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ASSESSMENT OF KNOWLEDGE AND UNDERSTANDING OF LABORATORY HEALTH PRACTICES AMONG SECONDARY SCHOOL STUDENTS IN NORTH-CENTRAL, NIGERIA

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ABSTRACT: *This research work was carried out to investigate the knowledge of laboratory health practices possessed by senior secondary school students in the North-Central geopolitical zone of Nigeria. A total of 893 students were sampled in North-Central Nigeria by means of stratified random sampling using the Questionnaire as an instrument. Data acquired was analysed using comparison of means and t-test at 0.05 statistical level of significance. The result of the study showed that the knowledge of laboratory precautionary practices possessed by the students is fairly good. In terms of gender, school type and location: Female students expressed a better knowledge than their male counterparts, Also, students from private and urban schools performed significantly better than their counterparts in the public and rural schools respectively. The researchers recommended that Science teachers should emphasize familiarity and understanding of laboratory warning symbols among others.*

KEYWORDS: Knowledge, Health Practices, Hazard Symbols, Laboratory, North-Central

INTRODUCTION

The use of the laboratory in science teaching has come of age and can indeed be said to be as old as science itself. Many researchers have upheld the continued use of the laboratory in science teaching all over the world due to the numerous benefits that has accrued to science education from engagement in laboratory activities. A few of these benefits as posited by Tobin (1990), Hodson (1993), Hergarty (1981), Shulman and Tamir (1973) and Akano and Nma (2003) are as follows;

- Enabling learners to have a conceptual understanding of science which has been identified as being highly abstract and complex,
- Offer of opportunity for students to participate in scientific enquiry as a way to appreciate the spirit and methods of science.
- Motivating students to acquire and develop a wide range of science process skills, a variable tool for research in science and this has helped to extend the frontiers of science.
- Making Science very interesting to students and the fact that science is made enjoyable when taught in an enquiry manner.

Despite the numerous benefits of laboratory activities to science education, the prevalence of laboratory accidents arising from the lack of knowledge of the nature and behaviour of chemicals, poor laboratory health management techniques, human errors and sometimes, sheer

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carelessness of laboratory users are everyday happenings that have bedevilled the laboratory experience. For instance, most laboratory experiments in Biology and Chemistry and sometimes in Physics largely involve the use of chemicals, substances and reagents of varying compositions that are corrosive, toxic, flammable and radioactive and hence, hazardous to both laboratory users and the environment, especially when they are wrongly applied.

Laboratory activities have globally been recognized to play distinctive and central roles in the realization of the goals of science education and science educators have regularly emphasized their use in the enhancement of students understanding of science concepts, acquisition of science process skills and attitudes, problem solving abilities and understanding of how science and scientist work. (Hofstein & Mamlot-Naaman, 2007). Nigeria like other developing countries eagerly seeks to increase enrolment of students in science in the tertiary institutions in order for them to enable her meet the growing demand of skilled manpower required in the 21st Century work place.

The training of skilled scientists and technologists will no doubt involve laboratory classes where students will be required to work with chemicals, reagents and elements that have potential hazards. There is therefore need to ensure that best practices of laboratory safety management are used in our schools, so as to minimize laboratory accidents. However, nothing is known so far about the state of safety precautions enforced in our schools or students understanding of safety implications of working in a laboratory. These researchers are faced with the problem of investigating the level of knowledge and understanding of laboratory health practices possessed by secondary school science students in Nigerian North-Central geopolitical zone.

The main purpose of the study is to investigate the knowledge of laboratory health practices possessed by senior secondary school students in the north central geopolitical zone of Nigeria. Specifically, the study sought to;

- Assess the knowledge of laboratory health practices possessed by all students in the north central geopolitical zone of Nigeria
- Assess if there is any difference in the knowledge of laboratory health practices possessed by students in the senior secondary schools in the north central geopolitical zone of Nigeria based on their gender, school type and location,
- Find the knowledge of laboratory hazard symbols and fire safety possessed by students in the senior secondary schools in the north central geopolitical zone of Nigeria.
- Find if there is any difference in the Knowledge first aid possessed by senior secondary schools in the north central geopolitical zone of Nigeria based on their gender, school location and school type.
- Ascertain the state of the laboratories in the senior secondary schools in the north central geopolitical zone of Nigeria
- Ascertain Student source of knowledge of laboratory safety practices.

In order to do this the following research questions have been formulated to serve as a guide to the study:

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(i) What knowledge of laboratory health practices is possessed by senior secondary school students in the north central geopolitical zone, Nigeria?

(ii) What is the Knowledge of laboratory health practices possessed senior secondary school students in the north central geopolitical zone, Nigeria, in terms of gender, school type and location?.

(iii)What is the knowledge of laboratory hazard symbols and fire safety precaution possessed by senior secondary school students in the north central geopolitical zone, Nigeria?

(iv) Is there any difference in the knowledge of first aid practices amongst senior secondary school students in the north central geopolitical zone, Nigeria based on their gender, school type and location?

(v) What is the state of laboratories in the senior secondary schools in the north central geopolitical zone, Nigeria?

(vi) What is the source of students' knowledge of laboratory safety practices and fire safety in the senior secondary schools in the north central geopolitical zone, Nigeria?

To ascertain the variabilities in the responses of the respondents. Four null hypotheses were developed

(i) There is no significant difference between the knowledge of laboratory health practices possessed Male and Female science students.

(ii) There is no significant difference between the knowledge of laboratory health practices possessed by students from good and poor laboratory environments.

(iii) There is no significant difference in the knowledge of laboratory health practices possessed by students from private and public schools.

(iv) There is no significant difference in the knowledge of laboratory health practices possessed by science students from urban and rural schools.

LITERATURE/THEORETICAL UNDERPINNING

The account of how pioneer scientists such as Gahlen, Berzelius, Liebig, Curie and Scheele, etc met their untimely deaths due to laboratory accidents is part of the curricular contents students learn from the history of science education and indeed in more recent times numerous accident are recorded from time to time in different parts of the world, such as acid burns, mercury poisoning, laboratory fire, explosions and even deaths. Sarifah, Rusil & Jusof and Abdullahi (2010) reports of different laboratory accident like the laboratory fire accident involving chemistry students in Malaya in 2001 and one involving Physics students in Kebanson in 2005. These accidents were said to have arisen from mishandling of chemicals and reagents. In another report Su and Hsu (2008) remarked that about 49% of laboratory accidents in Taiwan result from improper use of chemicals and the O' Nell 1995 TV program on safety in the science laboratory sponsored by the American Chemical Society have reported the death of a chemistry teacher caused by mercury poisoning.

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These few examples are sobering indicators of how dangerous the laboratory accident could be if not mitigated by carefully planned laboratory management. From the foregoing, it is very important that, our science students and their teachers must not be naive of laboratory health and safety practices that can ensure their safe use of the laboratory and serve as tools to equip them with the right skills and attitudes for further studies in science and technology disciplines. It is against this background that the researchers have chosen to investigate on the level of knowledge of science students in Nigeria about Laboratory health safety practices, at this time when the country is aggressively seeking to effect science and technological development through a high student enrolment in science under the 60; 40 science to art ratio in the admission of students into the Universities and other higher institutions.

METHODOLOGY

Research Design

Research design according to Kirumbi (2018) is defined as a set of procedures used for the collection and the analyzing of data of specified variables in a research problem. It shows the research type and for this study, the descriptive quantitative design was adopted and the survey method of data collection was used. In this method the respondents answered questions that were administered through a questionnaire.

The Study Population and Sample Size

The population for the study comprised of all senior secondary school science students from the north central geo political zone of Nigeria which comprises six states namely, Benue, Kogi, Kwara, Niger, Nasarawa and Plateau states. The sample size included four science schools in each state which are randomly selected to make a total of twenty four schools. From each school, at least 30 students comprising 15 boys and 15 girls were randomly sampled for the study, giving a total number of sampled respondents as Eight hundred and ninety three (893) students. By means of stratified random sampling four schools were selected from each state from schools categorized under public, private, rural, urban and good and poor laboratory environment.

Instrument for Data Collection

The instrument for data collection is a Laboratory Health Practice Knowledge Test developed by the researchers which comprise Six (6) sections: A. Knowledge of laboratory warning symbols, B. Classification and prevention of fire, C. Rating of importance of safety and precautionary practices, D .Understanding reasons for laboratory safety practices, E. First aid treatment and F. Laboratory health practice attitude. A laboratory environment check list was also be used to categorize the various laboratories as having good or bad environment.

Validity and Reliability of the Instrument

In order to ensure validity of the instrument, the face and content validation of the instrument was done by three (3) well experienced lecturers in Physics, Chemistry and Health Education departments. They read the test materials and the corrections were used to produce the final draft of the instrument for data collection. The items of the questionnaire were then used for the pilot test. The pilot test was conducted using three non-participating Science Secondary

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schools in Kontagora to determine whether the instrument was suitable for the survey. The construct validity was then analyzed using factor analysis which enabled the construct validity of a survey material to be tested (Roberts et al, 1999; Rattray and Jones, 2007).

To deduce whether an instrument construct is effective, a factor analysis was performed on all the dependent variables (items). The factor communalities for all the items ranged from 0.671 to 0.834 This implies that the instrument was well constructed. Likewise, an instrument is consistent when an item or items produce a similar result that reflects the whole questionnaire. Cronbach's alpha statistic was utilised to determine the consistency of the instrument. A greater relationship indicates a high reliability of an instrument. Cronbach's alpha rate must exceed 0.60 to be accepted as unidimensional (Pallant, 2005). For this study, the Cronbach's alpha coefficient yielded 0.727. This shows that there is high internal consistency in the items. The evaluated questionnaire on laboratory health practices among secondary school students is consistent and construct effective.

Data Collection and Analysis

Data collection was successfully achieved by distributing questionnaires to the selected states. Thereafter, the administered questionnaires were retrieved by the researcher for analysis and interpretation. Data was analyzed after grading the students' responses. Simple quantitative analysis used for the analysis of data, to answer the research questions and test the hypotheses; comparison of means and t- test analysis statistic was used at 0.05 statistical level of significance in the Statistical Package for Social Sciences (SSPS) IBM version 20.

RESULTS/ FINDINGS

Respondents Characteristics

In this section, the results obtained in this research with their interpretations are presented. The sample profile is presented following comparison made test of significance using t-test at probability of 0.05 confidence limit.

	GENDER		**SCHOOL TYPE**		**SCHOOL LOCATION**	
	Male	**Female**	**Public**	**Private**	**Urban**	**Rural**
Frequency	425	468	579	314	802	91
Percentage	47.6%	52.4%	64.8%	35.2%	89.5%	10.2%
Total	893 (100%)		893 (100%)		893 (100%)	

Table 1: Sample Characteristics

Table 1. Summaries the characteristics of samples and the sample composed of secondary schools students in five North-Central states and Federal Capital Territory. The data is represented below

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Research Questions

(i) Research Question 1: What knowledge of laboratory precautionary health practices is possessed by the students?

To answer this research question section C is the questionnaire was used. The responses of students on the items which bothered on laboratory precautions were analyzed by comparing the means the result is shown in table 2

Table 2. Knowledge of Laboratory precautionary health practices among different groups

	GENDER		**SCHOOL TYPE**		**SCHOOL LOCATION**	
	Male	**Female**	**Public**	**Private**	**Urban**	**Rural**
Frequency	425	468	579	314	802	91
Mean	7.7765(xx)	7.9722(xx)	7.3610(xx)	8.8344(xx)	7.9888(xx)	6.9121(x)
SD	2.47714	2.61630	2.70702	1.89954	2.48915	2.88540
T-Test (Sig.)	**.251**		**.000**		**.001**	
Interpretation	>.05 (NS)		<.05 (Sig.)		<.05 (Sig.)	

Key: Very good (xxxx)-11-15, Good (xxx): 9-10, Fair(xx): 7-8, Poor(x): below 7

From the results in table 2 different groups gender, school type and school location had means ranging from 6.91 to 8.83 out of a total score of 15 marks. The knowledge of precautionary health practices possed by students is generally fair however; the female student had a better precautionary experiences than the male students. This could be expected since most male students careless of many rules and sometimes violet certain rules. Students from private schools had better knowledge of precautions. Generally the state of our public schools is fast deteriorating due to incessant strike and many other factors therefore it is expected that private school student may have better understanding of some concepts as opposed to their counterparts in the public schools this has been reported in many researchers (Olasehinde & Olatoye, 2014;). Also the result reviewed that the knowledge of precautionary practices among students in rural schools was poor compared to that in urban schools. In general most students care less about precautionary health practices since they exposed to very few laboratory classes before the senior school certificate exams. This knowledge of health practices should not be condoning since it is expected that there should be 99% knowledge of laboratory precautionary practices by students to enhance laboratory safety. With this knowledge possessed by the students in North central Nigeria, the laboratory are not safe.

(ii) **Research Question 2: What knowledge of laboratory hazard symbols and fire safety classification is possessed by students?**

In order to provide answers to this research question section B(A) of the questionnaire was employed this involved simple identification of meanings of some regular hazard symbols in our laboratories. The responses of students were analysed and the results shown in table 3 and table 4

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Table 3: Knowledge of Laboratory harzard warning symbols

	GENDER		SCHOOL TYPE		SCHOOL LOCATION	
	Male	**Female**	**Public**	**Private**	**Urban**	**Rural**
Frequency	425	468	579	314	802	91
Mean	4.2541(x)	4.2222(x)	3.8549(x)	4.9427(x)	4.5337(x)	1.6264(x)
SD	2.79342	2.66023	2.75964	2.50939	2.62790	2.08512
T-Test (Sig.)	**.862**		**.000**		**.000**	
Interpretation	>.05 (NS)		<.05 (Sig.)		<.05 (Sig.)	

Key: Very good (xxxx)-11-15, Good (xxx): 9-10, Fair(xx): 7-8, Poor(x): below 7 ,

Table 4: Knowledge of fire classification and safety

	GENDER		SCHOOL TYPE		SCHOOL LOCATION	
	Male	**Female**	**Public**	**Private**	**Urban**	**Rural**
Frequency	425	468	579	314	802	91
Mean	1.1200(x)	1.2906(x)	1.1727(x)	1.2771(x)	1.2307(x)	1.0220(x)
SD	1.10837	1.37777	1.23019	1.30970	1.26527	1.19236
T-Test (Sig.)	**.043**		**.246**		**.119**	
Interpretation	<.05 (Sig.)		>.05 (NS)		<.05 (Sig.)	

Key: Very Good (xxxx):3.5-4.0, Good (xxx):3.0-3.49, Fair(xx):2.45-2.99 , Poor(x): below 2.45

From the table 3 and 4 above mean scores of students across the groups (gender, School type and Location) were compared. The mean scores ranged from 1.63 to 4.94 out of 15marks for hazard symbol and 1.02 to 1.29 out of 4marks for fire classification. Here again Students from Private schools had a better knowledge of laboratory hazard warning symbols and fire classification the reason for this cannot be far-fetched and has been elucidated above see (Olasehinde & Olatoye, 2014;). Rural schools also had the lowest knowledge of hazard symbols and fire classification. This may stem from lack of good science facilities and even the human resource to facilitate learning. In general the knowledge of laboratory hazard warning symbols among students in the North-central Nigeria is very poor this in consonance with the research report of Onoyase, (2015) and Mofon ,(2001) that student in urban schools perform better than their counterparts in rural dwellings. This situation is bothering that in two decades Nigeria as a country is yet to overcome the disparity in the education levels of the rural and urban dwellers.

(iii) Research Question 3. What is the knowledge of first aid possessed by the students?

Ours analysis of the data presented by the responses obtained from section B(D) of the questionnaire is presented in table 5.

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Table 5. Knowledge of students on First Aid

	GENDER		SCHOOL TYPE		SCHOOL LOCATION	
	Male	**Female**	**Public**	**Private**	**Urban**	**Rural**
Frequency	425	468	579	314	802	91
Mean	4.1835(xxxx)	4.2778(xxxx)	4.0967(xxxx)	4.4841(xxxx)	4.2132(xxxx)	4.1066(xxxx)
SD	1.59871	1.53607	1.63789	1.39192	1.26527	1.19236
T-Test (Sig.)	**.370**		**.000**		**.206**	
Interpretation	>.05 (NS)		<.05 (Sig.)		>.05 (NS)	

Key: Very Good (xxxx):4-5,Good (xxx):3.0-3.99, Fair(xx):2.45-2.99 , Poor(x): below 2.45

Students across the groups were well familiar with First Aid box, the mean responses of students ranged from 4.11 to 4.48 out of 5 marks. The First Aid box is a kit that is available at the disposal of students at homes, in the primary to secondary schools the availability and utilization of this kit has made it popular and the knowledge of it possessed by students is high. This same idea if it is used for other laboratory practices. Students are aware of this things their learning experiences will be enhanced. The result obtained in this section has shown that if there are enough learning facilities and are well utilized the gulf existing in the achievement of Rural-Urban School children will be closed as seen from the results.

(iv) Research Question 4: What is the state of Laboratories in secondary schools in North-Central Nigeria?

Section B (E) was used to answer this questions it constituted a four point likert structure which were giving ratings Strongly Agree (4), Agree (3), Disagree (2) and Strongly disagree (1). The means were compared among the different groups and presented in table 6a and 6b below.

(a) **State of Laboratories safety for Public and Private Schools**

From the results obtained the state of Science Laboratories safety for Private owned schools can be classified as good (xxx) since most of the items describing Laboratory safe practices were present the laboratories of Private schools except the possession of Functional fire extinguishers and Alarm systems. Public schools however, have deplorable state of laboratories as far as safety is concern. The laboratories can best be classified as fairly good (xx) or poor since some items describing the state of safety of the laboratories like alarm systems and functional fire extinguishers were poor (x). These two features are usually a problem even within the institutions of higher learning; most institutional laboratories lack fire alarms and functional fire extinguishers. This safety culture should be encouraged in secondary schools laboratories to prevent destruction due to infernos.

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Table 6a: State of Laboratory among Public and Private Schools

Laboratory Features	Mean Responses							
	Public			Private				
	N	Mean	SD	N	Mean	SD	T-test	Interpretation
Spacious & well lit	579	2.8048 (xx)	1.09966	314	3.4682 (xxx)	0.87963	.000	<.05 (Sig.)
Safety Charts displayed	579	2.4940 (xx)	1.06105	314	3.1497 (xxx)	0.99835	.000	<.05 (Sig.)
Functional fire extinguishers	579	2.6097 (xx)	1.18656	314	2.8822 (xx)	1.04015	.001	<.05(Sig.)
Electrical fixtures properly insulated	579	2.5769 (xx)	1.23061	314	3.1656 (xxx)	1.04015	.000	<.05(Sig.)
Storage containers identified	579	2.8256 (xx)	1.16419	314	3.2643 (xxx)	0.92716	.000	<.05(Sig.)
Alarm system present	579	2.2591 (x)	1.14754	314	2.5000 (xx)	1.18092	.000	<.05(Sig.)
First Aid box present	579	2.6649 (xx)	1.14743	314	3.3217 (xxx)	1.01508	.000	<.05(Sig.)
Lab. Rules posted boldly	579	2.4594 (xx)	1.16003	314	2.7675 (xx)	1.12484	.000	<.05(Sig.)

Key: Very Good (xxxx):3.5-4.0,Good(xxx):3.0-3.49, Fair(xx):2.45-2.99 , Poor(x): below 2.45

(b) **State of Laboratory safety for Urban and Rural Schools**

From the results in table 4.6b we can infer that the safety conditions of laboratories in the urban schools were just a little better in terms of the Laboratory space and storage of apparatus and chemicals. All other parameters that determine the safety of the laboratory was just fair (xx) and the same safety conditions existed in Rural Schools. Both urban and rural school laboratories in North-central Nigerian Schools are just fair with regard to Laboratory safety practices. Generally in Nigeria, the issue of safety practices is a national problem and should not be handled with levity. Most Secondary School Science Laboratories are just classrooms converted for that purpose. This situation is worrisome and needs urgent attention.

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Table 6b: State of Laboratories among Urban and Rural Schools

Laboratory Features	Mean Responses							
	URBAN			RURAL				
	N	Mean	SD	N	Mean	SD	T-test	Interpretation
Spacious & well lit	802	3.0648 (xxx)	1.06037	91	2.8022 (xx)	1.17587	.027	<.05 (Sig.)
Safety Charts displayed	802	2.7344 (xx)	1.07893	91	2.6374 (xx)	1.14034	.441	>.05 (NS)
Functional fire extinguishers	802	2.7207 (xx)	1.14680	91	2.5714 (xx)	1.11697	.231	>.05 (NS)
Electrical fixtures properly insulated	802	2.8030 (xx)	1.16271	91	2.6154 (xx)	1.48899	.158	>.05 (NS)
Storage containers identified	802	3.0362 (xxx)	1.08442	91	2.4835 (xx)	1.17722	.000	<.05(Sig.)
Alarm system present	802	2.3317 (x)	1.16748	91	2.4505 (xx)	1.13787	.348	>.05 (NS)
First Aid box present	802	2.9227 (xx)	1.14122	91	2.6593 (xx)	1.16638	.043	<.05(Sig.)
Lab. Rules posted boldly	802	2.5698 (xx)	1.15286	91	2.5495 (xx)	1.19502	.877	>.05 (NS)

Key: Very Good (xxxx):3.5-4.0,Good(xxx):3.0-3.49, Fair(xx):2.45-2.99 , Poor(x): below 2.45

(v) What is the major source of Knowledge of fire for the students?

To answer this question we made use of Section B (B) number three. The result is shown in table 4.7 and figure 4.1.

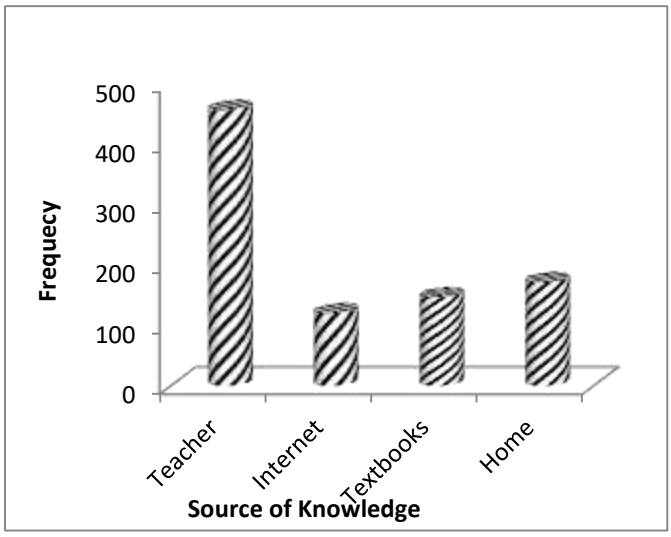

Figure 1. Source of knowledge for information on fire (Source: present work)

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Table 7: frequency of respondents

	Source of Knowledge			
	Teacher	**Internet**	**Textbook**	**Home**
Frequency	456	120	146	171
Percentage (%)	51.1	13.4	16.3	19.1

From the results obtained it is apparent that the basic source of students' information remains the teacher. This has great implication on learning. Subtract the teacher from the equation our educational system will suffer. Good teacher development will improve the level of laboratory health practices and the learning of science in general. There is need to pay attention to good teacher quality in our educational system.

Test of Research Hypotheses

(i) There is no significant difference between the knowledge of Laboratory health practices possessed by Male and Female students

The knowledge of laboratory health practices is looked at in different ways, the knowledge on precautionary health practices, knowledge on hazard symbols, and knowledge on first aid box. Considering table 4.2, 4.3, and 4.5 the t-test values were above 0.05 which indicates that the knowledge of male and female students on laboratory health practices was not significant at 0.05 confidence limit. Hence, we retain the null-hypothesis that there is no significant difference between the knowledge of laboratory health practices possessed by male and female student

(ii) There is no significant difference between the Male and Female Students in the classification of fire and safety.

From table 4.4 the t-test value yielded $0.043<0.05$ which shows that there is significant difference the knowledge of Male and Female student. The female students performed significantly better than their male counterparts in this regard. We therefore reject the null hypothesis.

(iii) There is no significant difference in the Laboratory safety state of the laboratories of public and private schools in North-Central Nigeria

Considering table 4.6a one will observe that for all the items describing the state of the laboratory with regard to safety standards the private schools had better laboratory when safety is concerned and this difference tested statistically at 0.05 level of confidence was significant since all the t-test values were less than 0.05. Hence, we reject the null hypothesis.

(iv) There is no significant difference in the laboratory safety state of the laboratories of Urban and Rural Schools in North Central Nigeria.

From table 4.6b we will observe that the state of laboratories in the urban Schools were better than those of the schools located in rural areas. However in most cases these was not statistically significant except in when considering factors like laboratory space, labels of storage containers and first aid box because of access to this things at the urban centers. In

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general the difference in the state of the safety the Urban-Rural laboratories were not significant. Hence, we reject the null hypothesis. This implies that generally in North-Central Nigeria, the condition of the laboratories used for secondary schools practical have a departure from safety standards and this calls for the stakeholders to help alleviate this situation.

DISCUSSION

The result of the study showed that the knowledge of laboratory precautionary practices possessed by the students is fairly good. In terms of gender, school type and location: Female students expressed a better knowledge than their male counterparts, Also, students from private and urban schools performed better than their counterparts in the public and rural schools respectively. In the assessment of Knowledge of laboratory hazard symbols and fire prevention, Students from the urban and the private schools performed better than those from the public and rural areas. Many long years of teachers strike actions in the public schools and the general inequality in infrastructure between the rural and urban areas may be responsible for disparity in the findings.

There is a wide gap in the quality of laboratories and safety precautions available in the various surveyed schools laboratories. Laboratories are better in the Private schools than those in the public schools and those in the urban areas also better than those in the rural areas in terms of quality and level of safety precautions available. The teacher was found to be the major source of students' information about laboratory safety and accident prevention.

IMPLICATION TO RESEARCH AND PRACTICE

The findings from this study which sought to find the knowledge of Secondary school students to laboratory health safety precautions lend themselves to a number of educational implications which are discussed below;

The level of knowledge of laboratory health and safety precautions possessed by the surveyed students and the state of laboratories in the sampled schools reveal obvious defects in the students' orientation for science laboratory work, teachers' preparation and negligence of the government in the provision of adequate laboratory infrastructure.

The findings imply that allowing these students to do experiment without a good knowledge of laboratory safe and precautionary pactice could leave room for potential danger that swing many students away from science. Already many schools are experience a low enrolment of science students and efforts must be made to make a laboratories free from accidents to encourage more students to study science.

The finding therefore offers implication for the improvement of students understanding and familiarity with science chemical symbols and compliance with safety rules. Specific trainings to remediate students' deficiencies in knowledge, awareness and attitudes to laboratory health practices should be encouraged.

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CONCLUSION

This knowledge of laboratory and safety precautions possessed by senior secondary school students in the north central zone of Nigeria was investigated. The result of the study showed that the knowledge of laboratory precautionary practices possessed by the students is fairly good. In terms of gender, school type and location: Female students expressed a better knowledge than their male counterparts, Also, students from private and urban schools performed better than their counterparts in the public and rural schools respectively. In the assessment of Knowledge of laboratory hazard symbols and fire prevention, Students from the urban and the private schools performed better than those from the public and rural areas. Many long years of teachers strike actions in the public schools and the general inequality in infrastructure between the rural and urban areas may be responsible for disparity in the findings.

There is a wide gap in the quality of laboratories and safety precautions available in the various surveyed schools laboratories. Laboratories are better in the Private schools than those in the public schools and those in the urban areas also better than those in the rural areas in terms of quality and level of safety precautions available. The teacher was found to be the major source of students' information about laboratory safety and accident prevention.

Based on the above findings, students need to be given more orientation on laboratory safety precautions so as to create a safe learning environment in schools. Though many of the respondents claim to have knowledge of laboratory safety practices, the findings reveal that they lack knowledge of potential hazards in the laboratory and the matching of hazard symbols with their corresponding effects. In line with the above conclusions, the researchers put forward these sets of recommended actions and guidelines for the concerned laboratories.

Future Research

Reports in this research covers the North-Central geopolitical zone of Nigeria, the research desire that other geopolitical zones be researched on this topic. Also methods of Science teaching that will enhance understanding of Laboratory Safety practices should be researched.

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