriculum. This can be partly attributed to the way it is introduced to learners. Teaching and learning mathematics are complex tasks but students' motivation can be highly influenced by instructional practices. According to a study conducted by (Leong KE, 2013), teachers selected immediate classroom situations as one of the factors that influenced the understanding of good mathematics teaching. Teaching large classes has been found to adversely affect morale, motivation and self-esteem of teachers National Centre for Education Statistics, 2000. A consistent relationship was found between class size and teaching by (Blatchford et al, 2003), they found that the larger the class the more non-teaching time.

Many studies have also shown that class size is an important factor that determines how much students learn. (Sa'ad et al, 2014) concluded that overcrowded mathematics class is one of the causes of poor performance in mathematics in public schools in Azare metropolis of Bauchi State, Nigeria. This finding agrees with the findings of (Owoeye & Olatunde, 2011) that class size is directly related to the performance of students. It was suggested that class sizes should be moderate in order to help students who may have problems understanding the concept being taught. Other studies suggested that class size improves students' academic achievement. (Babcock & Betts, 2009) found that teachers are able to offer special help to low-achieving students and effectively

control the low-effort students in smaller classes. (Blatchford et al, 2011) in a study found that there was a tendency for more on task and less off-task behavior as class decreased.

In Nigeria, the range varies from 40 plus to 200 depending on the level of the educational system. Virginia (1989) reports that in Japan, the average largest class size is 45 and the normal 38, while small class sizes range from 24 to 19. She went further to assert that small class size falls between 4 and 7. The introduction of UBE into the Nigerian nation is one of the steps in improving the literacy level of the Nigerian citizens. This is because UBE is directed towards sustainable and efficient education of all cadre of the Nigerian populace. The broad objectives of UBE are such that there would be increased enrolment in the school system. In other words, the implementation of UBE will lead to an astronomical rise in educational enrolment. The rise in the number of school children will mean an increase in class size and, thereby a rise in the pressure on the class teacher, Nnaji, (2009).

At the 33rd meeting of the National Council of Education held in Bauchi, a team from the World Bank conducted a preliminary survey on preliminary education in Nigeria, preparatory to programization confirmed the shortage of everything, especially of classrooms, books, and teachers. This shortage of classrooms leads to very large classes up to 100, to even 200 pupils. Nwosu, (2015) stated that the teacher/pupil ratio advocated in the National Policy on Education (1997) for primary schools is 1:40 for transitional period and 1:30 as the target figure. Ironi (1989) in an Appraisal of Research on the National Policy on Education in "Implementation of National Policy on Education" noted that in the school system, there are many students to teach and that this itself is a problem. Such management problems could be aptly put in the words of Nnaji, (2009) thus: "With such a high-teacher-student ratio, the teacher has no option but to adopt self-

help measures, which are in no way ideal or adequate for appropriate language learning". They suggested a number of coping measures, which include:

1. Teaching the group together using a large classroom.

2. Using the lecture method since it is most convenient in such an unavoidable situation. In this method which is basically information giving, the teacher rushes through everything without the students mastering anything.

3. Accepting choral response since individualized attention and learner-centred approach is virtually impracticable.

4. Refusing to give the required practice, which is essential for such skill, as speaking and writing.

5. Avoiding giving assignments and individual work because of the enormous load in correction and feedback.

6. Giving very few assignments without correcting them at all or keeping these assignments for such a long time that their correct effect is lost on the students. Other impeding variable which makes teaching impossible is the lack of concentration and teacher-pupil discomfort in the face of such staggering odds.

Mintz et al. (2005) a policy analyst at the C.D. Howe Institute, in one of the education papers on school class size: "Small Isn't Better", pointed out that few policy issues in elementary and secondary education generate more heat than class size. Teachers and their unions are nearly unanimous in their support for smaller class sizes as a means of improving class behavior and students' performance. In each of the five National Issues in Education Polls Commissioned by the Canadian Teachers' Federation (CTF) between 1997 and 2004, Canadians cited class size

reduction as the most pressing education spending priority. In the October, 2004 poll, some 76 percent of those surveyed said that public school classes are too large.

On the other side of the debate, some economists, researchers and education specialist cite a lack of empirical support and considerable costs as their reasons for doubting that class size reduction benefits students. Addonizio and Phelps (2000) established that the policy of reducing class size is cost effective than other feasible methods of improving students' achievement.

2.1.2 Predictor

According to American Heritage dictionary of English language, the verb (predict) means, that which tells about something in advance of its occurrence by means of special knowledge or inference.

In a non-statistical sense, the term "prediction" is often used to refer to an informed guess or opinion. A prediction of this kind might be informed by predicting person's abductive reasoning, inductive reasoning, deductive reasoning, and experience; and may be useful if the predicting person is a knowledgeable person in the field (Butterworth & Micheal, 2014).

Thus, this researcher intends to predict and forecast students' achievement in mathematics in some selected junior secondary schools in Chanchaga local government using class size.

2.1.3 Concept of Mathematics

Mathematics is the science that deals with the logic of shape, quantity and arrangement. Math is all around us, in everything we do. It is the building block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering, and even sports. Since the beginning of recorded history, mathematic discovery has been at the forefront of

every civilized society, and in use in even the most primitive of cultures. The needs of math arose based on the wants of society. The more complex a society, the more complex the mathematical needs. Primitive tribes needed little more than the ability to count, but also relied on math to calculate the position of the sun and the physics of hunting (Cox, 2013).

Traditionally it is defined as the scientific study of quantities, including their relationship, operations and measurements expressed by numbers and symbols. In mathematics dictionary by James & James it has been defined as the science of logical study of numbers, shape, arrangement, quantity, measure and many related concepts. Today it is usually described as a science that investigates abstract structures that it created itself for their properties and patterns". According to Wikipedia, "Mathematics is the study of quantity, structure and space". Mathematics seeks out patterns and uses them to formulate new conjectures. Aristotle has defined mathematics as "The science of quantity".

Benjamin Pierce defined it as "Mathematics is the science that draws necessary conclusions". Haskell Curry defined mathematics simply as "the science of formal systems". Albert Einstein stated that "as far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality". More recently, Marcus du Sautoy has called mathematics "the Queen of Science … the main driving force behind scientific discovery". Thus although all most all great mathematicians stated something for it, no generally accepted definition could be produced. A little attempt has been done in this article to define mathematics in a single sentence and exact form, which will be accepted for centuries without any counter example.

In the last decade issues of disadvantage and mathematics achievement have moved to the center of policy-makers' agenda and academic debate. Underachievement in mathematics is particularly

recognized as a major problem in schools serving disadvantaged communities in South Africa (Allie, 2018). Mathematics is a pillar of almost all the streams in academic sectors. Given the important role mathematics plays in tertiary education and most careers, it is not only beneficial but also essential to establish some of the factors that facilitates achievement in mathematics in disadvantaged schools. This study will hopefully facilitate the quest to improve achievement in mathematics in disadvantaged schools and establish what schools can learn from one another. Although there are studies conducted in other countries regarding factors that facilitate achievement in mathematics.

In an effort to identify the causes for low achievement in mathematics, some researchers (Castkle & Attwood, 2001) have suggested that achievement in mathematics in secondary schools is influenced by a number of variables. These variables include learners' abilities, attitudes and perceptions, family and socio-economic status, parent and peer influences, school related variables such as poor learning environment, learning cultures, past racial discrimination and low expectations by principals and teachers. According to Singh et al. (2002) many of these variables are home and family-related and thus are difficult to change and beyond control of educators. Such factors alone cannot account for the lack of mathematics achievement and persistent differences among traditionally disadvantaged learners. In particular, these explanations fail to account for intra-group achievement differences and the success of some South African disadvantaged learners in spite of these background factors. Some well- achieving disadvantaged learners come from the same communities and share similar socio -economic backgrounds, schools and classrooms.

In investigating factors that facilitate achievement in mathematics, variables related to school, learners and teachers were reviewed. In this regard Balasubraniian et al. (2005) in their literature review suggested that when investigating factors that facilitate achievement in science and

mathematics, a more extensive investigation should consider learner, teacher and school variables. The chapter concludes with some learning theories relevant to secondary school mathematics learning and teaching.

2.1.4 Concept of Academic Performance and Achievement

Academic achievement was once thought to be the most important outcome of formal educational experiences and while there is little doubt as to the vital role such achievements play in student life and later (Lubinski, & Benbow. 2021), researchers and policy makers are ever increasingly turning to social and emotional factors, as well as the relationships among them, as indicators of student well-being and psychological development (Chernyshenko et al, 2018; Frydenberg et al, 2017; Moore et al. 2006). Indicative of this movement is the recent addition of social and emotional measures to established Organization for Economic Co-operation and Development (OECD) measures (e.g. PISA, OECD, 2019). These measures include, according to Chernyshenko et al. (2018), emotional regulation (e.g. stress resistance, optimism), task performance (e.g. motivation, persistence, self-control) and compound skills (e.g. metacognition, self-efficacy). Consistent with this theme, you will find six quality empirical studies in this issue that examine some of the complexities of such factors, some related to academic achievement, others not, having a legitimacy in their own right.

Academic achievement plays a role in the studies by Colmar et al. (2019) and Martinez et al. (2019). For Colmar et al. (2019), the capacity of elementary school students to respond to academic setbacks, academic buoyancy was not predictive of academic achievement. However, academic buoyancy effects were demonstrated for both reading and mathematics achievement in Australian students when mediated by self-concept. Psychological capital resources (e.g. efficacy, hope,

optimism, resilience) are foregrounded in Martinez et al. (2019) examination of Spanish/Portuguese university students' engagement and achievement. Their findings showed that students who report being engaged in learning are more likely to be users of psychological capital who in turn are more likely to achieve higher academically.

Academic achievement is integrated also into the work of Eakman et al. (2019), where the focus is on the complexities of the emotional and social lives of returned veterans and service personnel. In a comprehensive study, learning climate support, post-traumatic stress, depression, self-efficacy and academic problems are linked to achievement showing, among other findings, that self-efficacy, less academic problems and autonomy supporting learning environments are positively related to achievement. Moreover, these factors persisted irrespective of depression or post-traumatic stress levels.

Overall, research shows that students in smaller classes perform better in all subjects and on all assessments when compared to their peers in larger classes. In smaller classes students tend to be as much as one to two months ahead in content knowledge, and they score higher on standardized assessments. It is worth noting, however, that some studies analyze student assessment results in terms of individual student performance and others in terms of class-wide aggregated performance, which can obscure the differences in individual students' performances.

These positive effects of small class sizes are strongest for elementary school students, and they become more powerful and enduring the longer students are in smaller classes. That is, students who have smaller classes in early elementary grades continue to benefit from this experience even if they are in larger classes in upper elementary or middle school (Bruhwiler & Blatchford, 2011; Chingos, 2013).

Despite the general positive effects of smaller classes, the benefits are not consistent across all levels and populations. Small classes make the biggest difference for early elementary school students, while for many high school students smaller classes do not make a significant difference in academic performance. However, for minority and at-risk students as well as those who struggle with the understanding mathematics, smaller classes enhance academic performance. Class size also shapes the quality of writing instruction at all levels, including college, because smaller classes are essential for students to get sufficient feedback on multiple drafts. Not surprisingly, smaller writing classes increase retention at the college level (Blatchford et al., 2002; Horning, 2007).

However, many researchers have the believe that there are other important factors that constitutes to class-size population as well as bring about the law academic performance of students in mathematics especially in their junior secondary school level. Factors which include student engagement, long term success, teacher retention and also the cost factor. Hence it is therefore necessary to briefly look at these important factors.

Student Engagement

Academic performance is important, but it is not the only measure of student success. In the area of student engagement, findings consistently show the value of small classes. Students talk and participate more in smaller classes. They are much more likely to interact with the teacher rather than only listening passively during classes. Not surprisingly, students describe themselves as having better relationships with their teachers in smaller classes and evaluate both these classes and their teachers more positively than their peers in larger classes. Students display less disruptive behavior in small classes, and teachers spend less time on discipline, leaving more time for instruction. Specifically, teachers in smaller classes can diagnose and track student learning and

differentiate instruction in response to student needs. In smaller classes students spend less time off-task or disengaged from the work of the class, and they have greater access to technology. Research also suggests that smaller class sizes can help students develop greater ability to adapt to intellectual and educational challenges (Bedard & Kuhn, 2008; Dee & West, 2011).

Long-Term Success

The benefits of smaller classes extend beyond test scores and student engagement. In addition to the longer-term positive attributes of small class sizes in the early grades, benefits include continued academic and life success. Researchers have found that reducing class size can influence socioeconomic factors including earning potential, improved citizenship, and decreased crime and welfare dependency. The beneficial effects of being assigned to a small class also include an increased probability of attending college. This benefit is greatest for underrepresented and disadvantaged populations. While the increased probability for all students is 2.7%, while it is 5.4% for African American students and 7.3% for students in the poorest third of US schools (Dynarski et al, 2013).

Teacher Retention

Teacher quality has, for some time, been recognized as the most important variable in the academic success of students. Recruiting and retaining effective teachers has become increasingly important as school districts impose mandates about student test scores and overall academic performance. Class size has an effect on the ability to retain effective teachers because those with large classes are more likely to seek other positions. Research indicates, however, that instead of rewarding effective teachers by decreasing their class size, administrators often increase the class sizes of the

most effective teachers in order to ensure better student test scores (Barrett & Toma, 2013; Darling-Hammond, 2000; Guarino et al, 2006).

The Cost Factor

One of the most common arguments against smaller class sizes is finance. School districts claim that they cannot afford to reduce the size of classes because it would be too expensive. However, it is also expensive when students leave public schools to attend private ones. Research shows that class size is a significant factor in parents' decisions to send their children to private schools. Despite the enormous emphasis on test scores in public schools, parents report little interest in these scores when choosing a school. Instead, two of the top five reasons parents give for choosing a private school are "smaller class sizes" (48.9 %) and "more individual attention for my child" (39.3%). The other three reasons are better student discipline, better learning environment, and improved student safety, all of which are influenced by class size (Cheng et al. 2016).

2.1.5 Class Size and Student/Teacher Ratio in Correlation with Students Achievement.

Over so many decades ago, the question amongst most have been, does class size and student/teacher ratio affect student performance? How should this factor affect how we teach? This issue is relevant whether we are teaching elementary or secondary or post-secondary schools. There has been an ongoing dialog about the value of reducing class size and student/teacher ratio versus the cost of education (Kezar, 2006). While proponents for each side of the debate point out the advantages and disadvantages of each position, does the focus on the number of teachers or the number of students really lead to improvements in student performance? The focus of this blog post isn't to compare which is better but rather, it is using data to examine the benefits and

limitations of both. In examining both sides of this issue, we as educators can make better choices with regard to instructional design and teaching style.

Class-Size Importance

Why is class size so important? Some state governments have pushed for smaller class sizes as a means of improving student test scores and overall success. Class size affects a host of variables when it comes to teaching. For example, class size can impact teacher-student interactions, both quantitatively and qualitatively. It is highly unlikely that in a class of 200 students, one professor would have the ability to spend much time directly interacting with each student. Moreover, those teacher-student interactions will be lacking in quality. Thus, class size is an environmental factor, teachers must consider when determining the methods of instruction and when making instructional design decisions (Taft et al. 2011). The approach a teacher should take in a large class differs from that of a small class.

Proponents of higher student/teacher ratios argue that strong evidence is lacking regarding the benefits of smaller classes, particularly in the setting of undergraduate and graduate education. One meta-analysis suggested that student performance was independent of class size. Could student achievement and class size really be independent? The key conclusion made by this study was the fact that it focuses on post-secondary education. In classes where students already possess higher-level thinking abilities, class size may not impact student performance. Indeed, there may be some benefits to larger class sizes such as greater competition, more ideas, more resources, and more efficient use of resources.

Proponents of smaller class size and lower student-teacher ratios argue that more and purposeful student-teacher interactions result in enhanced learning, particularly when it comes to helping

students develop their higher-order thinking and complex reasoning skills (Rawat et al.2012). When the class size is larger, the teacher has less influence over teaching and places more responsibility on students to learn (Gramapurohit & Radders, 2012). In larger classes it is harder for the teacher to have command over the environment. Lastly, class size may play a role in the teacher's attitude and commitment. In smaller classes, the teacher is more likely to be committed to every student's success whereas in a larger class setting, the focus may not always be teaching (Mills, 2014).

Class Size Influence on the Approach to Teaching

How should class size influence our approach to teaching? It starts with the instructional design. One must consider the desired result and goal of the class. For example, in a larger class setting, knowledge transmission may the goal and it may sufficient to completely and logically present information in the form of a lecture. In smaller class setting, the desired result may go beyond mere knowledge transmission. The approach to achieving the desired result may also differ in a smaller vs. larger class size. For example, in a smaller class size, informal interactions and one-on-one customized learning activities can be used while in a larger class size, a more structured lesson plan might be needed. Some modes of delivery might include lecturing, video media, and group discussions. It is important to note that in larger class settings, the same material must be provided to everyone (Berliner & Rosenshine, 2017). In a smaller class environment, it is possible for information to be conveyed differently to each student, which allows the educator evaluate each student's needs and give additional assistance as needed.

Class - Size and Evaluation Process

Also, the evaluation process usually differs depending on the class size population. In a larger setting, it is typically necessary to have examinations at the conclusion of instruction in order for students to demonstrate competency and understanding of the material. These exams must be efficient to administer and score. In contrast, in a smaller class setting, evaluations can occur almost simultaneously as one teaches the material.

Class-Size and Educational Instructional Design Approaches

Class size should influence on how the educator approaches instructional design. The educator needs to tailor his or her instructional approach and create an effective environment for learning. Whether the class is large or small, the educator still has control of how students are educated. Student performance is influenced by multiple factors: background knowledge, interactions, participation, attitude, course material … and class size. Success is multi-factorial and cannot simply be solved by focusing on one aspect. While class size does have some influence, it is not the only variable that determines student performance and success. And in the end, well-planned instructional designs are perhaps important too.

2.1.6 Junior Secondary School Students (JSSS)

Generally, society's thinking about different topics will advance incrementally, as various individuals make their contributions to the foundation of our understanding. From time to time however, one individual will have a significant impact on an important aspect of society, pushing it forward by leaps and bounds. John Dewey was just such a person. Schools, according to Dewey, are not just places where we learn facts and numbers, but also places where we learn how to live. In other words, the point is not just to learn a certain set of skills (though that helps as well) but rather to realize one's full potential, and use what you've learned for the greater good.

Therefore, a secondary school is a school for pupils or students between the ages of 11 and 18. The, Chambers Dictionary (New edition, 1999) describes a student, "as a person who studies, a person devoted to books or to any study; a person who is enrolled for a course of instruction, In the context of this work, Junior Secondary School students refer to children at post primary schools who are likely to be in Senior Secondary School classes 1-3, and who may be between the ages of 11 and above. This researcher intends to use the JSS II class for this study.

2.2 Theoretical Framework

Learning is a relatively enduring change in behavior, which is a function of prior knowledge (Practice). The main objective of school as an institution is to bring certain desirable changes in the behavior of children through the process of learning. As a process, learning has four attributes.

I. Learning is a permanent change in behavior. This does not include changes due to illness, fatigue, maturation, use of intoxicants, etc.
II. Learning is not directly observable, but manifests in the activities of the individual.
III. It results in some changes of enduring nature.
IV. Learning depends on practice and experience.

The emphasis of this study is on how the class size (environment) will influence in the teaching and learning of mathematics as well as predict how it affects student achievement in the same course of study (mathematics), two major groups of theorists have dominated discussion in connection with the learning process. These are the stimulus-response (S-R) and the cognitive field theorists.

2.2.1 The stimulus-response (S-R)

The stimulus-response (S-R) associations who stressed mechanistic learning and the development of psychomotor aspect of the learner. The Psychomotor learning involves the use of manipulative skills, the hands, and the minds, etc. In the view of J.B. Watson, when a stimulus and response (S-R) occur at the same time in close contiguity, the connection between them is strengthened. The strength of connection between stimuli – response (S-R) depends upon the frequency of S-R repetitions. Watson stressed law of frequency, but not of effect. He emphasizes the importance of frequency or exercise in learning. He pointed out that for the explanation of learning, understanding of brain and its function is very essential. He stresses that behavior is learned by interacting with external environmental stimuli. In the case of this research, the researcher focuses on class size as the external stimuli. Watson's theory has great impact on the education system; hence, emphasis was laid on providing conducive environment in school for efficient and permanent learning through sufficient practice and exercise. It is pertinent to state here that, sufficient practice and exercise which Watson advocates is the major focus of the researcher, hence, the researcher feared that large class size undermines the supposed sufficient practice in classes amongst students in schools.

2.2.2 The cognitive field theorists

The cognitive field theorists emphasize that any new idea or experience is embedded on already known one. the Gestalt Psychologists believe that man reacts to pattern of his own perception when he faces a problem, depending upon the set of stimulating conditions in the environment. Cognitive learning theory aims at a comprehensive theory of learning from the simplest to the most complex occurring in the organism. Again, cognitive learning theory is not based on what a person

knows, but on the response or functions in terms of what he perceives or believes and the explanation of this functioning must be sought in terms of the factors, which govern such perception.

Eclecticism

The researcher, after careful study of the two major theorists – the stimulus – Response (S-R) Associationist and the Cognitive Field Theorists understands that the theories are pertinent to the researcher's topic, the effect of class size on Junior Secondary Schools' student achievement in mathematics. This is because, in J.B. Watson's S-R Learning theory, the law of frequency or exercise is very much important in the study of mathematics where a lot of exercises are hoped to be done by students. On the other hand, the cognitive field theorists advocate that man perceives and thinks as wholes, and react to pattern of his own perception when he faces problem, parallels to what is obtained in mathematics whose topics are often treated as wholes and critical thinking is required in providing solutions to problems. In conclusion, the stimulus response, which is based on exercises show what is done in ideal learning and practice of mathematics, because both theories have impact on the researcher's work, hence, the coinage eclecticism in learning theory.

2.3 Empirical Studies

Brunello and Schlotter, (2011) defined non-cognitive skills as: "personality traits that are weakly correlated with measures of intelligence, such as the IQ index". Recent studies have shown a direct correlation between non-cognitive skills and student academic achievement (Chatterji & Lin, 2018; Pipere & Mierina, 2017). Since this correlation exists, I analyzed how class size affects non-cognitive skills, thus affecting student academic achievement. I found that smaller class sizes improve non -cognitive skills in students. Dee and West (2011) used nationally representative

survey data across middle school reading and math classes to estimate how class size affects non-cognitive skills. They found that reductions in class size were associated with improvements in non-cognitive skills related to psychological engagement with school (Dee & West, 2011). Some of these improvements include more positive reaction to teachers, peers, and academics in general, higher levels of interest and motivation, lower levels of boredom and anxiety, and a greater sense of belonging (Dee & West, 2011). Dee and West's analysis adds to the growing literature indicating that non-cognitive skills matter for subsequent academic success. Dee and West offered a hypothesis for their findings: "Smaller classes promote behavioral engagement by allowing teachers to limit disruptive behavior as well as to encourage attentiveness and asking questions. Smaller classes may also help teachers promote emotional engagement in the form of student interest and personal academic identification. Finally, smaller classes may promote cognitive engagement by allowing teachers to assist students in flexible problem-solving in the face of challenges."

These findings are in-line with Fredriksson et al. (2013) results of a study on the long-term effects of class size. Fredriksson et al. (2013) used unique Swedish data to trace the effects of changes in class size in primary school on cognitive and non-cognitive achievement at ages 13, 16, and 18. Fredriksson et al. (2013) found that placement in a small class during grades 4 to 6 increases non-cognitive ability at age 13. These results, combined with Dee and West's (2011) findings, indicate that smaller class size improves non-cognitive skills, which in turn, improves academic achievement (Chatterji & Lin, 2018; Pipere & Mierina, 2017).

Konstantopoulos and Chung (2009) used quartile regression analyses from Tennessee's Student Teacher Achievement Ratio (STAR) project to provide convincing evidence that all types of students (e.g., low, medium, and high achievers) benefit from being in small classes (in early

grades) across all achievement tests. Project STAR was a study of 325 K-3 classrooms across 75 schools in Tennessee. Over 7,000 students were randomly assigned into one of three interventions: small class (13 to 17 students per teacher), regular class (22 to 25 students per teacher), and regular-with-aide class (22 to 25 students). As part of the project, students were given the Stanford Achievement Test periodically throughout the 4 years of the study. The students' scores were recorded and analyzed (Folger & Breda, 1989). Specifically, Konstantopoulos and Chung (2009) found, "for certain grades, in reading and science, low achievers seem to benefit more from being in small classes for longer periods. It appears that the lasting benefits of the cumulative effects of small classes may reduce the achievement gap in reading and science in some of the later grades". Konstantopoulos and Chung (2009) offered a hypothesis for their findings: "One hypothesis is that in small classes teachers are more likely to identify low achievers and hence are more likely to provide instruction designed to benefit these students in early grades. Alternatively, in small classes, there is a higher likelihood for low achievers to interact with teachers and be more engaged in learning. These findings would suggest that small class size increase student achievement for students of all academic achievement levels, and for low achievers in particular."

Konstantopoulos and Chung's (2009) findings are in-line with research done by Bosworth (2014) who examined 4th and 5th M-grade class size data provided by the North Carolina Education Research Data Center. Bosworth concluded that "class size reductions appear to both raise average attainment and help close achievement gaps".

Babcock and Betts (2009) used a panel dataset containing achievement scores, grade point averages, and a rich set of behavior measures for primary school students in the San Diego Unified School District to analyze the effects of class size. Babcock and Betts' findings indicate that class-size expansion may reduce gains for low achievement students. Babcock and Betts offered an

explanation for their findings: “larger gains for disadvantaged students may have occurred because small classes allow teachers to incentivize disengaged students more effectively, or because students are better able connect to the school setting in small classes”. These findings, combined with Bosworth’s (2014), strengthen the notion that small class size increases student achievement for low academic achievers.

Finn et al. (2005) used data from Project STAR to analyze the effects of small classes on the likelihood of graduating from high school. Finn et al. (2005) collected data from 4,948 students who had participated in Project STAR from K-3, and had graduated, or dropped out of high school. Finn et al., (2005) found that more years in small classes had an increasing effect on the odds of completing high school. The findings were even more pronounced for students who were receiving free and reduced lunch. The data showed that for these low SES students: “The odds of graduating were 67.0% greater for students attending small classes for 3 years and almost 2.5 times greater for students attending small classes for 4 years” (Finn et al., 2005). This study also analyzed student performance in grades K-3 as an indicator of a student’s odds of graduating high school and found, “attending small classes for 3 or 4 years in the early grades had a positive effect on high school graduation above and beyond the effect on early academic performance” (Finn et al., 2005). These findings indicate that small class size increases academic achievement, particularly for low SES students.

These findings are comparable to research done by Maloney (2020) who also analyzed data from Project STAR. Their research involved examining the small class size effect on SES schools (e.g., inner-city, suburban, rural, and urban). Their research found that the small class advantage is found in all types of SES schools. However, largest on the average, in inner-city schools as compared with other types of schools (Maloney, 2020).

Krueger and Whitmore (2001) found that the beneficial effect of smaller classes on college aspirations appears to be particularly strong for students on free or reduced-price lunch. In the study, the researchers analyzed follow-up data from Project STAR, specifically ACT and SAT test data. The study found that students who attended small classes from K-3 had a significantly higher probability of taking either the ACT or SAT tests. Since most colleges require one of the two tests, a conclusion can be made that small class sizes appear to be beneficial to college aspirations of students who received free and reduced lunch (Krueger & Whitmore, 2001).

Vasquez et al. (2010) collected data from 419 schools in Houston, Dallas and Austin, Texas. These are typical urban school districts serving mostly low-income students (Vasquez et al., 2010). The researchers examined different variables to determine the most powerful predictor of changes in reading and math scores. The researchers found that "the most powerful predictor of changes in reading and math in all models was decreasing the student teacher ratio" (Vasquez et al., 2010). The researchers went on to note that, "decreasing the student-teacher ratio by 1 percentage point would increase the percentage of students proficient on the TAKS by 3% for reading and by 4% for math" (Vasquez et al., 2010). These findings, along with the findings from Folger and Breda (1989) and Krueger and Whitmore (2001), indicate that small class size increases academic achievement for low SES students.

Konstantopoulos and Chung (2009) found all types of students benefit more in later grades from being in small classes in early grades. "Longer periods in small classes produced higher increases in achievement in later grades for all types of students" (Konstantopoulos & Chung, 2009). The researchers offer a hypothesis for why class size reduction is an appealing intervention by noting: "it (class size reductions) is easy to implement and does not necessarily require changes in teaching methods or instructional practices" (Konstantopoulos & Chung, 2009).

Bosworth (2014), in his analyses of 4th- and 5th-grade class size data provided by the North Carolina Education Research Data Center, estimated: "the relationship between class size and the standard deviation of student achievement within a classroom to be positive on average, even after controlling for classroom composition". This finding, along with the findings of Finn et al. (2005), Konstantopoulos and Chung (2009), Folger and Breda (1989), and Glass and Smith (1979), reinforce the indication that small class size is beneficial to students in elementary grades.

Summary

The reviewed literatures suggest that reducing class size is a way of improving student performances and achievement in the study of mathematics but as well believed that larger classes controls educational budget. Most but not all previous researchers have it that small class sizes result in higher academic achievement. The studies show that smaller classes improve non-cognitive skills in students (Dee & West, 2011; Pipere & Mierena, 2017). The review also shows that smaller classes had a differential advantage for all students, especially low achievers (Konstantopoulos & Chung, 2009).

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction

The study investigates class size to predict the effectiveness of teaching and learning of Mathematics and students' achievement in the study of Mathematics using some selected public and private junior secondary schools in Chanchaga local government area of Niger State. The study was conducted during the 2019/2020 academic session in Niger State. This chapter describes the design of the study, area of the study, population, sample and sampling technique, research instrument, validity of the instruments, reliability of the instruments, method of data collection and method of data analysis.

3.1 Research Design

Multimethod research design was adopted in carrying out this research work, both methods being qualitative research methods, a one-week in-depth observation and three-weeks experimental exercise. A total of four (4) junior secondary schools were randomly selected for the both research methods out of 48 junior secondary schools in the local government using a simple random sampling technique. Two of the selected junior secondary schools were public schools with high class-size population of 70 JSSII students or more while the other two (2) selected schools were private schools with lower class-size population less-than 30 JSSII students.

JSSII classes of all the four (4) schools were carefully observed and surveyed during Mathematics classes by the researcher for one-week. The purpose of this observation was to distinguish between the Mathematics teacher's teaching strategies in large classes and in small classes. The researcher also focused on the activities conducted in the classes, class task, the teacher's attention, the

students' feedback, and classroom discipline. An observation sheet was constructed by the researcher to record the important points observed during the class observation. The researcher was not part of any class activity or instruction before, after, or during the observation. Through the class observation, various points were gathered related to teaching technique, the student's behavior in large and small Mathematics classes, disciplinary issues, problems faced by teachers in implementing various activities in large classes, and student's achievement in both contexts.

Also, JSSII students of all the four schools were also taught the same Mathematics topics which are perimeter and area of shapes (squares, rectangles and triangles) by the researcher using appropriate instructional aids and teaching methods that best fits each class size population of these schools, this exercise went on for good three (3) weeks and then a test was administered to the students. The purpose of these exercise was to determine and evaluate the level of understanding and achievement of students in classes with high and low class population.

3.2 Population of the Study

The population for this study consist of junior secondary school students and Mathematics teachers of all the public and private junior secondary schools in Chanchaga local government area of Niger state. The data was obtained from the Ministry of Education (MOE) Minna, Niger State in 2021. The data revealed that the total number of the public junior secondary schools in Chanchaga local government are sixteen (16), and the population of the junior secondary school students in these sixteen (16) schools is approximately five-thousand-four-hundred and thirty-six (5436), while the total number of Mathematics teachers in the sixteen (16) schools are thirty-seven (37). And the total number of the private junior secondary schools in Chanchaga local government are approximately thirty-two (32), and the population of private junior secondary school students in

these thirty-two (32) schools is approximately four-thousand and seventy-three (4073), while the total number of Mathematics teachers in the thirty-four (34) schools are fifty-three (53).

3.3 Sample and Sampling Technique

The sample and sample technique used for this research work is simple random sampling technique. A total of four (4) junior secondary schools were randomly selected from the local government using a simple random sampling technique, two of the selected junior secondary school were public schools with high class-size population of above seventy (70) JSSII students while the other two (2) selected schools were private schools with lower class-size population of less-than thirty (30) JSSII students. The final sample size of the study was two-hundred and four (204) JSSII junior secondary school students from the four (4) selected schools drawn from the overall population.

3.4 Research Instruments

A well-structured Observation Assessment Sheet (O A S) was constructed by the researcher for the in-depth observation of the two public and two private junior secondary schools randomly selected within Chanchaga local government. The observation assessment sheet was used to measure the quality of some research variables, this helped the researcher to analyze the proposed literatures and various factors mentioned in the research. The observation sheet focused on factors that effects or affects effective teaching and learning, factors such as rate of classroom management and control, rate of attention and supervision received by students from their teachers, rate of individual student involvement and participation during classroom instructions. Each of these important factors has four variables under it which were selected on the basis of the literature

for the study and each of the variables under these factor was scaled in 5 grades (A=5points, B=4points, C=3points, D=2points, E=1point and F=0point).

For the experimental research method, a Mathematics Achievement Test (MAT) which contains 20 multiple choice questions was developed by the researcher in accordance with the Mathematics topics treated and taught by the researcher. Each item of the research instrument is a multiple choice objectives question with four (4) different options (A – D) for the student to choose from within the period of twenty (20) minutes, this, for the sole purpose of testing the students understanding on the concepts taught during the periods of the exercise. The same questions were administered to all the students in all the four (4) schools and also same time was allocated to all the students. The data were collected and assessed with same mark allocation by the researcher.

3.5 Validity of the Research Instrument

To determine the face and content validity of the two research instruments used in this study, the researcher's supervisor and a lecturer from the department of pure and applied Mathematics, (FUTMINNA), reviewed the two instruments (Observation Assessment Sheet and Mean Achievement Test) in order to determine appropriateness, content coverage in terms of acceptability, adequacy and relevance to the stated objectives. Their comments, suggestions and corrections were used to produce a final draft of the instrument.

3.6 Reliability of the Instrument

The two instruments; Observation Evaluation sheet and MAT were piloted – tested using the same sample. Test and re–test method with one-week interval was used to determine the reliability coefficient of the two instruments using Pearson Product Moment Correlation formula (PPMC), the coefficient stability for the observation assessment sheet was calculated to be r= 0.95, while

the coefficient stability for the MAT was r= 0.80. The results seen to be appropriate for the research work.

3.7 Method of Data Collection

The researcher went to the four (4) schools, two (2) public schools with high class population, the first school has a total population of seventy-two (72) JSSII students while the other has a total population of seventy-six (76) JSSII students, and also two private schools with low class population, the first private school has only twenty-seven (27) JSSII students while the other has twenty-nine (29) JSSII students. The researcher sought the permission of the principals and the full assistance of the mathematics teachers in the schools. A good one-week classroom survey and observation was conducted by the researcher then followed by three-weeks experimental exercise. A total of two-hundred and four (204) JSSII students participated in the exercise. After teaching in each of these schools for three-weeks, each lesson lasted for the period of forty (40) minutes based on junior secondary school time table for teaching mathematics in Niger State, then the MAT instruments were administered to all the students in all the schools.

3.9 Method of Data Analysis

The results obtained from the administered researcher-designed observation assessment sheet and Mathematics achievement test were analyzed and interpreted using statistical tools, mean, mean percentage and standard deviation were used to answer the questions raised in chapter one of this study. Data collected were coded and analyzed using Statistical Package for Social Science (SPSS) version 20.0 from windows at 0.05level of significance.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

The purpose of this chapter is to interpret and analyze the data collected in a systematic way so as to facilitate verification and authentication of the preposition that were stated earlier in the reviews and to also form a basis for good and reliable recommendations. This chapter therefore contains the presentation of the results, data analysis and discussion of results.

4.2 Answers to Research Questions

The data collected were used to answer the research questions raised in chapter one of this research work. The interpretation and analysis of the data obtained will be presented in tables.

Research question 1: What is the total number of junior secondary schools in Chanchaga local government area of Niger state?

Table 4.2.1: Analysis of data obtained from Niger state ministry of education on the total number of junior secondary schools in Chanchaga local government of Niger state.

S/NO	SCHOOL TYPE	NUMBER OF SCHOOLS	TOTAL
1.	Public(Government) junior secondary schools.	16	48
2.	Private junior secondary schools.	32	

Table 4.2.1 above revealed that there are public(government) junior secondary schools as well as private junior secondary schools in Chanchaga local government area of Niger state. The data was obtained from the Niger state ministry of Education Minna. The table showed that the total number of public junior secondary schools in Chanchaga local government area of Niger state are 16 while the total number of registered private junior secondary schools in the local government are 32, both given a total of fifty-one (48) junior secondary schools in the local government.

Research question 2: What is the average total number of junior secondary school students and mathematics teachers in Chanchaga local government area of Niger state?

Table 4.2.2: Analysis of data obtained from Niger state ministry of education on the total number of mathematics teachers and students junior secondary schools in Chanchaga local government of Niger state.

S/NO	SCHOOL TYPE	SCHOOL POPULATION	NUMBER OF MATHEMATICS TEACHERS	NUMBER OF STUDENTS
1.	Public(Government) junior secondary schools.	16	37	5436
2.	Private junior secondary schools.	32	53	4076
TOTAL		48	90	9512

The table above reveals that there are 16 government junior secondary schools in Chanchaga local government area of Niger state and the total number of mathematics teachers in these 16 government junior secondary schools are 37 while the total number of students in the 16 government junior secondary schools are 5436. The table also revealed that there are 32 private junior secondary schools in Chanchaga local government area of Niger state and the total numberof mathematics teachers in these 32 private junior secondary schools are 51 while the total number of students in these 32 private junior secondary schools are 4076. The summation of mathematic teachers in both government and private junior secondary schools in the local government gives a total of 90 mathematics teachers, while the summation of students in both the government and private schools in the local government gives a total of 9512 junior secondary school students in the local government. The data was also obtained from Niger state ministry of education Minna.

Research question 3: Do teachers in reduced class sizes differ from teachers in high populated class sizes in terms of classroom management and student control?

Table 4.2.3: Analysis of variables observed on the basis of classroom management and control.

S/NO	Schools observed	Class size population	Mean of variables observed	Mean percentage	Standard deviation
1.	A	72	2.25	45%	0.515
2.	B	79	2.1	42%	0.633
3.	C	26	4.75	95%	0.111
4.	D	29	4.70	93%	0.209

The table 4.2.3 above revealed that four (4) different schools were observed and surveyed based on the variables outlined to assess and evaluate the rate of classroom management and control by teachers. The four (4) schools were labelled; school A, B, C and D respectively, schools "A" and "B" having a high class-size population of (72 and 79) JSSII students respectively while school "C" and "D" have a reduced class-size population of (26 and 29) JSSII students respectively. The mean of variables observed for school "A" and "B" was calculated to be 2.25 and 2.1 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 45% and 42% respectively and a standard deviation of 0.515 and 0.633 which clearly signifies that the rate of classroom control and management in these two schools were very low and below average. In the other hand, the mean of variables observed for school "C" and "D" was calculated to be 4.74 and 4.70 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 95% and 93% respectively, which clearly signifies that the rate of classroom control and management in these two schools were very high and above average.

Research question 4: Do students in reduced class sizes differ from students in high populated classes in terms of maximum attention and supervision received from teachers during classroom activities and instruction?

Table 4.2.4: Analysis of variables observed on the basis of rate of attention and supervision received by students from their teachers during classroom instructions.

S/NO	Schools observed	Class size population	Mean of variables observed	Mean percentage	Standard deviation
1.	A	72	2.3	46%	0.187
2.	B	79	2.3	46%	0.187
3.	C	26	4.9	98%	0.0948
4.	D	29	4.75	95%	0.111

The table 4.2.4 above also revealed that four (4) different schools were observed and surveyed based on the variables outlined to assess and evaluate the rate of attention and supervision received by students from their teachers during classroom instruction. The four (4) schools were also labelled; school A, B, C and D respectively. The table reveals that schools "A" and "B" have a high class-size population of (72 and 79) JSSII students respectively while school "C" and "D" have a reduced class-size population of (26 and 29) JSSII students respectively. The mean of variables observed for school "A" and "B" was calculated to be 2.3 and 2.3 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 46% and a standard deviation of 0.187 each, which clearly signifies that the rate of attention and supervision received by students from their teachers during classroom instruction in the two schools is low and below average. In the other hand, the mean of variables observed for school "C" and "D" was calculated to be 4.90 and 4.75 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 98% and 95% and a standard deviation of 0.0948 and 0.111 respectively, which clearly signifies that the rate of attention and supervision received by students from their teachers during classroom instructions in these two schools is very high and above average.

Research question 5: Do students in reduced class sizes differ from students in high populated classes in terms of the rate of involvement, participation and attainment of instructional objectives?

Table 4.2.5: Analysis of variables observed on the basis of rate of student involvement, participation and attainment of instructional objectives.

S/NO	Schools observed	Class size population	Mean of variables observed	Mean percentage	Standard deviation
1.	A	72	2.4	48%	0.143
2.	B	79	2.2	44%	0.187
3.	C	26	4.9	98%	0.0948
4.	D	29	4.85	97%	0.0997

The table 4.2.5 above revealed that four (4) different schools were observed and surveyed based on the variables outlined to assess and evaluate the rate of individual student or group involvement, participation and attainment of instructional objectives taught by teachers. The four (4) schools were labelled; school A, B, C and D respectively. The table also shows that schools "A" and "B" have a high class-size population of (72 and 79) JSSII students respectively while school "C" and "D" have a reduced class-size population of (26 and 29) JSSII students respectively. The mean of variables observed for school "A" and "B" was calculated to be 2.40 and 2.20 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 48% and 44% and a standard deviation of 0.143 and 0.187 respectively, which clearly signifies that the rate of students

involvement, student participation and attainment of instructional objectives in these two schools are low and below average. In the other hand, the mean of variables observed for school "C" and "D" was calculated to be 4.90 and 4.85 respectively out of the maximum mean (5.0) with both schools having a mean percentage of 98% and 97% and a standard deviation of 0.0948 and 0.0997 respectively, which clearly signifies that the rate of student involvement, student participation and attainment of instructional objectives in these two schools are very high and above average.

Research question 6: Does class-size has any impact or effect on junior secondary school students?

Table 4.2.6: Analysis of results from Mathematics Achievement Test (M.A.T) administered to students

S/NO	SCHOOLS	CLASS POPULATION	NUMBER OF PARTICIPANTS	MEAN OF M.A.T	MEAN %	STANDARD DEVIATION
1.	A	72	68	46.94	46.9%	8.790
2.	B	79	73	44.49	44.5%	9.210
3.	C	26	26	82.10	82.1%	6.306
4.	D	29	28	79.14	79.1%	7.628

JSSII students of four schools labelled schools A B C and D were taught same mathematics concepts for three weeks and same test was administered to the student base on the concepts taught. The table shows that school "A" has a class size population of 72 JSSII students but only 68 students out of the 72 students participate in the Achievement Test, school "B" has a class-size population of 79 students but only 73 students out of the 79 students participate in the Achievement Test. The means of students' scores in the Achievement test for the two schools (A and B) were calculated to be 46.94 and 44.49 respectively out of maximum mean 100 with both schools having a mean percentage of 46.9% and 44.5% and a standard deviation 8.790 and 9.210 respectively. The results clearly signify that the rate of achievements of students in school (A and B) in the Mean Achievement Test administered is low and below average. The table also reveals that school "C" has a class size population of 26 JSSII students and all the 26 students participate in the Achievement Test, school "D" has a class-size population of 29 students but only 28 students out of the 29 students Participate in the Achievement Test. The means of students' scores in the Achievement test for the two schools (C and D) were calculated to be 82.10 and 79.14 respectively out of maximum mean 100 with both schools having a mean percentage of 82.1% and 79.1% and a standard deviation 6.306 and 7.628 respectively. The results clearly signify that the rate of achievements of students in school (C and D) in the Mean Achievement Test administered is high and above average.

4.2 Discussion of Findings

The results presented in the tables showed there is a significant difference between teachers and students in reduced class sizes and those in overpopulated class sizes. the results clearly reveal that teachers in reduced class-sizes have maximum and full control of their classes than teachers in

overcrowded classes. This result is in line with the findings of (Hu, 2017), in his findings he revealed that classroom management is a significant challenge for teachers who often lead and teach larger classes. (Blatchford & Russell, 2019) also reveals in his findings that many teachers find it very difficult to manage and control their classes because students display various patterns of behavioral and learning challenges. The findings also showed that teachers in reduced class-sizes give maximum attention to their students than teachers in overcrowded classes, it also signifies that students in reduced class-sizes have more cordial relationship and receive more supervision from their teachers than students in over-crowded classes. This result is in line with the findings of Babcock and Betts (2011), they found that teachers are able to offer special help and assistance to low achieving students and effectively control the low effort students in smaller classes. (Blatchford et al. 2011) conducted a study at both primary and secondary level and found that in larger classes students level of interaction with their teachers decreases which results to student lower level engagement. It also that the rate of achievement of student in reduced class sizes is greater and higher than the rate of achievement of students in overcrowded classes, which implies that class size has a great impact and effect on junior secondary school students. This result is in line with the findings of Sa'ad et al. (2014), the results in their findings revealed that overcrowded mathematics classes is one of the causes of poor performance of students in Azare metropolis in Bauchi state. Robinson (2010) also in his findings indicates that a positive relationship exists between smaller class-sizes and student academic achievement.

Summary of Findings

From the discussion above, the following findings were highlighted;

1. students in overcrowded classes do not participate much in instructional activities like students in reduced classes.

2. There is lot of disruption and low attentiveness in overcrowded classes and students do not receive maximum attention and supervision from their teacher.
3. The rate of individual student/teacher relationship is low in overcrowded classes, while in reduced classes student are engaged more in participation and have more cordial relationship with their teachers.
4. The finding also revealed that mathematics teachers in overcrowded classes in junior secondary schools find it very difficult in managing and controlling their classes.
5. Teachers in overcrowded classes spend more time in correcting students' behavior than conducting classroom instruction which leads to students' low understanding of the concepts taught and also leads to low attainment of instructional objectives.

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CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the research, conclusion, recommendation and suggestions for further reading for the study.

5.1 Summary of the study

This study was undertaken to determine the effect of class size on the academic achievements of Junior Secondary School students in the study of mathematics within Chanchaga local government area of Minna, Niger State. The study adopted multimethod qualitative research methods, a one-week mathematics classroom observation and three-weeks experimental class exercise. The sample size for the research work was JSSII students of four selected junior secondary schools within Chanchaga local government area of Niger state, two out of the four schools were schools with reduced class size of less than 30 JSSII students while the other two were schools with high class population of more than 70 JSSII students. In order to effectively carry out this research work, six (6) research questions were raised to guide the study. The instruments used for data collection for the two research methods were Observation Assessment Sheet and a Mean Achievement Test. JSSII mathematics classes of the four selected schools within the local government were observed for one week to ascertain the level of classroom management and control, students participation and involvement during classroom instructions and the rate of attention and supervision received by students from their teachers, Also the same JSSII students of the four selected schools were taught same mathematics concepts for three weeks, mathematics achievement test was then administered to the student to ascertain the level and rate of achievement of students in reduced class sizes and those in high populated classes in the concepts taught. The

data collected from the two methods were analyzed and interpreted. The analysis was based on mean, mean percentage and standard deviation.

The findings of this study clearly shows that class size has a significant effect on the achievement of junior secondary school students.

5.2 Conclusion

The analysis of data in this study has led to certain findings from which the following useful conclusions were drawn:

The study has revealed that students in overcrowded classes do not participate much in instructional activities like students in reduced classes, there is lot of disruption and low attentiveness in overcrowded classes and students do not receive maximum attention and supervision from their teachers, also the rate of individual student/teacher relationship is low in overcrowded classes, while in reduced classes student are engaged more in participation and have more cordial relationship with their teachers.

The finding also revealed that mathematics teachers in overcrowded classes in junior secondary schools find it very difficult in managing and controlling their classes, teachers in overcrowded classes spend more time in correcting students' behavior than conducting classroom instruction which leads to students' low understanding of the concepts taught and also leads to low attainment of instructional objectives.

5.3 Recommendation

Based on the findings and conclusions of this study, the following recommendations are made:

1. Government should increase budget allocation to improve schools' infrastructural facilities in junior secondary schools.

2. The Ministry of Education, policy makers, parent-teachers association, old boys/students association and other non-governmental organizations, corporate bodies and religious organizations should contribute respectively to renovate dilapidated classrooms, build more classrooms to contain the growing enrolments in the junior secondary schools and provide the schools with the facilities they need to make teaching and learning easier and effective.

3. School managements should provide wide range instructional medias that will effect teaching and learning in all kinds of class population and also encourage teachers in using them.

5.4 Suggestions for further study

This study was limited to Chanchaga local government area of Minna, Niger State. The study can as well be extended to other local government area in Niger state using a larger sample size. Studies could be conducted on the following

i. Class-size effect on pre-primary and post-primary students' performance.

ii. Class-size effect on senior secondary school students and teachers.

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APENDIX I

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

DEPARTMENT OF SCIENCE EDUCATION

EVALUATION AND ASSESSMENT SHEET

An evaluation sheet constructed to assess the rate at which class-size population affects junior secondary school Mathematics teachers and also junior secondary school students' achievement in the study of Mathematics.

Name of school: _____

Class observed: _____

Subject observed: _____

Date: _____

Duration of lesson: _____

Class population: _____

Table 1: Classroom Management and control table.

S/NO	Variables observed	1st Observation (5mks)	2nd Observation (5mks)	3rd Observation (5mks)	Average
1.	Rate of preparation, arrangement & organization of classroom environment.				
2.	Teacher approach (establishment of norms and expectations).				
3.	Rate of student/teacher interaction.				
4.	Rate of management of student behavior and maintenance of discipline.				
SUMMATION OF ALL AVERAGES					

Table 2: Rate of attention and supervision received from teachers during classroom instructions.

S/NO	Variables observed	1st Observation (5mks)	2nd Observation (5mks)	3rd Observation (5mks)	Average
1.	Relationship with individual students during classroom instruction.				
2.	Constant feedback from both parties.				
3.	Rate of student motivation and reinforcement				
4.	Rate reinforcement of class rules and regulations				
SUMMATION OF ALL AVERAGES					

Table 3: Rate of student individual involvement, participation and attainment of instructional objectives.

S/NO	Variables observed	1st Observation (5mks)	2nd Observation (5mks)	3rd Observation (5mks)	Average
1.	Rate of individual student involvement during classroom instruction.				
2.	Rate of student participation during classroom instruction.				
3.	Student attentiveness during classroom instructions				
4.	Establishment of good instructional methods to facilitate student optimal learning.				
SUMMATION OF ALL AVERAGES					

APENDIX II

FEDERAL UNIVERSITY OF TECH NOLOGY, MINNA.

DEPARTMENT OF SCIENCE EDUCATION

Mathematics Achievement Test (MAT) for JSSII students on the basis of the concepts taught in a three (3) weeks exercise course to ascertain the extent to which class-size population affects students' achievement in the study of mathematics by:

Name: Usman Abdullahi

Institution: Federal University of Technology Minna, Niger State.

Department: Science Education

Research topic: Class-size as predictor of Mathematics achievement among junior secondary school students of Chanchaga Local Government area of Niger State.

PARTICIPANT'S INFORMATION

Name of Student: _____

School: _____

Class: _____

QUESTIONS

1. _____ is a shape with three (3) sides and three (3) angles.
   (a) Rectangle (b) Square (c) Triangle (d) Circle
2. _____ has all it four (4) interior angles equal and each measures 90
   (a) Cone (b) Square (c) Triangle (d) Cone
3. The diagonals of a square bisects each other at angle _____
   (a) 180 (b) 90 (c) 360 (d) 270
4. The opposite sides of a rectangular shapes are _____ and _____
   (a) equal and parallel (b) perpendicular and curved
   (c) parallel and inclined (d) curved and inclined.

5. The formula for perimeter of square is given by _____

   (a) 4L + 4B. (b) 4L + 2b. (c) 4(L + B) (d) 4L

6. The formula for area of rectangle is given by _____

   (a) (b) L × B. (c) 2(L + B). (d) L × B × H

7. The formula for area of square is given by _____

   (a) (b) L × L × L. (c) L + L+ L (d) 2L

8. The formula for perimeter of rectangle is given by _____

   (a) 4L. (b) 2(L + B). (c) L × B (d) 2HL

9. The formula for area of triangle is given by _____

   (a) 2bh (b) (c) 2(b + h) (d) b × h

10. The formula for perimeter of triangle with sides a, b and c is given by _____

    (a) a + b + c. (b) a × b × c. (c) a + b × c. (d) a(b + c)

11. The total interior angles in a triangle is equal to _____

    (a) 180 (b) 90 (c) 360 (d) 270

12. What is the perimeter of a square with sides 10cm each?

    (a) 10m (b) 40 (c) 30cm (d) 40cm

13. If a square has it perimeter to be 20cm, what is the length of each side of the square?

    (a) 4cm. (b) 5cm (c) 20cm (d) 10cm

14. A square has the lengths of it sides to be 7cm each, what is the area of the square?

    (a) 49 (b) 49cm (c) 49m (d) 14

15. 10cm

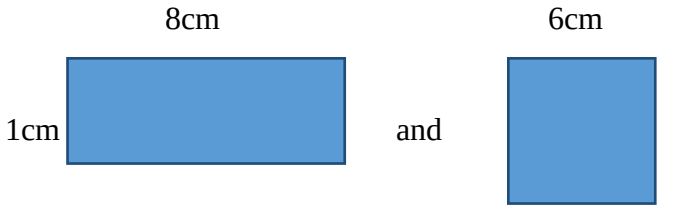
5cm. What is the area of the given rectangle?

    (a) 15cm (b) 15 (c) 50 (d) 50cm

16. What is the area of a triangle with base 4m and height 7m?

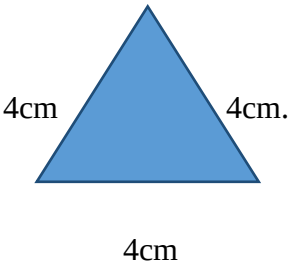
    (a) 28 (b) 14 (c) 28 (d) 11

17. What is the sum of the perimeters of these two shapes?

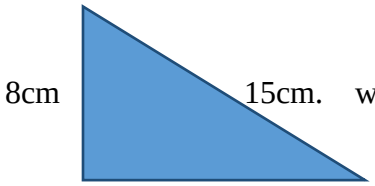


(a) 42cm. (b) 14cm (c) 15cm (d) 28cm

18. What is the perimeter of the given triangle below?



(a) 36 (b) 36 (c) 20cm (d) 12cm

19. 

what is the area of the given shape?

(a) 19 (b) 88 (c) 34cm (d) 34

20. What is the difference between the areas of two (2) squares with sides 7cm and 4cm respectively?

(a) 33 (b) 38 (c) 33cm (d) 38cm