CLASS SIZE AND STUDENTS' ACADEMIC PERFORMANCE IN MATHEMATICS AND SCIENCE IN SECONDARY AND PRIMARY SCHOOLS IN NIGERIA

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Abstract

The paper focuses on the issue of class size as it relates to students' academic performance in mathematics and science. Class size was viewed in the paper from various perspectives, ranging from student-teacher ratio, students' number per class and instructional materials available to cater for the needs of students in the class. The issue had, over the years been hotly debated and it was found that class size has effect on the academic achievement of students. Theoretically, the paper argued that there are some difficulties encountered by learners in the process of learning that are environment-based while some are considered to be personal to the learner; each of which has bearing to how the classroom is structured to take care of such difficulties. The paper in the end recommended that the existing structures should be expanded so as to allow for decongesting the present ones and teachers should be recruited to complement the expansion.

Keywords: Class Size, Academic Performance, Mathematics and Science

Introduction

The duo of mathematics and science are two areas, each requiring attention for its teaching and learning and the proper dissemination of the knowledge for the advancement of humanities and society at large. Teachers of mathematics and science who are the epicenter in the dissemination of the knowledge tend to find it uncomfortable in the process; which is attributed to a number of factors. According to Camak (2009), these factors are among others, the characteristics of subject content, class size and physical condition in the classroom and are considered instrumental in the instructional process. From among these factors, emphasis had been made on class size especially because of the role it plays in the process of teaching and learning mathematics and science because of their bearing to life entirely. Thus, increase in class size which is commensurate to increase in population makes the performance of students to become an issue (Owoeye & Yara, 2011). The vulnerable population of this menace is mostly learners operating at secondary and primary school levels. Because of the importance of these levels in knowledge acquisition, especially that of science and mathematics which serves as the basis for preparing students to eventually ventures into various areas of specializations, attention has to be focused on the levels; in the hope of proffering solutions and extolling the virtues of moderate classroom atmosphere at the end. Little did authorities know that this problem seriously affect the achievement in mathematics and science perhaps why incessant failure had been recorded over the years in these fields as captured by (Salman, Mohammed, Ogunlade & Ayinla, 2012) for failure in mathematics senior secondary school examination, and Nbina (2012), who considered the importance of chemistry in the unfolding world and as core in science, maintained that the performance of Nigerian students in the subject at secondary school remains a dismal failure.

Furthermore, the concept of class size and its influence on academic achievement of students had been studied for quite some time, e.g. (Mcgowen, 2007; Kornfeld, 2010; Bakasa, 2011; Majanga, Nasongo & Sylvia, 2011), each one of these with varying opinion and a variable of comparison different from one another. For effective teaching and learning of science and

mathematics, a reasonable class size, devoid of inconveniencies such as students' congestion, poor students' sitting arrangement, inadequate instructional materials, infrastructural deficits and the like has to be ensured. This will enable the teaching to be conducted successfully, ensure conducive atmosphere and consequently make the achievement in mathematics and science possible. Because class size was described by Adeyemi (2008) as an educational tool that can be used to describe the average number of students per class in a school setting, it then follows that students to be assigned to a certain class has to be taken into cognizance by the authorities concerned; failure of which the aftermath may be quite devastating and consequently affect the process of teaching and learning.

Achievement in mathematics and science had also been widely discussed and thoroughly investigated. In mathematics for instance, (Kunene, 2011; Suh, 2005; Lamb & Fullarton, 2001; Afrassa & Keeves, 1999; Hong, 1996) have all studied achievement in mathematics by comparing it to some factors. For example, achievement in mathematics is strongly related to math phobia whereby the latter according to Omotosho, Titiloye and Titiloye (2013) appears through some series of symptoms such as tension, nervousness, concern, worry, edginess, impatience, confusion and mental block and this ultimately affects achievement level of learners in mathematics. In this regard, achievement in mathematics is considered to be marred strongly by the appearance and manifestation of such mathematics disorders and appropriate remediation has to be offered to learners identified with such difficulties. This will go a long way in keeping the learners to the track of what is obtainable in mathematics and what is expected of them to be acquainted with in the process.

However, achievement and performance in science had as well been studied for quite some time now (Obomanu & Adaramola, 2011; Ekeyi, 2013). Meanwhile, some studies were not specifically on mathematics and science but on academic achievement generally in which mathematics and science are not exceptions (Kosgei, Mise, Odera & Ayugi, 2013; Amatobi & Amatobi, 2013). Furthermore, in some studies, it was a comparison between mathematics and science (Kurumeh, Igyu & Mohammed, 2013). This indicates that a number of reasons may be attributed to the good performance or otherwise of students in mathematics and science. But what should be considered in this respect is the issue of class size and its effects on achievement in mathematics and science, dwelling much on the existing literatures on studies conducted by scholars having to do with how class size had actually impacted on the achievement of students in mathematics and science.

Theoretical Framework

Because class size could be considered on one hand as the students' environment and on the other as teachers' laboratory, environmental theory of learning and social interaction theory could be used to establish the framework of the class size and students' achievement phenomenon. Conceptualizing learning environment, Frenzel, Pekrun and Goetz (2007) considered learning environment as having observable features such as school structures and instruments used for teaching and some features externally observed between learners and the instructors. According to them therefore, for environment to be worthy for studies for both learner and the teacher, it has to be well organized such that whatever is required to be used in the process is made available. This is especially in mathematics and science because they are considered to be somewhat in abstract, thereby posing problem to students. In his words, Nenty (2010) posited that:

In the academic arena, the most important event is the success or failure of the learner to learn. Experience of failure in a task designed to test the level of learning is often followed by a 'naïve' reaction of blaming either lack of ability, lack of effort, difficulty of the task or lack of luck. Success on the other hand, is often followed by an attribution to possession of ability, exertion of effort, easiness of task or possession of luck. While ability and effort are seen as personal factors internal to the learner, task difficulty and luck are seen as environmental factors external to the learner. On the other hand, ability and task difficulty are considered stable, while effort and luck are considered unstable factors (Heider, 1958). Associated with attribution to internal factors are positive or desirable achievement-related behaviour and superior performance, while with attribution to external factors are associated negative or undesirable achievement-related behaviour, as well as inferior performance in mathematics.

By the foregoing submission by Nenty, it can be seen that environment is very central in the process of learning. Some factors are considered external to the learner and determined by the environment in which the learning is taking place. Difficulty in task was considered as one of such factors and for a task to be difficult; such may be attributed to how the class is structured to overcome such a difficulty. In most cases, classroom structure as an environmental factor can be attributed to such a difficulty if for instance the size is big enough to cater for the needs of the learner at a certain point and this may ultimately result in finding it difficult for the learner to cope effectively with such type of environment.

Conceptual Clarification of Class Size

Class size plays a central role in the achievement of students in their various disciplines and over the years attracted studies, each trying to depict how it can influence performance and ultimately achievement in the stated objectives of a given area of study. Before bringing to the fore the studies, the need of conceptual clarification of the term is highly needed. Class size was viewed from holistic viewpoint to mean a phenomenon often mentioned in the educational literature which influences pupils' feelings and achievement, on administration, quality and school budgets (Dror, 1995). This implies that a lot has been said about class size and it was believed that feelings and achievement of students is directly linked to how the class is structured. In terms of interaction of students with their colleagues, teachers and the instructional materials, class size is of paramount importance. Some scholars view the concept of class size in terms of student-teacher ratio (Lewit & Baker, 1997; Hoffman, 1980). If for example the number of teachers in the school can take care of the instructional needs of students then the class size is said to be manageable and if otherwise, then there is a class over size and as such for the instructional process to be effective more teachers have to be provided so that their number would be commensurate to that of the size of the students. In a study conducted by Pascarella and Terenzini (1991) about class size and other educational factors, it was found that there is an inverse connection between the students' achievement and their preparation. They however maintained that class size matters for students who are not prepared and are from disadvantaged background but matter little for students who bring in the way social, capital, aptitude and other resources. In this regard

therefore, students' family background plays a significant role in how they view classroom and how it impacts on their beliefs about it.

In addition to foregoing, some scholars viewed the problem from another perspective and its relative consequences. Okebukola (1997) said large class sizes, inadequate funding, insufficient curriculum resources and lack of support for teachers limits the quality of teaching and learning science in Nigerian schools. It could as such be seen that class is of paramount importance and if judiciously utilized, the instructional process would be made very simple and students will equally enjoy the teaching devoid of any hitch; which may either emanate from the way the class is structured or the provision made for the instructional materials to be used in the instructional delivery.

Class Size and Students' Performance in Mathematics

The presence of fewer students in class is attractive to both teachers and parents (Lewit and Baker, 1997). According to them, teachers feel that smaller classes increase student-teacher interaction which allows for more thorough evaluation of students' outcome after instruction. In mathematics class for instance, the atmosphere was described by Rajoo (2013) as the circumstances in the classroom, who further maintained that students perform better if they perceive the classroom environment positively. In support of this view, Hoffman (1980) described classroom atmosphere as the number of students per teacher in a class. This means that students can expect to perform better if their number did not outweigh that of teachers, so that the teachers can to some extent, take care of the individual differences; which are believed to be in existence in every classroom. But if the reverse becomes the case, both the students and the teachers would find it extremely difficult to learn effectively on the part of the students as well as impart the knowledge with efficacy on the part of the teachers. Other factors considered as hindrance to the learning and achievement in mathematics are students' personal interest towards mathematics, classroom climate, mathematics anxiety, lack of experienced mathematics teachers and shortage of qualified mathematics teachers, teaching practices and teaching methods (Al-Agili, Mamat, Abdullah and Maad, 2012). This is indicating that quite a number of factors can be attributed to achievement in mathematics but it should be noted however that virtually all these factors are in one way or another related to classroom whether it is students' interest, mathematics anxiety, mathematics teachers or teaching approaches. In this regard therefore, for mathematics achievement to be possible, classroom has to be structured in such a way as to take care of all these predicaments.

Class Size and Students' Performance in Science

In science too, part of what is affecting students' level of performance is the size of the classroom. This hinges on the number of students in the class and the number of equipments per student in the laboratories. While in the laboratory for practical, some students, who for instance, would conduct experiment in chemistry, may not have a retort stand that they will make use of to carry out simple titration. This is equally applicable in other remaining science subjects at senior secondary level. While at primary level, where laboratories are not mostly found or are limited in supply, the story is the same. Some students may not be exposed to the required laboratory equipments that will accord them the opportunity to learn science effectively well. Some studies were conducted, each portraying the aforementioned assertions (Ehrenberg, Brewer, Gamoran & Willms, 2001; Leithwood and Jantzi, 2007).

These studies revealed the attendant consequences of class size and students' performance in different parts of the world.

Conclusion

The paper discussed on class size and students' academic achievement in mathematics and science. It was observed that class size plays a significant role in affording students the opportunity to partake fully in all class activities which will ultimately affect their level of learning and when the class has overcrowded structure that will not allow for effective learning to take place, the students as well as the teachers, the paper argued will find it extremely difficult to grasp what is being taught in the class on students' part and for the teachers too, they will find it difficult to teach. This is especially noticeable in science and mathematics; the duo of which are considered vital at secondary and primary levels in terms of preparing students for all science and technology courses at high level of learning.

Recommendations

i.   Government should endeavour to expand the existing structures in secondary and primary schools so as to allow for de-congesting the present overcrowded type of classrooms we do have in schools.

ii.   Recruitment of teachers of secondary and primary schools should be commensurate with the number of students in our schools today so that the student-teacher ratio will not be so wide. This will reduce the possibility of taking more number of students by teachers in a particular class.

iii.   Where class size is inevitably large, teachers should devise a means of dichotomizing students into segments so instructional and pedagogical strategies to be applied by the teacher will enable the students to effectively harness the lesson very well.

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