SCHOOL FACTORS AS DETERMINANT OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY

By

Banjoko, O. O., Gbadamosi, M. R., Abudu, K. A., Moyib, O. K., & Lawal, O. A.

Department of Chemical Sciences,
Tai Solarin University of Education, Ijebu-Ode.

Abstract

There is abundant research evidence to support the view that when Chemistry is taught in an enabling environment, meaningful learning takes place. But in reality this is not always so, hence observable low performance in chemistry at the secondary school level. This study therefore examined the extent to which school factors determine senior secondary school students' achievement in chemistry. A cross-sectional survey design was adopted for the study. Study sample were 200 senior secondary school chemistry students, drawn from five randomly selected secondary schools in Sagamu local Government area of Ogun State, South western Nigeria. Instruments were developed and validated for the study. Three research questions were raised and answered. Data were analyzed using descriptive statistics, simple percentage and analysis of variance (ANOVA). Findings from this study showed that each of the three factors used in the study (Science library facilities, instructional materials used and laboratory adequacy had a probability value less than 0.05 ($P < 0.05$), which implies that there is a significant difference in the performance of the students exposed to these factors than their counterpart who were taught without the facilities. The present results suggested that if the school factors are improved, the performance of students in Chemistry will also improve. Recommendations were made based on these finding to the government and other stakeholders in the education industry.

Keywords: Implications, Performance, Ex-Post facto, and Stakeholders.

Introduction

Science and Technology are imperative for sustainable, responsible and global development (Ben, 2010). Through the application of the knowledge of science, man ensures the longevity of his existence in various discoveries, innovation and interventions that have improved the quality of lives of mankind. Developing nations of the world are so called because of their advancement and growth in science and technology. In other words, for Nigeria to be at par with the developed nations of the world there is the need to make science more interesting among citizenry and ensures effective teaching of science in our schools (Obamamu, 2010).

Chemistry is one of the fundamental ingredients of technology. It is a branch of science that deals with the practical and experimental understanding of natural phenomena (Ogunleye, 1999). Umoiyang and Okpala, (2001) opined that three societal needs could be accomplished through the knowledge of chemistry. These are needs for physical survival, living a satisfactory economic life and raising the level of socio-cultural life. Chemistry had broaden our knowledge of methods of water purification, food preparation and care resources management, varying materials for construction of industries, roads, automobile and home, in addition to solving problems resulting from human interaction with the environment. As good as chemistry is, an important aspect in the delivery of chemistry is the methods and materials employed in transmitting knowledge by the teachers.

Chemistry teaching can only become result-oriented when students are willing and the teachers are favorably disposed to using the appropriate methods and resources in teaching the students (Adesoji and Olatunbosun, 2008). With the current increase in scientific knowledge globally, much demand is placed and emphasis is laid on the teacher, the learner, the curriculum and the development in the whole process of teaching and learning of science (Adesoji and Olatunbosun, 2008). Even though, the knowledge of chemistry to the society is very important, students' achievements in chemistry as measured by their scores in Senior Secondary Certificate Examination are poor in Nigeria. Among factors that have been identified are teachers' attitude (Aghadiuno, 1992), poor science background (Oshokoya, 1998, Adesoji, 1999), class size (Oguntoye, 2011, Afolabi, 2002), and school location (Aderonke, Victoria, Michael and Sakibu 2013).

Previous studies in chemistry have found that students understand the course unit on physical and chemical changes, but have difficulty in understanding event at the micro level and explaining chemical changes in relation to chemical bonds

(Mirzalar *et al*., 2005). In addition, the literature shows that students have difficulty in constructing the topic of the chemical changes unit in their minds; and that teachers do not support students to have adequate knowledge during the construction process (Akkus *et al*., 2007). The reason for this weakness is frequently attributed to the lack of laboratory practice (Yang and Hey, 2007). Although, laboratory work is an indispensable element in understanding chemistry , previous studies have reported that it can be properly embedded into traditional chemistry courses for various reasons, such as safety concerns, lack of self-confidence and an excessive amount of time and effort required to conduct accurate experiment (Elton *et al*., 2010). Nonetheless, it is not impossible to overcome these obstacles via teachers' periodical training in the laboratory.

Laboratories stimulate a real practical environment and processes, which are defined as academic environment in which students convert their theoretical knowledge into practical knowledge by conducting experiments (Woodfield, 2005). Laboratories provide students with meaningful virtual experiences and present important concepts, principles and processes. By means of virtual laboratories, students have the opportunity of repeating any incorrect experiment or to deepen the intended experiences. Moreover, the interactive nature of such teaching methods offers a clear and enjoyable academic environment (Ardac and Akaygun, 2004). In addition to laboratory facilities, another important school based factor that affects academic achievement of students' in chemistry is class size. The question that is asked is "Are smaller classes better than larger classes?" this continues to be debated among teachers, administrators, parents and researchers. However, Robinson, (2000) concluded that research does not support the expectation that classes will of themselves result in a greater academic gains for students. He observed that effects of class size on students learning vary by grade level, pupil characteristics, subjects' area, teaching methods and other learning interventions. Adeyela, (2000), found that large class size is not conducive for serious academic work.

The impact of instructional materials and school location on academic achievement cannot be overemphasized. Akinola, (2009) observed that instructional materials are important in the teaching and learning of chemistry as it creates retention needed in students and as such chemistry classes taught without instructional aid is a waste of time because most of what is learnt there are abstract and concrete evidence is important for understanding and retention. In addition, school location determines to a very large extent the patronage such school will enjoy. Factors that influence students' academic achievement at the Senior

Secondary School are multivariate; hence, it is a matter of great concern to Nigeria government despite the introduction of new chemistry curriculum to consider the effects of school factors on students' achievement in chemistry. It is on this premise that this study present study is based and some school factors considered to be militating against students' performance were investigated. The variables in the study include the following independent variables are laboratory inadequacy, school location, science library facilities, and class size while the dependent variable is students' achievement in chemistry.

Research Questions

1. Is there any significant difference in the students' performance in chemistry for senior secondary schools with well-equipped library and those with underequipped library?
2. Is there any significant difference in the students' performance in chemistry for senior secondary schools with adequate instructional materials and those with inadequate instructional materials?
3. To what extent does laboratory inadequacy affect the performance of senior secondary school students in chemistry

Methodology

Research Design

The study adopted a survey design (the ex-post facto type). This design helps to present factors systematically and accurately in response to the problems under investigation and also it shows conditions as they exist without influence of the investigators. The investigator studied them retrospectively in terms of their relationship with the dependent variables.

Population of the Study

This study was carried out in five randomly selected Senior Secondary Schools in Sagamu Local Government Area of Ogun State, Southwest Nigeria. This area was chosen as a result of the researchers' observation of the abysmal poor performance of Students in secondary school in the area through their WASSCE and NECO chemistry results. A total of two hundred (200) Senior Secondary School Chemistry Students (SS II) purposively selected constituted the sample for this study. Forty (40) students were selected from each School. The population consists of both public and private schools

Sample and Sampling Technique

A simple purposive sampling method was used to select a total of forty (40) students from five selected school in Sagamu Local Government area of Ogun State. The selected Schools were all chosen as a result of the researchers' observation of the abysmal poor performance of Students in secondary school in the area through their WASSCE and NECO chemistry results. The schools are

i. Remo Secondary School
ii. Methodist Comprehensive College
iii. Remo Methodist High School
iv. Topmost Model College
v. Remo Division High School
vi. Research Instruments

The instrument of data collection in this study wasStudents'Chemistry Learning Inventoryand Student Chemistry achievementTest developed by the researchers. The questionnairewhich was divided into two parts was used to elicit demographic information from the students while the second part was used to obtain information on the other variables of interest in the study.

Validation of Research Instruments

Two experienced chemistry graduate teachers in secondary schools in Ijebu-Ode Local Government area and two senior lecturers in the curriculum department approved the face and content validities of the research instrument after careful reading and corrections.

Reliability of Instrument

To establish the reliability of the instrument, the instrument was pilot-tested with forty (40) students from selected Senior Secondary School in Sagamu Local Government Area of Ogun State, which were different from the population of the study and a test-retest reliability co-efficient of 0.829 was obtained for Chemistry achievement test.

Procedure for Data Collection and Analysis

The questionnaires were administered to the SS II students and retrieved the same day. Analysis of variance (ANOVA) was used to analyze the data collected from the students. Answers were provided through this medium to the research questions raised in the study. In decision making as whether to accept or reject the

null hypotheses, the computed sig. value was compared with the alpha sig. value which stands at 0.05. The null hypotheses were accepted if the computed sig. value is greater than sig. value of 0.05 while it was rejected if otherwise.

Results

Hypothesis One

HO_1: There is no significant difference in the performance of students in chemistry with well-equipped science library and those with underequipped science library.

Table 1: Summarized Table of Analysis of Variance (ANOVA) for Science Library

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig**
Between Gropu	37.780	4	9.445	7.981	0.000
Within Groups	230.775	195	1.183		
Total	268.555	199			

Source: Researcher Field, 2014.

From the Table 1 above, the F-calculated (7.981) is greater than F-tabulated (6.25) as shown with low probability value of 0.000 which is extremely lesser than 0.05 ($P < 0.05$) the chosen level of significance while 4 and 195 are the degree of freedom. There is sufficient evidence to accept the alternative hypothesis. Therefore, the presence of functional and well equipped science library with modern chemistry textbooks has a significant influence on student performance in chemistry.

Hypothesis two

HO_2: There is no significant difference in the performance of students taught with chemistry instructional materials and those without instructional materials

Table 2: Summarized Table of Analysis of Variance (ANOVA) for testing hypothesis on Instructional Materials

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig**
Between Group	30.870	4	7.717	6.989	0.000
Within Groups	215.325	195	1.104		
Total	246.195	199			

Source: Researcher Field, 2014.

Findings from table 2 above, shows that F-calculated (6.989) is less than F-tabulated (6.25) as shown with higher probability value of 0.000 which is extremely lesser than 0.05 ($P < 0.05$) the level of significance. Therefore, there is sufficient evidence to accept the alternativehypothesis which states that there is a significant difference in the performance of students taught with instructional materials and those taught without instructional materials. Hence, the use of instructional materials have a positive impact in enhancing students retention, thereby facilitating learning of chemistry as it can be seen with a difference in the result of student exposed to instructional materials and those taught without instructional materials.

Hypothesis three

HO_3: There is no significant difference in the performance of students with laboratory adequacy and those with inadequate laboratory facilities

Table 3: Summarized Table of Analysis of Variance (ANOVA) for testing hypothesis on Laboratory Inadequacy

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig**
Between Group	36.380	4	9.095	11.05	0.000
Within Groups	160.500	195	0.823		
Total	196.880	199			

Source: Researcher Field, 2014

F-Calculated = 11.050
F-tabulated = 6.26

From the above result, the F-calculated (11.050) is greater than the F-tabulated (6.26) as shown with low probability value 0.000 which is extremely lower than 0.05 ($P < 0.05$) the level of significance. There is sufficient evidence to accept the alternative hypothesis which states that there is a significance difference in the performance of students exposed to laboratory facilities and the use of laboratory than those with inadequate laboratory facilities. Hence it is imperative to know that functional laboratory facilities enhance the teaching and learning of chemistry and students' learn better when the teaching become practical rather than the abstract way. Furthermore, students' interest are arouse when they are able to link the theoretical concept to practical demonstrations.

Discussion

The results obtained in Tables 1, 2 and 3 shows that those students who have access to well-equipped science library, those who are taught using up-to date and functional science instructional materials and those with adequate exposure and frequent practical classes due to the presence of laboratory facilities tends to perform better than those taught without these facilities and see chemistry as one of the simplest science subjects. This study also lends credence to the concern raised by the experts who designed the new Senior Secondary School chemistry curriculum that factors such as laboratory inadequacy (unavailability and inadequate of materials, equipment and apparatus), absence of well-equipped science library and un-use of up-to date science instructional material could pose a difficulties for the implementation of the new chemistry curriculum. Result showed that there is significant relationship between the utilization of laboratory resources and achievement of students in chemistry. Findings of the present study are in line with the findings of Akinola (2009), Ola (2000), Lawal (2006) and Yang and Hey (2007). In addition, findings of Tatli and Ayas (2011) also corroborated the present findings in which they all affirmed that by maximizing interactivity, laboratory practical applications render students to be active thinkers instead of passive observers and thereby construct an effective and meaningful learning process. It was obviouslyshown from the present findings that school facilities such as library facilities, laboratory adequacy and the use/availability of science instructional materials have significant influence on the students' performance in Chemistry.

Conclusion

The present findings showed that: Significant difference was found when chemistry students were exposed to laboratory practical which relates the theoretical concepts taught in class to the practical and observable experience, when teachers used functional science instructional material for their teaching and when there is library facilities, equipped with recent and relevant chemistry and science related textbooks as compared with performance of chemistry students taught without the aforementioned facilities, the difference was in favour of those students exposed to these facilities. For students' achievement, laboratory adequacy, instructional materials used and availability of library facilities were predictors as they have significant effects on the academic achievement of the students especially at Senior Secondary school level. These factors have indicated the area that need to be

addressed in order to enhance the learning outcomes of students in Chemistry. If government and other stakeholders in education industry could improve all the above mentioned school factors, it is very likely that students' performance in chemistry will improved exponentially.

Recommendations

In view of the results of the present findings and conclusion reached, the following recommendations are hereby offered:

- Government and school authorities should through the allocation of funds, materials and apparatus for sciences teaching make school laboratories more adequate for effective implementation for Chemistry curriculum so as to enhance the performance of students in the Subject.
- Students should be exposed to more laboratory practical in order to bridge the gap between the theoretical experience which many termed to be more abstract and practical experience which enhance students' retention and improved learning of Chemistry and familiarized the students' with laboratory materials and equipment.
- Chemistry teachers should try to improvise materials for practical work where possible so as to lighten the financial burden of school administrators while the government should improve on the funding of schools to alleviate this challenge.
- The school administrators should on their part provides enough instructional materials for teachers and students for effective teaching and learning process.
- Government and other stakeholders with the school administrators should provide a modern library facilities stocked with recent and relevant chemistry and other science textbook and encourage teachers and student to often use them.
- Practical activities should be taught by techniques that will generate interest in students.

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