RELATIONSHIP BETWEEN AVAILABILITY OF LABORATORY FACILITIES AND ACADEMIC ACHIEVEMENT IN BIOLOGY AMONG SECONDARY SCHOOL STUDENTS IN MINNA METROPOLIS, NIGER STATE

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Abstract
The study investigated the relationship between the availability of Biology Laboratory facilities and academic achievement among senior secondary school students in Minna Metropolis, Niger State. The design of the study was a correlation survey type. The population of the study comprised of all the final year students totaling 3,761. The sampled size used for the study was 53 students randomly selected. Instrument for data collection was Questionnaires which were administered to ascertain the availability of laboratory facilities in selected secondary schools and also to source for the WAEC result for a period of four years (2012-2015). The instruments were validated by three science educators from Federal University of Technology, Minna and two experts from Niger State Ministry of Education. The reliability of the Questionnaire was determined using split half method and r= 0.82 was obtained. The data collected were analyzed using Cronbach alpha. While the academic achievement and availability of laboratory facilities scores were computed using Pearson Product Moment Correlation formula. The result revealed that deficiency in the availability of laboratory facilities affects students' achievement in Biology. Comparison in gender achievement showed that female students' achievement exceeded that of male despite the fact that they face the same challenges in terms of inadequacy of laboratory facilities. It was therefore recommended that the relevant regulatory authorities should provide the necessary needed Biology facilities for schools.

Keywords: Laboratory, Facility, Academic Achievement, Teaching, Learning

Introduction

Since the beginning of human civilization especially around 18th to 20th century, science and technology has progressed extensively. But the search for new knowledge is based on rational thinking, which is fundamental for progress and for making new discoveries. Science is an education process that allows the educated and creative minds to question, experiment or observe in an attempt to find answers, and then try to identify a set of unifying principles, concepts, and laws that embraces all phenomena of nature. The aim is to better understand the universe and gain new knowledge that will enlighten humanity by unveiling mysteries of how nature works. In the process we may make new discoveries and inventions that change the way we think and/or create new technologies that transform the society (Ahmed, 2002).

Science has become a very important part of Nigerian secondary school curriculum. The more popular subjects are Chemistry, Physics and Biology. Over the years the enrolments of students in public examination conducted by the West African Examination Council (WAEC) shows that Biology is most preferred to the other science subjects because it was the only core science subject offered by both art and science students. The role of science is being threatened by poor teaching habits of teachers and learning of practical tasks in internal and external examinations (Baruwa, 2006). People however, have given various reasons for this poor performance of students and these range from inadequate resources, non-availability of laboratory facilities, large classes, in adequate time allocation, poor science teaching due to teachers' incompetence and poor commitment to students' poor attitude to learning (Ango, 2002).

However, education all over the world has been identified as one of the vehicles for the development of any nation. It is also an instrument for creating awareness and instrument for future development of any individual, while school is a formal place where learners are being taught and inculcated with various knowledge and skills necessary for capacity development which eventually lead to national development (Yakubu, 2005).

The examinations conducted by the two bodies that organize SSCE examinations West African Examinations Council (WAEC) and the National Examinations Council (NECO) demand that the candidates should respond to questions on both theoretical knowledge and practical. The results of such examinations have shown that the candidates probably lack the competence expected of them since the rate of failure in the two organized exams is relatively high (Sadiq, 2007). It is necessary to note that practical techniques in Biology has a relationship with availability of equipment and ability to use such equipment and other laboratory facilities (Maperderum, 2002). This is so because the processes and skills in Biology can be carried out and mastered by appropriate and adequate laboratory facilities (Kimuru, 2005).

Laboratory facilities have may be seen a potent factor to quantitative education. The importance of teaching and learning is the provision of adequate instructional facilities. The dictum that "teaching is inseparable from learning but learning is not separable from teaching" is that teachers do the teaching to make the students learn, but students can learn without the teachers (Muhammed & Mango, 2002).

Laboratory has been conceptualized as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms. Nwagbo (2008) stated that the saying that "seeing is believing" as the effect of using laboratories in teaching and learning of science and other science related disciplines as students tend to understand and recall what they see than what they hear or were told. Laboratory is essential to the teaching of Biology and the success of any science course is much dependent on the laboratory provision made for it. Affirming this, Omosevvo (2008) said there is a general consensus among science educators that the laboratory occupies a central position in science instruction. It could be described as a place where theoretical work is practicalized whereas practical's in any learning experience involves students in activities such as observing, counting, measuring, experimenting, recording, observation and carrying out field work. These activities are totally different from the theoretical work which involves listening to talks and taking down notes from such talks. According to Ango (2002) laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation, promotes that science is not only products or process, affords the learner the basic skills and scientific method of problem solving and Knowledge obtained through laboratory work promotes long term memory.

Availability of laboratory facilities are prerequisite in obtaining high student achievement in science practical. Okachi (2006) noted that mastery of practical techniques in Biology has a relationship with the availability of equipment and the ability to use such equipment and other laboratory facilities effectively. Availability of laboratory facilities promotes effective Biology teaching and learning especially in the introduction of demonstration pedagogical approach (Ibrahim, 2014). Nzewi, (2008) noted that the materials employed in impacting knowledge is a very crucial aspect in the delivery of Biology.

Biology laboratory is vital for students' investigative method of learning especially when they are actively involved in practical sessions. Unavailability of laboratory facilities, similarly, it has been the bane of many schools and has led to schools performing poorly in practical, this is

collaborated with the findings of Viadero (2006); Sadiq (2007); Nzewi (2008) who independently stated that there has been poor performance of Biology students in senior secondary schools in recent times especially in the science subjects.

The pertinent question often asked is, what has led to the high failure rate amongst the SSCE examination candidates? On this premise therefore, an investigation was undertaken to buttress on this question with particular reference to Minna Metropolis. This study is limited to assessment of laboratory facilities and SSCE results for four years under review.

One of the cardinal principles of the National Policy on Education (FME, 2004) is to "create in the students' awareness of the impact and influence that science has on the society, so preparing him for life in a technological age". To be able to synthesis this awareness, secondary schools need to be equipped with up-to-date and standard laboratories suitable for this level of education. A thorough understanding of science programme is therefore called for in setting up Biology laboratory and this requires the knowledge and expertise of specialists in the subject (Joy, 2013).

Practical activities in Biology provide opportunities for students to actually do science as opposed to learning about science. Nzewi (2008) asserted that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher (teaching) more real to the students as opposed to abstract or theoretical presentation of facts, principles and concepts of subject matters. He maintained, that practical activities should engage the students in hands-on, mind-on activities, using varieties of instructional materials/equipment to drive the lesson home; these are contained in the laboratories (Nwagbo, 2008).

Studies on the biological explanation of gaps in performance between male and female learners suggested that differences in brain structure, hormone production, and/or maturation rates may account for differentiated performance in school-related tasks. Studies further show that the parts of the brain responsible for processing verbal information and permitting the exchange of information between hemispheres were more highly developed in girls (Kimura, 2005). Girls also demonstrated earlier development in the brain regions responsible for impulse control, and, in general, matured earlier than boys (Viadero, 2006).

Many reasons have been advanced for low participation of girls in science. Some studies reported that females are deficient in practicals because they lack analytical and visual-spatial skills that are needed for abstract reasoning in science (Ogunleye, 2002). However, this argument has been proved wrong because emerging evidence shows that ability is not a determining factor in whether or not females would participate in science. Girls and boys are found to perform equally well if instructional context is fair and conducive (Erinosho, 2008). Also, Seweje (2002) findings revealed that there is a significant difference between male and female students towards Biology practical activities in favour of male. Perhaps, this has been the reasons for males' better performance in Biology practical achievement. This finding corroborates earlier findings of Udo (2000) which observed similar difference between males and females. For example, teachers' use of an inquiry approach that combined efforts to raise students' interest and engagement, including appropriate laboratory techniques reduced the gap between boys and girls.

Researchers have found Science laboratories to be central to the teaching of Science in secondary schools. Biology and other science subjects' laboratories have been found to be the scientist's workshop where practical activities are conducted to enhance a meaningful learning of science concepts and theories (Seweje, 2000). They have also been found to be a primary

vehicle for promoting formal reasoning skills and students' understanding, thereby enhancing desired learning outcomes in student's test (Ogunleye, 2002).

Maperderun (2002) emphasized on the need to make laboratory facilities available and enough in order to promote effective teaching of science and learning activities in schools. He also said that making these laboratory facilities un-available affects students' academic performance in Biology. Negatively students demonstrated significantly higher achievement in the school where active practical learning methods were pervasive (Okachi, 2006). Active involvement of students enhances their academic performance (Muhammed & Mango, 2002).

Omosevvo (2000) opines that a truly committed Biology teacher is expected to improvise from time to time as the need arises by engaging students on participatory project activities and practical that would develop in them proper scientific skills, knowledge, attitudes and values which they can apply presenting and in future for better performance in examination. Hence there is need for improvisation. Omosewo (2008) considered the human factors as the teacher's professional commitment, creativity, mechanical skills, initiative and resourcefulness.

Obviously, when Facilities for practical are not available, the required practical lesson cannot hold, in such cases, the teacher tends to teach the practical by lecture method, consequently the students do not develop the practical skills required to pass the examination in science there by contributing to a high failure in students' academic achievements. Therefore, adequate provision, proper utilization as well as effective delivery of instruction will lead togood performance in SSCE examination and Biology in particular.

It is no more news that the general performance of students in WAEC especially Science subjects and in particular Biology has not been impressive in the past few decades despite efforts by the different levels of government and all stakeholders to improve the performance of the students. Quite a number of factors have been identified as contributory to this poor performance among students such as inadequate/insufficient laboratory facilities in secondary schools which cannot cater for practical lessons top the list in the science education literature. This constitutes a pedagogical hindrance in the effective teaching and learning of Biology concepts. It is against this that this study was undertaken to investigate the relationship between the availability of laboratory facilities and their effects on students' academic achievement at Senior Secondary School Biology Examinations focusing on Minna Metropolis, Niger State.

Research Questions

The following research questions were formulated;

(i) Would there be any relationship between the availability of Biology laboratory facilities and students' academic achievement in Biology in WASSCE in Minna Metropolis Niger State?

(ii) Is there any relationship between the academic achievement of male and female students in relation to availability of laboratory facilities?

Research Hypotheses

The following null hypotheses was formulated and tested at 0.05 level of significance:

Ho_1: There is no significant relationship between the availability of Biology laboratory facilities and academic achievement of students in the Biology in WAEC in Minna Metropolis, Niger State.

Ho_2: There is no significant relationship between male and female academic achievement in Biology based on the availability of Biology laboratory facilities in Minna Metropolis, Niger State.

Research Methodology

The research design adopted for this study was a correlational survey and ex-po factor design. It was design to describe the relationship between availability of laboratory facilities and students' academic achievement in WAEC Biology Examination for years (2012-2015). A survey study is a data collection technique in which information is gathered from samples called respondents, by having them respond to questions. It is concerned with the generalized statistics that results when data are abstracted from number of cases. The population of the study comprised of nine thousand five hundred and eighty (9,580) students in all the Senior Secondary Schools in Minna Metropolis, Niger State. Out of this number 3,761 students constitute the required target population of the study. The research design used purposive sampling procedure in which five secondary schools were selected from the entire population of (53) Secondary Schools that have registered and sat for WAEC/SSCE for the four-year review (2012-2015). The total number of students that sat for WAEC examination within 2012-2015 was three thousand seven hundred and sixty-one (3,761) with male students accounting for 1891 and female students accounting for 1870.

The choice of Minna Metropolis is for easy accessibility and the name of the schools are: Ahmadu Bahago Senior Secondary school (ABSS), Zarumai Model Secondary School (ZMSS), Bosso Secondary school (BSS), Government Day Secondary School (GDSS) and Army Day Secondary School (ADSS). The instrument used for data collection were; a checklists structured by the researcher containing vital information about laboratory facilities and the second was the WAEC results for four years (2012-2015).

The instrument was validated by three Science Educators from Federal University of Technology Minna, Niger State for face validity and content validity of the items. The face validity focused on the logical arrangement of the items while the content validity focused on the subject matter content of the checklists. The designed checklist was tested for its reliability by using split half method. The scores were collected and analysed using Cronbach alpha formula and reliability coefficient index of 0.82 was obtained. The researcher personally administered the checklist to ensure fairness, clarify areas not clear enough and for objectivity and immediately collected the check lists to avoid lost. This was achieved through the assistance of the Biology teachers in each of the schools sampled.

The data collected were analysed using mean, standard deviation and Pearson product-moment correlation (r) statistics correlating the academic achievement and availability of laboratory facility.

The Biology result for each school for four years was measured using four points scale (Bloom 1971) as Point scale from A1-B3 (Distinction) is given 4; Point scale from C4-C6 (Credit) is given 3; Point scale from D7-E8 (Pass) is given 2; Point scale from F9 (Fail) is given 0. The average percentage pass obtained for each school for four years was summed up and compared against the schools scores on available laboratory facilities.

The scoring pattern for the facilities is as follows: An item within a category of equipment/facilities is scored two points where it is considered "available and adequate", one if it is "available not enough" and zero if it is "not available" because non availability means nothing. The scores for each category of equipment are summed up since four categories of the equipment of equipment were listed namely general materials, charts, reagents and models. The scores on all these categories were added up to have a final total score for each school. The names of the schools are designed as ABSS, ADSS, BSS, GDSS and ZMSS respectively for the purpose of confidentiality and anonymity.

Results

Table 1: Laboratory facilities variables

S/N	School	General Materials	Charts	Reagents	Models	Total
1	ABSS	32	11	18	10	71
2	ADSS	20	03	03	01	27
3	BSS	23	03	16	07	46
4	GDSS	24	13	16	01	54
5	ZMS	24	08	10	01	43
	Total	103	38	63	20	235

Table 1 shows the equipment scores for each of the Secondary Schools. The School with the highest score in the study area is ABSS with a total score of 71 out of 82 followed by GDSS, with total score of 54 and the school with least score is ADSS with 27.

Ho_1: There is no significant relationship between the availability of Biology laboratory facilities and academic achievement of students in Biology in WASSCE in Minna Metropolis, Niger State

Table2: WASSCE Biology Result and Schools Equipment Scores

Schools in abbreviation	Total on equipment scores	SSCE Biology Results from 2012-2015				Total No. of candidates
	X	$4(A_1-B_3)$	$3(C_4-C_6)$	$2(D_7-E_8)$	$0F_9$	Total
ABSS	71	0	201	210	184	595
GDSS	27	0	4	36	476	516
ZMSS	46	6	69	36	273	384
BSS	54	0	0	27	762	789
ADSS	43	0	360	705	412	1477
						3761

Source: School WAEC Record (2015)

Table 2: Summary of Pearson Product -Moment Correlation (R) statistics of achievements in biology at wasce and availability of laboratory facility

Variables	Mean	SD	r-Cal	Df	r-crit	P-value	Decision
Achievement	0.886	0.89					
	3761		0.161	3759	0.087	0.01	*significant
Laboratory facilities	48.2	16.084					

*significant at $P < 0.05$

The result in Table 2 reveals that there is a significant relationship between achievement in WASSCE Biology and availability of laboratory facilities, this is because the r-value is 0.161, P-value = 0.01 is less than 0.05 level of significance set for this study. Hence, the null hypothesis ($H0_1$) is rejected, that is there is a significant relationship between the availability of laboratory facilities and student achievement in Biology in WASSCE.

Ho_2: There is no significance difference between Male and Female academic achievement in Biology in relation to availability of Biology laboratory facilities.

Table 3: Summary of independent t-test between male and female achievement in relation to the availability of laboratory facilities in WASCE

	Gender	N	Mean	SD	t-Cal	Df	
Achievement	Male	1891	47.88	10.837	6.301	3759	0.000*
	Female	1870	45.06	15.168	6.623		

*significant at P-value < 0.05

Table 3 reveals that the Male and Female achievement in Biology is statistically significant, since the P-value 0.000 < 0.05 level of significance. Hence, the null hypothesis ($H0_2$) is rejected, that is there is significant difference between male and female academic achievement in Biology in relation to availability of Biology laboratory facilities meaning that the performance of the groups of students varies in respect learning outcomes when laboratory facilities are available.

Discussion

Table 3 shows the equipment scores for each of the five selected Secondary Schools in Minna Metropolis. There are four categories of equipment and these include; General Materials which is 35 in number, Charts 13, Reagents 23 and Models 11. Total number of equipment is 82 with each school showing the number of available equipment in each category.

ABSS has 71 number of equipment. The general materials are 32 out of 35, 11 for charts out of 13, 18 reagents out of 23 and 10 models out of 11. ADSS with a total number of 27equipment, have 20 general materials, 3 charts, 3 reagents and 1 model.

BSS with a total of 46 equipment, 23 general materials, 3 charts, 16 reagents and 7 models, GDSS have total number of equipment of 54, with 24 general materials, 13 charts, 16 reagents and 1 model and finally ZMSS with a total equipment of 43, have 24 general materials, 8 charts, 10 reagents and 1 model.

The result of the WASSCE for four years (2012-2015) study period based on the achievement of students in relation to the availability of laboratory facilities (Table 4.2) indicate that the availability of laboratory facilities plays less role in determining the students' achievement. A School by School analysis shows that ABSS with 595 registered students in Biology produce 201 students with C_4-C_6(Credit level), 210 with D_7-E_8(Pass level) and 184 at (Fail level).

ADSS with 516 registered students in Biology produce 4 students with C_4-C_6(Credit level); 36 with D_7-E_8(Pass level) and 476 at (Fail level) also ZMSS with 384 registered students in Biology produce 69 students with C_4-C_6(Credit level), 36 with D_7-E_8(Pass level) and 273 at (Fail level), BSS with 789 registered students in Biology produce 0 students with C_4-C_6(Credit level), 27 with D_7-E_8(Pass level) and 762 at (Fail level) and GADSS with 1477 registered students in Biology produce 360 students with C_4-C_6(Credit level), 705 with D_7-E_8(Pass level) and 412 at (Fail level)

Table 1 reveals that there is a significant relationship between achievement in WASSCE Biology and availability of laboratory facilities; this is because the statistic values correlate positively to the stated objective. Hence, the null hypothesis ($H0_1$) is rejected, and the alternate suggestion is accepted which state that there is a significant relationship between the availability of laboratory facilities and student achievement in Biology in WASSCE. This result is in agreement with Joy, (2013) in a similar study of relationship between the availability of chemistry laboratory facilities among senior secondary schools in Zaria Metropolis.

Table 2 shows the gender components of students' achievement in Biology, it indicates that female achievement is more than that of male with significance difference of 10 and 15 for male and female respectively at 0.05 level of significance. There is significance difference between male and female academic achievement in Biology in relation to availability of Biology Laboratory facilities. This is in agreement with Joy, (2013) in a similar study of relationship between the availability of Chemistry laboratory facilities among senior secondary schools in Zaria Metropolis found out that availability of laboratory facilities has profound relationship with academic achievements of students in Biology.

Conclusion

In conclusion there is significant relationship in the level of availability of Biology laboratory facilities on students' performance in Biology and also there is a significance difference between Male and Female academic achievement in relation to availability of Biology laboratory facilities.

Recommendations

On the basis of the findings emanating from this study, the following recommendations are made for consideration by educational administrators, curriculum planers and measurement and evaluation bodies:

(i) Federal and State Ministries of Education should make available to every school standard laboratory materials and facilities needed for practical.

(ii) Policies and guidelines should be formulated for the efficient use of science laboratories for teaching and learning purpose.

(iii) Ministries of Education and schools should provide separate laboratories for the sciences, and encourage their usage by students and ensure effective use of laboratories at all levels of education.

(iv) Provisions should be made for Biology practical in school time table preferably double lessons.

(v) Teachers and laboratory attendants should be encouraged to go for workshops and seminars in order to improve their skills in the use of laboratory facilities.

(v) Zonal science laboratory equipment centers with the sole function of providing laboratory equipment for science teaching should be set up for the furnishing of laboratories in schools.

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