

Evaluation of Laboratory Safety Awareness among NCE Biology Students in Colleges of Education in North West, Nigeria

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ABSTRACT

The study titled "Evaluation of awareness of safety measures in Laboratory among Biology Students in Colleges of Education in North West Geo-political Zone of Nigeria". Two objectives and two Research questions were generated and two Hypotheses were formulated. The study was an empirical research based on descriptive survey. Population of the study comprised 13,822 students. Sample size used was 338 for students. A structured questionnaire and direct observation were used for data collection. SPSS was used to analyze the data. The findings revealed that (0.000; $p < 0.05$) there is a significant relationship between the extent of awareness and the magnitude of safety measures in laboratory among NCE Biology students in the Colleges of Education North-West Geo-political zone Nigeria., There is a significant ($p < 0.05$) in the extent of implementation of safety measures between male and female NCE Biology students in Colleges of Education in North-West Geo-political zone Nigeria. Based on the findings it was recommended that science teachers should take awareness program of laboratory safety very serious for students. Laboratory rules, regulations and safety measures should be boldly written and placed at the laboratory.

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INTRODUCTION

Science, from its linguistic origin derived from the Latin word "Scientia" which means "Knowledge" (Eneh 2000). Science as a branch of knowledge is the systematic study of things around us. The totality of Knowledge obtained from such studies constitutes scientific knowledge. Science deals with nature, through observation and subsequent experimental investigation (Anaso, 2007; Kalu 2007). Usman, (2008), defines science as consisting of a specific branch of a general body of knowledge such as Biology, Chemistry, Physics, Geology or

Astronomy to mention but a few. In science students are exposed to teaching and learning strategies/methods including lecture method, demonstration, discovery, discussion, laboratory activities, co-operative learning etc, depending on the aspect one wants to teach.

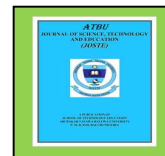
Safety is the state of being safe and free from danger. it is a top priority in school biology laboratory (Byebunu, 2016). Laboratory personnel realize that the welfare and safety of each depend on clearly defined attitudes of team work and personal responsibility. Accordingly, a crucial component of Biology

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education at every level is to nurture basic attitudes and habits of prudent behavior so that safety is valued and inseparable part of all laboratory activities. In this way, a culture of laboratory safety becomes an internalized attitude. (Ghoshal *et al*, 2007). Safety rules in laboratories must be included in each person's Biology education throughout his or her scientific career.

According to Mcleod, (2017) Potential exposure to chemical hazards can occur both during the use and via storage of chemicals. Biological hazards, examples include pathogenic microorganisms, animals, biological tissues, blood, and other body fluids (human and animal) potential exposures to allergens, infectious zoonotic (animal diseases transmissible to humans), and experimental agents such as viral vectors while physical hazards are associated with noise, radiation, manual handling of laboratory facilities, the most obvious being slips and falls in wet locations and the ergonomic hazards of lifting, pushing, pulling and repetitive tasks. Examples of electrical/mechanical hazards are high voltage, apparatus, and machinery with moving parts while psychological hazards are emotional stress, workplace bullying e.t.c.

When planning any work in a laboratory the risk of exposure to laboratory hazards is an important consideration because harmful chemicals are liable to cause local toxic effects, systemic toxic effects, or both when exposed to the body. In the first place, local effects refer to injury at the site of first contact i.e. the eyes, the skin, the nose and lungs, and the digestive tract. National Academy Sciences (2011) itemized cases of local effects which include (1) hazardous materials inhalation causing toxic

effects in the nose and lungs; (2) skin or eyes contact with harmful materials leading to effects ranging from mild irritation to severe tissue damage and (3) caustic substances ingestion causing burns, ulcers or even cancer in the mouth, esophagus, stomach, and intestines. On the other hand, systemic effects manifest after the toxicant has been absorbed from the site of contact into the bloodstream and distributed throughout the body. Some chemicals produce adverse effects on all tissues of the body but others tend to selectively injure a particular tissue or organ without affecting others. Organs often affected include the liver, lungs, kidney, and central nervous system.

A well-equipped biology laboratory would enable students to develop good judgments, self-reliance, critical thinking, and technical personal contact with apparatus and materials present in the laboratories under the direction\supervision of the teacher. Biology laboratory needs to be well organized so that a climate for investigating scientific concepts will exist such a climate ensures that the laboratory is safe for those using it. Since the laboratory environment is meant for man to handle, accidents and injuries are bound to occur. Therefore the teacher in the biology laboratory is responsibly committed to teaching his students how to handle chemicals and materials, to bring about good results in a safe manner of preserving life. In this regard, Byrd (2017) posited that most of the accidents and injuries that occur in secondary school biology laboratories mainly result from inadequate knowledge of safety rules, insufficient skill by the laboratory workers, and carelessness.

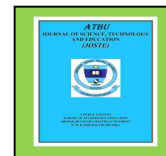
Statement of the Problem

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Science educationist realizes the importance of school laboratories and each relationship with science courses e.g biology that represent a key study to students knowledge in the years of preparation as these courses are based on stimulating thinking, analysing phenomenon and dictating scientific methodology in research.

Safety measures are of paramount important to Nigerian colleges, if they are not checked and managed, the health and safety of all those that carry out various activities in the science laboratory will continue to be at risk. It is on this note that this study intends to evaluate the safety measures in biology laboratory among NCE Biology students safety, and health in six (6) Colleges of Education in the North West Geo-political Zone of Nigeria.

Objectives of the study

1. Determine the extent of awareness of safety measures in the laboratory among NCE students in Colleges of Education in the North West Geo-political Zone of Nigeria.
2. Determine the differences in the extent of implementation of safety measures between male and female NCE biology students in the Colleges of Education in the North West Geo-political Zone of Nigeria.

Research Question

1. What is the extent of awareness of safety measures in the laboratory among NCE biology students in Colleges of Education in the North West Geo-political Zone of Nigeria?
Is there any difference in the extent of implementation of

safety measures between male and female NCE Biology students in North-West Geo-political zone Colleges of Education in Nigeria?

Null hypotheses:

1. There is no awareness of safety measures in laboratory among biology students in Colleges of Education in the North West Geo-political Zone of Nigeria
2. There is no significant difference in the extent of implementation of safety measures between male and female NCE Biology students in North-West Geo-political zone Colleges of Education in Nigeria.

METHODOLOGY

A descriptive survey research design was used for the study. According to Ali (2006), descriptive survey design is concerned with the documentation and description of what exists or the present status of existence or absence of what is being investigated without any manipulation of what caused the event. It develops a profile on what is and not why it is so. It is considered appropriate for the study because it is based on the views, and opinions of respondents as well as resources available in the area of study. The study was conducted in six (6) Colleges of Education in North West Nigeria.

The population of the study comprised 13,822 students, It comprises all biology Nigerian Certificate in Education (NCE) students levels one, two, and three (NCE levels: 1, 2, and 3), in both state and federal Colleges of Education in North West Nigeria. (2020/2021 COEs

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NCE Academic Session)

Three hundred and thirty eight (338) was used for the study. The sample size used was based on Adigun *et al* 2015.

Using Adigun *et al* 2015 Ss =
$$\frac{Ns \times n}{Nss}$$

Nss

A structured questionnaire and direct observation were used for data collection. The Questionnaire focuses on hazards and safety measures in the Biology laboratory and is divided into three (3) sections (A-C). Section A was designed to obtain background information from respondents while sections B-C were to elicit information from the respondents to answer the two (2) research questions. The research also observed on how students are carrying out their practical sessions.

The Researchers collected letter of introduction from Chairman, TETFUND Institution Based Research (IBR) in collaboration with the Deputy Provost; Federal College of Education Zaria., whereby NCE 2 students were used for the study. The Researchers visited all the six (6) Colleges of Education in North West Geo-political Nigeria. To educate them on how to fill the Google forms online. Open

Data Kit (ODK) or ODK Collect software was also used as a back up to administered questionnaires to the respondents. All necessary instructions needed for the successful completion of the academic exercises were clearly stated and explained to the students during the orientation before the commencement of the exercise.

In collecting the data android/mobile phones were used to send and collect the questions and responses from the lecturers, technologists and students. Data collected from the respondents were analyzed using SPSS 27 version (Statistical Package for the Social Sciences). Linear regression Correlation and T-test was used to compare the level of awareness of safety in biology laboratories among students in colleges of education in North West Geo-Political Zone Nigeria.

RESULTS

Q1. The extent of awareness will not affect the magnitude of safety measures among biology students in Colleges of Education in the North West Geo-political Zone of Nigeria.

TABLE 1: Summary of Awareness of Safety Measures in Biology Laboratory

Model Summary										
Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.618 ^a	.382	.380	.42922	.382	207.933	1	336	.000	2.354
a. Predictors: (Constant), LABORATORY_SAFETY MEASURES										
b. Dependent Variable: LABORATORY_AWARENESS										

From table 1, the value of the R square is 0.38, this means that 38% of the variation in Laboratory safety is

accounted for by Laboratory awareness. The F statistic (0.000) is statistically significant at a 0.05 level of

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significance.

Conclusively, the extent of awareness will affect the magnitude of safety among biology students in the College of Education in North West geo-political Zone of Nigeria

Q2. There is no significant difference in the extent of implementation of safety measures between male and female NCE Biology students in North-West Geo-political zone Colleges of Education in Nigeria.

Group Statistics					
	1. Gender	N	Mean	Std. Deviation	Std. Error Mean
LABORATORY SAFETY	MALE	199	4.0548	.47008	.03332
	FEMALE	139	4.2176	.50043	.04245

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LABORATORY SAFETY	Equal variances assumed	1.351	.246	-3.052	336	.002	-.16285	.05337	-.26783	-.05788
	Equal variances not assumed			-3.018	285.059	.003	-.16285	.05396	-.26907	-.05663

From table 2, There is a statistically significant difference ($p < 0.05$) in the extent of implementation of safety measures between male and female NCE Biology students in North-West Geopolitical zone Colleges of Education in Nigeria.

DISCUSSION

From table 1, the value of the R square is 0.38; this means that 38% of the variation in Laboratory safety is accounted for by Laboratory awareness. The F statistic (0.000) is statistically significant at a 0.05 level of significance.

The extent of awareness will affect the magnitude of hazards among biology students in the College of Education in North West geopolitical Zone of Nigeria

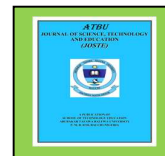
The result obtained is similar to the findings of Olugbenga and Thomas (2013), awareness and negligence are two factors that influence students' laboratory use. Most students are ignorant of basic rules and precautions before making use of the laboratory. As such, they act ignorantly and acquire avoidable injuries or even death. In another circumstance, students fail to comply with the rules or take appropriate precautions even

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when they are already aware of what they ought to do. The teachers and other laboratory staff are directly responsible for instructing the students about the rules and regulations as well as the necessary safety precautions. Unfortunately, these staffers neglect their duties and the students are left exposed to dangers and injuries. Availability of laboratory facilities: The study concluded in table 2 that facilities are inadequate for laboratory activities in science in NCE program in Nigeria.

From table 2, There is a statistically significant difference ($p < 0.05$) in the extent of implementation of safety measures between male and female NCE Biology students in North-West Geopolitical zone Colleges of Education in Nigeria. Sadaf and Yaqoob (2011) studied gender-based occupational health hazards among paramedical staff in public hospitals of Jhelum. The results of the study showed that females were more exposed to occupational health hazards than were males. There was no difference between male and female paramedical staff in exposure to occupational health hazards. Females are more exposed to psychological occupational health hazards than are males. Physiological health hazards influence the paramedical staff's health more than psychological health hazards do in public hospitals.

Furthermore, the finding is in line with the finding of Akpobire and Owkwondue (2020). Who studied on Awareness and Perceptions of Biological and Chemical Safety in Laboratories by Polytechnic Students; Implications for Professionalism. The result of the study shows that the mean value of 3.80 and 3.74 indicates that the science laboratory students consider Laboratory rules and

regulations as necessary and relevant for safety in the laboratory environment. The study regards Statistical means of 2.5 and above as responses indicating 'relevant', while responses receiving mean score less than 2.5 are regarded as responses indicating 'not relevant' The implications of this findings underpins the need for enforcement and training of the students on compliance with safety rules. The students know that the rules are relevant. However, they need enforcement mechanisms to ensure they do the right thing. The calculated r-value of 0.688 is greater than the r-critical value of 0.195 at degree of freedom of 238 and 0.05 level of significance. This implies that the null hypothesis (H_0) is rejected, and alternative hypothesis (H_1) accepted. The findings show that there is a significant and strong positive relationship between Male and female science laboratory students' perception on relevance of compliance to basic Laboratory rules for safety in the Laboratory environment.

CONCLUSION

The study revealed two issues about the conduct of laboratory activities in science in NCE program in Nigeria. Firstly, laboratory facilities were inadequate for the conduct of laboratory activities. Secondly, students do not comply with laboratory safety measures. The study also found out that the teachers' apply appropriate instructional approaches in laboratory activities and also students show positive attitudes towards laboratory activities.

RECOMMENDATIONS

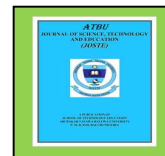
Based on the issues found in the study, the researcher made the following recommendations: 1. Non-

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compliance with laboratory safety measures: The science teachers should hold awareness programs on laboratory safety for the students. Laboratory rules, regulations and safety measures should be boldly written and conspicuously placed at the laboratory. A handbook on laboratory safety should be prepared and circulated among the students. The science teachers and other laboratory staff should enforce discipline among students while working in the laboratory.

2. Inadequacy of laboratory facilities: The authorities and the proprietors of NCE awarding institutions should equip the science laboratories with modern and functional facilities. Where possible, the teachers should improvise facilities to supplement the available ones.

REFERENCES

- Anaso J.M (2007). Investigation into the causes of students' poor academic achievement in chemistry in Senior Secondary School Certificate Examination. *Nigerian Journal of Science and Educational Research*, p, (98-119)
- Akpobire O. and Owhwodue E. R. (2020). Awareness and perception of Biological and chemical Safety in laboratories by Polytechnic Students; Implication for Professionalism. *International Journal of Science and Research Publication*. Vol 10 Pp 763-767.
- Bryd,C.F. (2017) Working safety with chemicals in the laboratories London, Genius publication
- Byebunu, A.A. (2016).Managing safety and health as strategy for improving service delivery in senior secondary schools in Rivers State in the 21st century. *African Journal of Educational Research and Development (AJERD)*, 8(1), 380-391.
- Eneh, J. O (2000). *History and Philosophy of science: An Outline*, Magnet Business Enterprise, Publishing Division. Enugu, 2010.
- Kalu U. U. (2007). Review of the methodologies for effective practical Biology Instruction in secondary schools in Nigeria. *Journal Education Research and Development*, 11, pp 52-70.
- Macleod, C. (2016). *Laboratory organization and administration*. London: Macmillan Publication.
- Olugbenga, A. J. & Thomas, O. O. (2013). Analysis of hazards and safety in science laboratories in Ekiti State, Nigeria. *British Journal of Education, Society & behavioural Sciences*, 4(3), 403-414.
- Sadaf J. and Yaqoob T. (2011). Gender-Based Occupational Health Hazards among Paramedical Staff in Public Hospitals of Jhelum, *International Journal of Humanities and Social Science*, Vol. 1, No.3, pp. 175-180.
- Usman, I. (2008). The Relationship between Students' Performance in Practical Activities and their Academic Achievement Integrated Science Using NISTEP Mode of teaching. Ph.D Thesis Ahmadu Bello University, Zaria.

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