
COMPETENCY OF STUDENTS IN THE IDENTIFICATION OF BIOLOGY LABORATORY APPARATUS IN SECONDARY SCHOOLS IN KADUNA STATE

BY

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ABSTRACT

The main objective of this study was set to determine the competency level of Senior Secondary Biology students in identifying and stating names and uses of some laboratory apparatus. Three research questions and three hypotheses guided the study. Survey research design was used for the study. The population for this study was 5587 Senior Secondary Biology students of public schools in Sabon-Gari and Kudan local government areas, Kaduna state. The sample of the study consisted of 357 students drawn using Krejcie and Morgan, table. The research instrument used in this study was Biology Students Laboratory Apparatus Questionnaire (BSLAQ) developed by the researcher. Frequency, Percentage score and t-test analysis with the help of Statistical Package for Social Sciences (SPSS version 20) were used to analyze the data. Result revealed that Biology students in the study areas have a very low competency level in identification and stating names and uses of common laboratory apparatus. T-test analysis further revealed that, there is no significant gender difference, in achievement based on gender and location. It was recommended that Biology teachers should be provided with adequate knowledge, skills and resources that will enable them to teach effectively in practical learning environments. Conducting more practical lessons will increase the exposure of Biology students to laboratory materials and equipment.

Keywords: Exposure, Competence level, Identification, Laboratory apparatus, Biology students

INTRODUCTION

Education is universally recognized as a form of investment in human capital for economic benefit of countries. The objective of providing quality Education in Nigeria is a concern that has preoccupied the minds of parents, educationists and the government till date. The worth of a learners output is determined by the quality of Education offered to the learner either formally or informally (Hofstein, 2004). Secondary Education is

important as it constitutes an investment in Education that yields considerable social and private returns. One importance of Secondary Education is the moulding of learners into responsible citizens of tomorrow and that cannot be undermined (Kurian, 2008). Availability of necessary physical facilities enhances quality of teaching and learning and the academic performance of learners in all subjects. The direction of teaching and learning of Science subjects in schools is expected to

lead students to acquiring the required Science Process skills, life skills and competence as enshrined in the revised edition of National Policy on Education (FRN, 2013). Laboratory work is an indispensable part of Science instruction and no effective Science Education can exist without practical work (Udo, 2010), which are dependent on the level of equipping of the laboratory with relevant apparatus and the ability of the teacher to effectively and efficiently utilize them (Katcha & Wushishi, 2015; Hofstein, 2004). The main purpose of laboratory work in Science Education is to provide students with conceptual and theoretical knowledge to help them learn scientific concepts and through scientific methods to understand the nature of Science (Dan-Ologe & Shittu, 2012). Availability of laboratory equipment, facilities and materials play a vital role in determining the extent of best laboratory practices that will ensure acquisition of Science Process skills and competence in Science concepts by the learners (Katcha & Wushishi, 2015).

Biology students have been performing below expectation and poor performance of students in Biology is persistent (Awolaju, 2016; WAEC, 2013). Shaibu, (2014) also noted the declining poor performance of Kaduna state students in senior secondary certificate Biology examinations. Nwosu, (2014) discovered a low competency level of secondary school students in identification and stating names of chemistry laboratory apparatus. Among the reasons responsible for these poor performance includes poor laboratory practical activities due to large class size, inadequate laboratory equipment and often many Biology teachers and students thought the subject to be simpler than other Science subjects and instructional materials seems to be very common as they can be sourced in the environment (Awolaju, 2016; Katcha & Wushishi, 2015). However, the students and teachers always discover that required materials are in short supply considering

the large number of students to utilize those materials (Katcha & Wushishi, 2015). Studies also carried out at the university level in Turkey indicate that students cannot properly recognize laboratory materials and equipment (Costu, Ayas, Calik, Ünal, & Karatas, 2005). Similar researches conducted in Nigeria (Awolaju, 2016; Katcha & Wushishi, 2015; Ibe, Adah & Ihejiamazu, 2013; Dan-Ologe & Shittu, 2012) also indicate a low level of competency among teachers and students. Challenges often faced in carrying out practical in inadequately equipped laboratories has led teachers to separate Science lessons into practical and theory lessons and/or shifting practical work till a conducive time. Biology must be properly taught in the laboratories where experiments are carried out to reinforce the practical skills of students. Okoth (2011) noted that the role of the laboratory has been increasingly marginalized in African schools, Colleges and Universities. He further stressed that this marginalization is a constraint on the teaching of Science (Physics, chemistry and Biology) in Africa. Attitudinal constraints, constraints imposed by examinations, constraints due to lack of apparatus and inability to improvise are some other constraints faced. Any educational system that does not have adequate resources cannot achieve quality Education. Heinichet.al., cited in Okoth (2011) pointed out that concrete experiences facilitate learning retention and usability of abstract symbols. Hands-on activities provide necessary concrete experiences in that skills that are hard to conceptualize are clearly showed. They also show how the processes of each skill relate to each other. Several factors have to be considered if the quality of education is to be raised. One of these factors is the availability of teaching resources. Facilities such as laboratory equipment and apparatus as well as other teaching aids are ingredients for effective teaching and learning (Olutola, 2000).

It is against this background that the researcher intends to determine the competence level of Senior Secondary Biology students in laboratory activities specifically in identifying and stating the names and uses of common Biology laboratory apparatus.

Objectives of the study

The objectives of the study are to:

1. Determine the competency level of Senior Secondary Biology students in identifying and stating names and uses of some laboratory apparatus.
2. Ascertain the competency level of students in identifying and stating names and uses of some laboratory apparatus based on gender.
3. Determine if the location of the students influence their competency level in identifying and stating names and uses of some laboratory apparatus.

Research questions

The following research questions are posited to guide this study:

1. To what extent will Senior Secondary Biology students identify and state name and uses of some laboratory apparatus?
2. What is the competency level of Biology students in identifying and stating name and uses of some laboratory apparatus based on gender?
3. To what extent does location of Biology students affects their competence level in identification and stating name and uses of some laboratory apparatus?

Hypotheses

The null hypotheses postulated to guide this study are:

Ho₁: There is no significant difference in the competence level of Senior Secondary Biology students in identifying and stating name and uses of some laboratory apparatus.

Ho₂: Gender has no significant effect on the competence level of Senior Secondary Biology students in identifying and stating name and uses of some laboratory apparatus.

Ho₃: location of Biology students has no significant effect on their mean achievement in identification and stating names and uses of some laboratory apparatus.

METHODOLOGY

The research design adopted for this study is survey design. The population of this research work constitutes all the Senior Secondary School students of Kudan and Sabon-gari Local Government Areas of Kaduna State. Kudan L.G.A. has four (4) Senior Secondary Schools, while Sabon-gari L.G.A. has eight (8) Senior Secondary Schools with a total population of five thousand, five hundred and eighty – seven (5587) students. A total of 357 Senior Secondary students were selected as sample for the study in line with Krejcie and Morgan, (1970) table of determining sample size. Students in this population are expected to have learnt some topics in Biology and some are preparing to write SSCE in their various schools. The sample includes both males (98) and females (78) in the study area. The study has unequal number of males and females because random sampling was done.

Instrumentation

Biology Students Laboratory Apparatus Questionnaire (BSLAQ) as developed by the researcher and it contains two sections. The first section (Section A) contains the general information such as sex, age, class and name of school while Section B consists of questions on

identification and stating names and uses of Biology laboratory apparatus. Pictures of thirty-three commonly used Biology apparatus were given and students were asked to identify and state the names and uses of each one of them. The content of BSLAQ was validated by two Science Education experts (Professors) from Ahmadu Bello University, Zaria. A pilot study was carried out to establish a reliability coefficient value of 0.67 for the instrument with PPMC. Fifty (50) questionnaires were

administered by the researcher to Biology Students in Zaria Local Government Area of Kaduna State. BSLAQ was administered to all respondents by the researcher with the help of the form tutors in the various schools under study. Mean, Percentage, standard deviation and students' t-test for unequal sample size using Statistical Package for the Social Sciences (SPSS, version 20) were used to analyze the data obtained from the study.

RESULTS

Table 1: Summary of Percentages of Biology students with correct identification by stating names and use of each apparatus N = 357.

S/N	Name of Apparatus	Number with correct Identification	Percentage (%)	Number with Correct uses	Percentage (%)
1	Preserved plant specimen	4	1.1	0	0
2	Preserved animal specimen	8	2.2	0	0
3	Dissecting kit	8	2.2	8	2.2
4	Auxanometer	0	0	0	0
5	Herbarium cabinet	0	0	0	0
6	Desiccator	0	0	0	0
7	Hand gloves	245	68.6	94	25.5
8	Microscope Slides	0	0	0	0
9	Balances	67	18.8	0	0
10	Dissecting board	0	0	0	0
11	P ^H meter	16	4.5	0	0
12	Goggles (safety device)	24	6.7	0	0
13	Water Bath	8	2.2	0	0
14	Lab coat	221	61.9	83	23.2
15	Photometer	16	4.5	0	0
16	Hand lens	47	13.2	0	0
17	Centrifuge	0	0	0	0
18	Hygrometer	0	0	0	0
19	Beaker	83	23.2	24	6.7
20	Aquarium	16	4.5	0	0
21	Microtome	0	0	0	0
22	Microscope	174	48.1	126	35.3
23	Projector	32	9.0	8	2.2

24	Measuring tape	197	55.2	138	38.7
25	Test tube	77	21.6	32	9.0
26	Conical flask	79	22.1	16	4.5
27	Measuring Cylinder	142	78.5	32	9.0
28	Test tube holder	24	6.7	0	0
29	Test tube rack	79	22.1	39	10.9
30	Petri dish	32	9.0	0	0
31	Thermometer	95	26.6	47	13.2
32	Washing bottle	24	6.7	0	0
33	Spatula	47	13.2	16	4.5

From Table 1, only four items(Hand gloves 68.6%; Lab Coat 61.9%; Measuring Tape 55.2% & Measuring Cylinder 78.5%) of the thirty-three apparatus listed were identified by 50% and above of the respondents, one item(Microscope 48.1%) by 48% and the remaining twenty-eight items were below 40%. This

means that majority (84.8%) of the thirty-three commonly used laboratory apparatus were not correctly identified by Biology students in the study area. Very few students also stated the correct use of some of the thirty-three listed apparatus which were all below 40%.

Table 2: t-test comparison of Mean scores of Male and Female Biology students

Sex	N	Mean	SD	Std error	Df	t-value	P	Remarks
Male	98	6.93	5.06	0.52	355	0.262	0.03	NS
Females	78	10.0	6.40	0.73				

Table 2 indicates that male Biology students have a mean score of 6.93 while females have mean score of 10.0. This shows that the females performed better than the males. However, t-test analysis reveals a no significant difference. The P calculated 0.03 is less

than 0.05. The overall mean of achievement of all the students which is 8.47 is far less than 40 which have been conventionally accepted as a passmark for assessment of cognitive achievement.

Table 3: t-test comparison of Mean scores of Biology students in Kudan and Sabon-Gari LGAs

LGA	N	Mean	SD	Std error	Df	t-value	P	Remarks
Sabon-Gari	176	8.51	5.85	0.44	355	0.055	0.03	NS
Kudan	181	8.82	5.53	0.42				

Data from Table 3 reveals that location has no significant effect on the achievement of Biology students since calculated P is less than 0.05.

DISCUSSION

This study reveals that only five(Hand gloves 68.6%; Lab Coat 61.9%; Measuring Tape 55.2%; Measuring Cylinder 78.5%& Microscope 48.1%) out of

the thirty-three listed commonly used Biology apparatus were correctly identified with more than 40%. Twenty-two (84.8%) of the apparatus listed were not correctly identified. This signifies a low level of exposure and competence in identification of commonly used laboratory apparatus among Biology students in the study area and hence inadequate acquisition of the necessary skills in practical Biology. H_0_1 which states that "there is no significant difference in the competence level of Senior Secondary Biology students in identifying and stating uses of some laboratory apparatus" was retained. This finding supports studies of Nwosu, (2014) who reported that only 7% of the senior secondary school chemistry students in Sabon-gari, Zaria could identify commonly used chemistry laboratory apparatus and Ibeh, et al., (2013) who also discovered that 78% of chemistry teachers in Cross River State could not identify correctly some commonly used chemistry laboratory apparatus. Students should be exposed to more laboratory applications and activities so that they can recognize laboratory materials and equipment. Knowing that students who do not have proper pre-knowledge and experience could not be successful while they were doing experiments and also in their academics. Adeyemo (2012) concluded that availability of laboratories and laboratory facilities contribute to student's good academic achievement. The outcome of this study showed a no significant difference at 5% level, therefore it is highly essential and important that all secondary schools in Zaria have well equipped Biology laboratories in order to ensure that Biology is realistically taught and understood by the students. The role of the teacher however is important in students achieving higher in their studies. Without a well-educated, strong motivated, skilled, well-supported teacher the zeal for excellence in achievement by senior secondary school Biology students will collapse. The teacher is the keystone of quality. Education research

has continued to show that our effective teacher is the single most important factor of student learning (Darling-Hammond, 2000; Marzano, 2007). Marzano characterizes an effective teacher as one who matches the strategies to the students. According to the literature, the laboratory approach is regarded as an indispensable element of Science Education, and students subjected to constructivist learning theory-based laboratory instruction exhibit higher achievement scores, deeper attention and more frequent participation in learning (Tatli & Ayas, 2013; Koseoglu & Tumay, 2010). On the relationship between educational resources and students' academic performance, Idiagbe (2004) concludes that adequate facilities are determinants of assessing academic performance of students in secondary schools. This is in agreement with Nwangwu (1997) who also believed that teaching and learning with adequate activities, will result in effective teaching and improved academic performance of students.

The finding in Table 2 indicates that mean score of female students is higher than that of males in the level of competency in identification and stating names and uses of Biology laboratory apparatus. Even though the females achieved higher, t-test analysis further reveals a no significant difference. H_0_2 which states that "Gender has no significant effect on the competence level of Senior Secondary Biology students in identifying and stating names and uses of some laboratory apparatus" was also retained. The finding supports studies of Nwosu, (2014) that also discovered a no significant gender difference.

Result in Table 3 shows that there is no significant difference in the achievement of Senior Secondary School Biology students in terms of location. H_0_3 which states that "location of Biology students has no significant effect on their mean achievement in identification and stating names and uses of some

laboratory apparatus" were also retained. Finding is contrary to Ibe et al., who discovered that location has a significant effect on achievement.

There was poor performance generally and most students in the study area have low level of competency in identifying and stating names and uses of Biology laboratory apparatus. The findings in this study tend to reveal that students may not be having enough exposure to practical experiences which is a requisite need to pass Biology at SSCE. It also implies that students are not adequately prepared for their examinations and they also lack the necessary skills that prepare them for higher institutions and work life. Even though the curriculum requires the integration of both theory and practical in Science teaching, Nbina (2010) noted that lack of good laboratories equipped with adequate apparatus in most public schools have made many teachers to lag behind in teaching practical lessons. This means that the aim of teaching Biology at secondary level has not been effectively achieved. Increase in students' enrolment into Science subjects (especially Biology) makes the available resources and equipment to be grossly insufficient for any meaningful activity-based learning. Researchers such as Obioha (2006) and Ogunleye (2002) also reported that there were inadequate resources for teaching Science subjects in secondary schools in Nigeria. They further stated that the available ones are not usually in good conditions.

CONCLUSION

Uses of laboratory apparatus therefore provide appropriate introduction and learning of new and complex concepts. They also help in motivating the students to learning thus increasing their participation and concentration. The use of instructional resources would make discovered facts glued firmly to the memory of students. A well planned and imaginative use of visual

aids in lessons should supplement inadequacy of books as well as students interest by giving them something practical to see and do and at the same time helping to train them to think things out themselves. Biology students should be exposed to more laboratory applications and activities so that they can recognize laboratory materials and equipment. This will further enhance their academic achievement and their performance in national/international examinations.

RECOMMENDATIONS

This paper recommends the following:

- Since laboratory activities have special potential as media for learning that can promote important science learning outcomes for students, Biology teachers need to be provided with adequate knowledge, skills and resources that will enable them to teach effectively in practical learning environments. They need to be motivated by all concerned to enable students to interact intellectually as well as physically, involving hands-on activities in the laboratory.
- Adequately trained laboratory technicians should be employed to help Biology teachers in the laboratories because when they are overloaded with lessons and lack enough time to adequately prepare and conduct the practical lessons.
- Policy makers and relevant stakeholders need to avail resources to equip the laboratory in order to improve the exposure level of students to Biology laboratory apparatus and increase their performance in Biology.
- Students' perceptions and behaviors towards Biology laboratory activities should be greatly influenced positively by their teachers. This will

increase their competence level in laboratory activities.

REFERENCES

- Adeyemo, S.A. (2012): The influence of teachers' supply and the provision of laboratory facilities on students' achievement in Physics. *European Journal of Educational Studies* 4(3), 397- 409
- Awolaju, B.A. (2016): Instructional Materials as Correlates of Students' Academic Performance in Biology in Senior Secondary Schools in Osun State. *International Journal of Information and Education Technology*, 6(9), 705- 709
- Costu, B; Ayas, A; Calik, M; Ünal, S. & Karatas, F. Ö. (2005): Determining Pre-service Science teachers' competences in preparing solutions and use of laboratory tool. *H.U. Journal of Education*, 28, 65-72.
- Dan-Ologe, I. A. & Shittu, A. O. (2012): Improving the Standard of Teaching and Learning of Practicals in our Secondary Schools: Emphasis on Biology and Chemistry practicals. *Journal of Qualitative Education*, 8 (1), 1- 5.
- Federal Republic of Nigeria (2013): National Policy on Education (revised edition). Federal Ministry of information Printing Division, Lagos
- Hofstein, A. (2004): The laboratory in Chemistry Education: Thirty years of experience with developments, implementation and research. *Chemistry Education: Research and Practice* 5(3), 247-264
- Ibe, J.O; Adah, S.A. & Ilhejiamaizu, C.C. (2013): Assessment of Secondary School Chemistry teachers' quality through identification and uses of laboratory apparatus in cross River State, Nigeria. *Journal of Education and Practice*, 4(5), 135-141
- Katcha, M. A. & Wushishi, D. I. (2015): Effects of laboratory equipment on Secondary School students' performance and attitude change to Biology learning in Federal Capital Territory, Abuja, Nigeria. *Journal of Education Research and Behavioral Sciences*, 4(9), 250-256 www.apexjournal.org
- Nbina, J.B. (2010): Issues and challenges of Science Education and development in the 21st century. In Iloputaife, E.C; Maduwesi, B.U. & Igbo, R.O. (Eds). *Issues and challenges in Nigerian Education in the 21st Century*, 281-305.
- Nwosu, O.N. (2014): Extent of exposure of Secondary School students to chemistry laboratory apparatus. Unpublished Professional Diploma in Education thesis. Federal College of Education, Zaria.
- Obioha, N.E. (2006): *STAN Physics for Senior Schools*. Heinemann Educational Book Publishers, Nigeria.
- Ogunleye, B.O. (2002): Towards the Optimal Utilization and Management of Resources for the Effective Teaching and Learning of Physics in Schools. Proceedings of the 41st Annual Conference of the Science Teachers' Association of Nigeria, 215-220.
- Okoth, B.K. (2011): Impact of resource utilization on the performance of Physics in KCSE in Public

- Secondary schools in Ugunja/Ugenyadistricts, Kenya. Submitted in partial fulfillment for the award of degree in Master of Education (Planning) of Kenyatta University. Proquest, UMI dissertations Publishing.
- Shaibu, A. (2014): Navigating the Maze of Students' Underachievement in Science: Does Science Education Research Provide a Road Map? Inaugural lecture at Ahmadu Bello University, Zaria. A.B.U Press Limited, Zaria.
- Tatli, Z. & Ayas, A. (2013): Effect of a Virtual Chemistry Laboratory on Students' Achievement. *Educational Technology & Society*, 16(1), 159-170.
- Temiz, K.B. & Kanli, U. (2005): The identification of first-year undergraduate students' understanding on the basic Physics laboratory equipments. *National Education*, 33, 168
- Udo, M.E. (2010): Effects of integrating practical work with theory on students' achievement in Secondary School Chemistry. *Niger. J. Sci. Sci. Educ.* 8(2): 103-116.