

Evaluation of Safety Practices in Biology Laboratories in Selected Secondary Schools within Gumel Emirate, Jigawa State, Nigeria

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Abstract

The work was carried out to find out the extent the teachers and students are aware of safety practices and device while working in the biology laboratories during practical sessions. The research questions were answered and the significant of the work was outlined. The methodology was thoroughly explained; sets of questionnaires were used for teachers and students, followed with interviewed. These methods were used as a means of data collection. Ten (10) secondary schools were selected randomly for the work. A total of twenty-three (23) biology teachers and one hundred (100) students were used. The data collected were analyzed, which revealed that 71% of the students and 73% of the teachers have good knowledge of safety practices in biology laboratories. Majority of the biology teachers in the selected secondary schools are Bsc Ed holders, with the number constitutes 65% with (5 - 10) years working experiences. Majority of the selected biology laboratories have inadequate first aid kits. The only available items were cotton wool, bandage, Delton solution and iodine solution. The finding revealed that teachers and students in the selected schools have good knowledge of safety practices. However, majority of the schools lacked safety gadget and inadequate first aid kits.

Keywords

Safety Practices, Laboratories, Questionnaire, Respondents

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1. Introduction

Safety practice can be explained to mean the process of averting danger. According to advance learner's dictionary, "safety is freedom from danger or risk" (Oxford Advanced Learners Dictionary of Current English A. S. Hornby, 1982). The importance of safety measure in every activity of individual cannot be over emphasized. It forms an integral part of individual understanding. Laboratory activities demand adequate safety measures in order to overcome danger. This can be achieved either by the teachers or students. Aminu (1982) maintain that most laboratory hazards can be reduced by good value judgment, careful manipulation adequate supervision, and most of all the knowledge of how to use the safety material or device present in the laboratories. It is obvious that anyone who is not alert and safety conscious stand the greater risk of turning a minor hazard into an accident which might be fatal. To ensure safety in our biological science laboratories, students and teachers should be well-informed of the safety practice and how to operate simple safety gadgets during emergency. Also there is the need that these safety gadgets be constantly checked to ensure proper functioning during emergency. Laboratories serve as a training ground for scientist and a means for discovering new knowledge and testing hypothesis. "A school laboratory is an instructional facility for helping pupils learn what science is and how the scientists work" (Archohold, 1977).

In the study of biology, the equipments and facilities to which students are exposed are very important. It is believed that students with rich background in terms of exposure to many and varied equipment and facilities have advanced intellectual developments than the less privilege ones (Fafunwa, 1984).

Laboratory according to the world book encyclopedia can be defined as a place equipped with scientific apparatus where scientist perform experiment to test hypothesis. Science laboratory is not confined to a room with sink and fitting for experiment but rather, it includes any place in the field, stream near school, garden or workshop especially equipped and set aside for the function it is intended to serve (Danazumi, 1992).

Practical works and safety practices run concurrently in laboratories. This is reflected in one of the objectives of the adequate practical teaching in biology science, which is to teach public how to handle safety materials that could be dangerous. Child center or activity method is one of the recognized methods of teaching biology. This method of teaching ensures a high degree of student participation. The success of practical lesson and the realization of the positive goals of teaching biology in secondary school depend on the measures taken to measure the safety of both the students and teachers (Ahmed, 2001).

Conclusively, many lives can be saved if necessary safety measures are considered or taken appropriate in the biology lessons or practicals.

1.1. Statement of the Problem

The work intended to find out the following:

- 1) Whether biology student in Gumel emirate in Jigawa state lack good knowledge of safety practices in biology laboratories during practical lessons.
- 2) Whether biology teachers in Jigawa state senior secondary schools lack good knowledge of safety measures in biology laboratories.
- 3) Whether Jigawa state senior secondary schools lack safety gadgets in their biology laboratories.
- 4) Whether students in Jigawa state senior secondary school students know how to operate simple safety gadgets in biology laboratories.

1.2. Purpose of the Study

The purpose of this work is as follows:

- 1) To evaluate the student ability to ensure safety practices during biology practicals in the laboratories in secondary schools within Gumel Emirate, Jigawa State.
- 2) To examine how biology practicals conducted in laboratories in Jigawa state secondary schools.
- 3) To find out how teachers and students make effective use of safety gadgets, when there is a need for that in senior secondary school in Jigawa state.

1.3. Significance of the Study

Accidents are common in biology laboratories. Appropriate safety practices can reduce tremendously the rate of

accidents and hence guarantee the safety of lives. Teachers and students sometimes find themselves helpless when it come to safe handling of accident situation. Therefore, this work will provide students and teachers with knowledge and skills on safety measures in biology laboratories.

The work will also enlighten students, teachers, science supervisors, and ministry of education on how to ensure safety practices in biology laboratories.

This will also serve as a guide to many biological teachers and laboratory attendants on appropriate steps to take in biology laboratories.

This work will serve as guide for references to any student that intends further work on this issue.

2. Materials and Methods

This work is designed to evaluate the safety practices in biology laboratories in some selected secondary schools in Jigawa state. Thus the following areas were considered:

- Research questions;
- Research procedure;
- Data collection procedures;
- Procedure for analysis of data.

2.1. Research Questions

The researcher intends to seek answers to the following questions:

- 1) Do students in Jigawa state senior secondary schools have good knowledge of safety practices in biology laboratories?
- 2) What proportions of biology teachers in senior secondary school in Gumel emirate in Jigawa state have good knowledge of safety practices in biology laboratories?
- 3) What parentage of senior secondary school has adequate safety gadgets in laboratories?
- 4) What percentage of the students knows how to operate simple safety gadgets?

2.2. Research Procedure

- 1) Surveying of the available literature to assess the safety practices and dives in biology laboratories also to examine the availability of fire extinguishers and first aid kits.
- 2) Questionnaires were constructed for the purpose of collecting data. The questionnaires were administered to biology teachers from randomly selected secondary schools in Gumel emirate Jigawa state.
- 3) Observations were made in (10) biology laboratories in selected secondary schools within the emirate and asses their safety practices and equipments.
- 4) One hundred students were interviewed, ten students from each school.
- 5) The data collected were treated and analyzed.

2.3. Data Collection Procedure

Questionnaires were used to assess the staff in biology department of the ten (10) selected schools. One hundred (100) students were interviewed comprising of ten (10) SS II and III students from each school. All the teachers of biology were administered with the questionnaires. A total number of twenty five (25) questionnaires were administered and twenty three (23) were collected for data analysis.

2.4. Procedure for Data Analysis

The data collection through research instrument of the work was analyzed.

3. Result

The purpose of this section is to prevent and analyze the data collected from the sample population. The outline of this section would contribute to the drawing up of conclusion and areas for further research.

The statistics adopted is percentage method, since the result will be determined by the safety practices in the biology laboratories in secondary schools. The response of the questionnaires observation sale, and interview are

translated into table. Thus the following were considered:

- Data presentation;
- Demographic data of the study;
- Teacher's knowledge of safety practices;
- Student knowledge of safety practice;
- Assessment of biology laboratory organized from safety point of view;
- Available of first aid kits/contents.

Data Presentation

The following data collected were analyzed and summarized in the following tables.

Table 1 shows that 23 teachers from (10) selected secondary schools responded to the questionnaires, and 8 teachers 35% are (NCE) national certificate of education holders, while 5 which represent 65% are (Bsc Ed) Bachelor Degree in Education.

Among the (10) selected none of the biology had M Ed (Master Degree) in education. Based on the working experience (4) teachers which represent 22% are in the category of 12 and above years.

Table 2 shows that 74% of teachers in secondary school have good knowledge of safety practices in biology laboratory, while 27% of the teachers lack good knowledge of safety practices in biology laboratories while 27% of the teachers lack good knowledge of safety practices in biology laboratories of secondary school used for the work.

Table 3 shows that 71% of the students have good knowledge of safety practices in biology laboratory while 29% of the students lacked good knowledge of safety practices in biology laboratories.

Table 4 summaries the nature of shelves and the arrangement of tables and chairs in the biology laboratories. Safety judgment shows that 60% agreed that the shelves is not loaded beyond its capacity while 70% agreed that the arrangement of while 70% agreed that the arrangement tables and chairs allow easy evaluated finally the safety judgment in good.

4. Discussion

Majority of the teachers in the selected school have Bsc Ed which represented 65% and remaining teachers have (NCE) Nigerian certificate of Education which represented 35% **Table 1**.

Most of the teachers have (5 - 8) years working experience which represents 35%, (1 - 5) year represents 17%, (8 - 12) years represents 26%, and 12 years and above represents 22%. Based on the teacher qualification and working experiences, only those teachers with Bsc Ed made above 50% the rest categories score less than 50%.

A good number of teachers have good knowledge of safety practices most especially their relationship with the laboratory attendants, use of safety Google and fire blanket, and also majority of teachers have good knowledge of precaution against any laboratory accidents but most of the schools lack fire extinguishers, which is very important in each laboratory (Olatunde et al., 1983).

Majority of student also have good knowledge of handling microscopes from the preparatory room to their tables it could be concluded here that the teachers did a good training for their students since they have good knowledge of the safety devices (Adejuga, 1983).

Table 1. Demographic data of teacher.

S/N	Items	Teachers Responses	Frequency	Percentage
1.	Teachers educational qualifications	NCE	8	35%
		Bsc Ed	15	65%
		Med	0	0%
	Total		23	100%
2.	Teachers working experience	1 - 5 years	4	17%
		6 - 8 years	8	35%
		9 - 12 years	6	26%
		13 and above	5	22%
	Total	12 and above	23	100%

Handling of reagents bottles, most of the students do not know how to do this and it is very important for students to handle reagents bottles not with only one hand but one hand at the neck of the bottle and the other hand at the bottom (Aminu, 1982). Most of these students cannot operate fire extinguishers and do not know the use of fire blanket. Meaning if there is any minor fire outbreak, the students will not control it. According to Archhold (1977), accidents in the laboratories can be minimized if careful measures are taken.

Majority of the schools have well designed biology laboratories as well as good arrangement of working benches. Some of student have good knowledge of safety practices, most especially in the aspect of observing animals kept for practical purposes Eniayeju (1990) emphasized the importance of equipped first aid this is because safety practices do not only involve what practices one carries out to ensure safety but what happen in case of accident. Therefore, from the data obtained on responses of knowledge of safety practices of students in the laboratories, about 71% of student have good safety practices in biology laboratories. While 29% of the student lacked good knowledge of safety practices in biology laboratories.

Table 2 shows that 73% of teachers have good knowledge of safety practices in the schools selected. Majority of the schools do not have adequate safety gadgets this is shown in Table 3. The data collected proved that only 45% of the schools have adequate safety gadgets. While the highest percentage which is 55% of the schools does not have safety gadgets. This should not be so, as availability of safety gadgets in laboratories is very important for the general safety of students, teachers and the entire school.

Table 4 summaries the laboratories shelves arrangement of tables and chairs whereby 60% and 70% respectively said the safety judgment is good.

5. Conclusions and Recommendations

The findings are that students in the school visited have the following safety practices.

- 1) The students have knowledge of observing animals in biology laboratories kept for practical purposes.

Table 2. Teachers' responses safety practices and advice.

S/N	Item	Teachers' Responses	Frequency	Percentage	Safety Judgment
1.	Number of times in biology laboratory	1. During practical with radiating substance	4	17%	Good
			19	83%	
2.	Number of fire extinguishers in your laboratory	2. During practical with animals	16	70%	Good
			7	30%	
3.	Role of laboratory attendant or assistant	1. Protect the teachers and students during practical from fire accident	-	-	Good
			13	57%	
4.	When to wear safety Google	2. Is just for tab attendants	6	26%	Good
			19	83%	
5.	The use of fire blanket	1. Removal of poison gland, make use of chloroform to kill the animal 2. Slaughter the animals	4	17%	Good
			21	19%	
	What are the precaution during dissection of animals in biology laboratory	1. To avoid occurrence of any accident 2. To render such animals harmless	2	9%	Good
			14	91%	
	What are the reason of removal of poison gland in animals before practical	1. Take the gas cylinder out of the laboratory for repairs 2. Use soap to cover the affected areas	9	9%	Good
			12	53%	
	Prevention of accident through gas leaking cylinder	1. Naked wire should be changed or cerotype 2. Stop students from going to the affect area 3. Don't know	11	47%	Good
			10	43%	
6.	Prevention of accident can caused "by electric socket and naked wires	1. To prevent fire accident 2. To of fire flame during fire accident 3. Don't know	13	57%	Good
			9	39%	
	Prevention of accident can caused "by electric socket and naked wires	1. To prevent fire accident 2. To of fire flame during fire accident 3. Don't know	12	52%	Good
			2	9%	
	What is the function of the fire extinguisher	1. Partially adequate 2. Adequate 3. Not adequate	9	39%	Good
			12	52%	
			2	9%	
	Do you regard the safety Gadget in your biology laboratory adequate?	1. Partially adequate 2. Adequate 3. Not adequate	4	17%	Good
			2	9%	
			17	74%	

Table 3. Students' responses on safety practices in biology laboratories.

S/N	Item	Students' responses	Frequency	Percentage	Safety Judgment
1.	How do you hold reagent bottle	1. Hold them by neck	53	53%	Bad
		2. Hold them with tow hand	24	24%	
		3. Hold them by the bottom	23	23%	
2.	Observing laboratory	1. Touch them	20	24%	Good
		2. Avoid touching them, just observe	64	64%	
		3. Make noise so that they move	16	16%	
3.	Disconnecting of an electrical gas appliance after use	1. Call the lab assistance	20	20%	Good
		2. Switch off the pull the plug	59	59%	
		3. Just leave it there	21	21%	
4.	Questioning in times of difficulties in the laboratory	1. Ask the teacher	73	73%	Good
		2. Ask a class mate	10	10%	
		3. Ask the lab attendant	17	17%	
5.	Can you operate safety gadgets e.g. fire extinguisher?	1. No	33	33%	Good
		2. Yes	67	67%	
6.	How do you hold microscope in biology laboratory	1. With one hand	23	24%	Good
		2. With two hands one hand at the top one below	76	76%	
7.	Do you have safety gadget in your biology lab? If yes, adequate or not adequate	1. Yes but not adequate	82	82%	Bad
		2. Yes adequate	18	18%	

Table 4. Observation scale based on laboratory organization from the safety point of view.

S/N	Item	Result of observation	Frequency	Percentage	Safety Judgment
1.	Shelve	Over loaded	3	30%	Good
		Not over loaded	6	60%	
		Shaky	1	10%	
2.	Arrangement of tables and chairs	Allow for easy evaluation	7	70%	Good
		Does not allow for easy	3	30%	

- 2) They know how to disconnect the electrical and gas appliances.
- 3) They have the habit of asking their teachers questions whenever they are in difficulty.
- 4) They also know how to handle microscope, for instance from the preparatory rooms to the main laboratories.
- 5) They also have good habits of not eating in the laboratories. However the finding also revealed that students do not have good knowledge of safety.

They taught the students how to use common apparatus in the biology laboratories during practical; such apparatus include microscope, thermometer and charts of diagrams.

However, teachers lack good safety knowledge in the following areas.

- 1) Not all could operate fire extinguisher.
- 2) They do not keep accidents records.

The areas where the biology teachers lacked good safety practices in the laboratories constitute 27%.

Another aspect noticed was laboratory design, most of the schools visited have their laboratory building were situated in a way that directs rays from the sun find their ways into the laboratories. This is hazardous because it could lead to vigorous reactions between the rays and some chemicals. Most of the schools visited, their laboratory organization from the safety point of view was poor, lacked safety gadgets and inadequate first aid contents.

6. Recommendations

The following recommendations are made to check the rate of accidents in biology laboratories and to improve the knowledge of safety practices to student and teachers:

- 1) All schools offering biology their laboratories should be equipped with the following:
 - a) Fire extinguishers and students should be taught how use them;
 - b) Fire blankets students should be taught how to use them;

- c) Equipped first aid box at students and teachers disposals.
- 2) Teachers should explain to students what is expected in biology laboratories.
- 3) The students should know where the safety gadgets are kept in biology laboratories and should have free access to them.
- 4) All schools should provide safety goggles for their biology students. This would protect their eyes when conducting practical classes.
- 5) All schools offering biology should have accident record books. This is necessary for the teachers working in the laboratories. Such book should contain the name of students, class, type of accidents and type of aid treatment given. This would help the teachers from being persecuted by overzealous parents if the accidents eventually turn to death.
- 6) Students should not be allowed access to places where chemicals, explosive or other apparatus are kept without the knowledge of teachers.
- 7) All electrical appliances should be constantly checked before students are allowed to use them and after usage they should be switched off. The checking should be done by a technician.
- 8) Biology students should wear lab coats when working in the laboratories to protect their bodies from being damage by chemical.
- 9) Biology laboratory windows should be made of wood for security reasons, windows and doors should always be left open when students are working in the laboratories.
- 10) It was observed that few schools have laboratories assistants, who have knowledge of the various aspects of laboratory organization, management, and design. This will help in the safety of the laboratories and people who work in it.
- 11) Students should be advised when pouring liquid from reagent bottles.
- 12) Teachers should participate in workshops to enable them update on their first aid habit and techniques.
- 13) It was observed that majority of the schools do not have adequate first aid/kits. School heads should try to supply all the necessary first aid contents to their biology laboratories.
- 14) In case of high population of students, they should be grouped, for effectiveness and to avoid accidents during practical lessons.

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