DISCOVERY

58(319), July 2022

A survey of environmental and occupational hazards on the teaching and learning of science in Ankpa local government area of Kogi State, Nigeria

Akuh Mark Attah

To Cite:
Akuh MA. A survey of environmental and occupational hazards on the teaching and learning of science in Ankpa local government area of Kogi State, Nigeria. *Discovery*, 2022, 58(319), 756-765

Author Affiliation:
Department of biology/chemistry, Kogi state college of education Ankpa Kogi state Nigeria; Email: akuhmark@gmail.com

Peer-Review History
Received: 06 May 2022
Reviewed & Revised: 08/May/2022 to 12/June/2022
Accepted: 14 June 2022
Published: July 2022

Peer-Review Model
External peer-review was done through double-blind method.

ABSTRACT

The study surveyed environmental and occupational hazards in the teaching and learning of science in Science Secondary Schools in Ankpa Local Government Area of Kogi State. Four research questions were formulated to guide the study. Questionnaire survey was used with a sample of 55 respondents - 5 teachers and 10 students each from the five selected schools. A 10 items questionnaire each for students and teachers drawn from three research questions was constructed and used as instrument for data collection. Data collected were analysed by a simple percentage. The results of the study showed that chemical exposure, inhalation of toxic particles, parental attitudes, student threats, nuclear risks, office environments... and neglect, ignorance, unfavourable scientific progress, and so on affects teachers and students; and are hazardous to teaching and learning of science. Based on the results, there were a number of recommendations, which include among many others: Government's attention should be drawn to improving the living and health standards of science teachers and students since science is the bedrock to a developed nation, employment of educationally qualified and knowledgeable science teachers, formulation of curriculum that are minimally hazard-free despite the hazards in the teaching and learning of science etc.

Keywords: environmental hazards; occupational hazards; teaching and learning of science

1. INTRODUCTION

Etymologically, the word "science" comes from the Latin word "scientia" which means knowledge. Science refers to a systematic and organized body of knowledge in all areas of research acquired using the "scientific method" (scientific methods are described below). Science can be divided into two major categories: natural sciences and social sciences. Natural science is the study of naturally occurring objects and phenomena such as light, objects, matter, the earth, celestial bodies, and human bodies. Science can be further divided into

physical science, earth science, life science, and so on. Physical science consists of fields such as physics (science of physical objects), chemistry (science of materials), and astronomy (science of astronomical objects). Earth science consists of fields such as geology (earth science). Life sciences include areas such as biology (science of the human body) and botany (science of plants). In contrast, social science is the study of people or groups of people, such as groups, companies, societies, or economies, and the behavior of those individuals or groups. Social sciences can be divided into areas such as psychology (science of human behavior), sociology (science of social groups), and economics (science of enterprises, markets, and economics) (lumenlearning.com, 2010).

Wikipedia.com (2010) pointed out that science is far more of an aim than a collection of facts.; It is a particular way of understanding the natural world. It extends the intrinsic curiosity with which we are born. This is an objective, rational and observable way to understand the principles and forces that are functioning in nature.

Peter (1999) sees science as the ordered arrangement of verified knowledge, including the methods by which such knowledge is expanded and the criteria by which its truth is tested.

The Field Called Science (Branches of Science)

The following Subjects are regarded as science subjects. Chemistry, Biology, (Botany or Zoology), Physics, Health Science, Agricultural Science, Geology.

At the university there are a number of disciplines or career options that are based on these scientific subjects. Some of them are biochemistry, Microbiology, Stereo-chemistry, Radiochemistry, Optometry, Medicine, Chemistry, Astronautics, Food Science and food Technology, Oceanography, Engineering (Mechanical, Marine…), Meteorology, Astronomy, etc. These opportunities of science are based on the two main areas of specialization which are Biological (life) Science, which deals with biological studies and the physical science that deals with chemistry, Physics etc.

Importance of Science

The contribution of science to man and the society is enormous, some of these are:

1. Science helps us to sharpen our views about ourselves, have a good knowledge of our surrounding and our place in the universe by the help of the science teachers.
2. Research by nuclear physicists has led to the development of nuclear energy as sources of power e.g. solar power generation.
3. Agricultural products of various kinds have soared as agricultural scientists have developed better varieties of plants and highly effective fertilizer and animal husbandry.
4. The development of antibiotics and other new drugs by pharmacists, medical practitioners, etc. have led the control and cure of many diseases with studies in Anatomy and physiology and an amazing new surgical technique due to inventions of life saving machines.
5. Climatologists have helped us to forecast our climate and weather conditions, thereby allowing free movement.

Hazards of Learning Science

Although Scientific and technological Achievements of Science have benefited us in numerous ways, they have also created serious problems in the environment. Some of these hazards are environmental pollution, Occupational hazards, Global warming resulting in acid rain, development of weapons of war for human destruction, imbalance of ecosystems, to mention but a few (Benjamin 2009).

These hazards and problems associated with science have created a phobia of teaching and learning and discouragement in the study of science both at the secondary and tertiary levels.

The implications of these on learning science

The implications of hazards are numerous, but particularly on the environment and occupational for instance, medical practitioners and nurses in hospitals, engineers at the construction site are faced with various occupational hazards- Mechanical, Electrical, Chemical, Biological etc. Ferret (2001) explained these occupational hazards as:

1. Electrical occupation hazards which may include electric shocks, electric burns, electric fires, explosion, arching, portable electrical electrocution due to exposure of the body to the flow of electrical current through it.
2. Engineers and science teachers, especially chemistry teachers are faced and exposed to chemical hazards during practical in the laboratory and construction sites by corrosive substances which burns the skin and the living tissue, expulsion of gases e.g. carbon (ii) oxide, nitrogen, sulphides which are absorbed into the blood stream as harmful substances.

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

3. Mechanical/machinery hazards are bruises through varying measures of injuries and mutilation from disabling up to crushing, shearing, hazards which traps part(s) of the body e.g. hand(s), Leg(s), fingers between moving and fixed parts of the machine during unplanned release or dropping of loads are such hazards faced by engineers and construction workers.
4. Science teachers, students and workers are exposed to biological hazards due to fungi, molds, algae, verses and bacteria as agents of irritant which cause skin (dermatitis) or lung, (bronchial) inflammation, with many chemicals used as solvents (white spirit, toluene and acetone). Formaldehyde used as a biological preservative and ozone are other biological examples of biological hazards from irritant, for example, medical doctors are exposed to various viruses, bacteria.
5. The exact nature and scale of environmental risk of science to human health and implication in occupation varies dramatically, according to where and how one lives with factors such as level of socio-economic development, wealth distribution and equally important: policy choices and interventions.

Implications of these on learning

With these hazards mentioned above, it is clear that its implications on learning are:

- Discouragement of students from learning science due to the risk and hazards of science mentioned above.
- It creates phobia (fear) for subjects or discipline that a science student may faces or embark on during the study of science.
- It has led to low levels of enrolment in most higher secondary schools, for instance high school Demonstration Kogi State College of Education, Ankpa science students performance level and enrollment of science students decreases relative to art students.
- The above hazards have discouraged many science students and teachers from taking part in scientific activities, for example, practical activities dealing with a concentrated corrosive chemical.
- The alarming poor performance and the risks that all those who deal with science directly or indirectly face pose many problems.
- With these, world resources 1998-99 is concerned not just with today's environmental health threats which are rampaging but also with the extent to which human activities are altering the environment and what those changes foretells for human health in the nearest future.

2. METHODOLOGY

Research Design

The research design adopted for the study is the survey type. The choice of designing is because it's considered the use of questioner developed on the topic as above in some selected senior secondary schools in Ankpa Local government area of Kogi state, Nigeria.

Population of the Study

The population of the study comprises science teachers and students in some selected secondary schools in Ankpa Local government Area of Kogi State, Nigeria.

Area of the Study

The area of the study includes the following selected schools in Ankpa Local Government Area of Kogi state, Nigeria

1. Demonstration Secondary School KSCOEA
2. Elite Foundation College,
3. St. Charles College.
4. Prison Staff Modern Secondary School.
5. Hope Academy Secondary.

Sample and Sampling Technique

The study considered simple random sampling of Fifty (50) Students and five (5) Science Teachers drawn from Five (5) Senior secondary schools, and specifically, ten students each and a teacher each were randomly selected from each of the five (5) Schools in the area of study.

Instrument Used

The instrument used for the study is structured questionnaires. Each of the questionnaires had ten items on environmental and occupational hazards on teaching and learning of science based the research questions. The ten items questionnaires designed were

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

made up of four items on sources on environmental and occupational hazards, Effects of science advancement and factors necessitating these hazards. Respondents (Teachers and Students) were required to answer (Yes/No) to each item in the questionnaires.

Liability and Validation of Instruments

Two lecturers, one from Chemistry and the other from Biology Department in Kogi state College of Education Ankpa assessed and validated the questionnaires.

Method of data Collection

The researcher administered the questionnaires by himself through personal contact with the respondents who gave their responses almost immediately to the items in the questionnaire. The researcher used the responses from the respondents (teachers and students) to obtain data.

Method of Analysis

The result of the questionnaires was set out in tables and the data were analyzed using simple percentage.
Formula used is shown as this:

Percentage (%) = $\frac{\mathbf{X}}{\mathbf{N}} \times 100$ where

X= Number for respondents that answered (Yes/No) to a particular item in the questionnaire.
N= Total number of respondents.
100 = the constant percentage (%).

Data Presentation and Analysis

In this chapter the researcher focuses on the presentation and analysis of the data obtained from the respondents of the questionnaire on the problem put forward by the researcher. Basically, it is concerned with the analysis and interpretation of data based on the research questions.

3. RESULTS

The researcher distributed fifty (50) questionnaires, ten (10) for each of the schools sampled and five (5) for the teachers. And he was able to retrieve forty-eight (48) copies for the student's questionnaire and five (5) for the teachers were recovered. The analysis is discussed as follows: -

Research Question 1: What are the sources of occupational and environmental hazards?

Table 1

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
1	Have you noticed inhaling of board writing chalk as a source of environmental and occupational hazards to your teaching?	4	80%	1	20%
2	Are chemicals handled in the course of teaching science one of the hazard sources in occupation?	5	100%	0	0%
3	Are students' misbehaviour hazardous to teaching and learning science?	60	60%	2	40%

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

4	Can parents' attitudes serve as a source of hazard to the performance of students' learning?	4	80%	1	20%

From table 1, it can be inferred that inhale of chalk particles and board ink during teaching, chemical inhaling, students misbehaviour and parents' negative attitudes could serve as sources of environmental and occupational hazards to the teaching and learning of science due to the secondment of the respondents (80%) to the items.

Research Question 2: what are the effects of environmental and occupational hazards on the teaching and learning of science?

Table 2

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
5	Environmental and occupational hazard affect teachers' efficiency in teaching and learning of Science.	3	60%	2	40%
6	Does environmental and occupational hazards affect content coverage of Science teaching and learning	1	50%	4	80%
7	Can threats from student serve as environmental and occupational hazards affect teaching and learning of science	4	80%	1	20%
	TOTAL **8**	**160/3=53.3**	**7**	**140/3=46.6**	

From table 2, it is observed that 53.3% of the respondents agreed to the fact that item 5-7 could serve as the effects of environmental and occupational hazards while 46.6% disagreed the effects on teaching and learning of science.

Research Question 3: what are the factors necessitating environmental and occupational hazards to teaching and leaning of science.

Table 3

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
8	Does your office settings affect your effectiveness in science teaching?	4	80%	1	20%
9	Is science advancement hazardous to science teaching and learning	1	20%	4	80%

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

10	Does chemical exposure and handling result to environmental and occupational hazards in science teaching and learning?	5	100%	0	0%
	TOTAL **10**	**200/3=66.7**	**5**	**100/3=33.3**	

Table 3 shows that office setting and exposure to poisonous chemicals necessitate environmental and occupational hazards. This is as a result of 80% agreement with item 10 though 80% of the respondents to item 9 disagreed that science advancement is hazardous to science teaching and learning.

Student Questionnaire

Research Question 1: What are the sources of environmental and occupational hazards to the teaching and learning of science?

Table 4.1

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
1	Have you swallowed base during pipetting in a volumetric analysis before?	16	33.3%	32	66.7%

From table 4.1, though a greater percentage 66.7% of the respondents do not swallow base during pipetting in science experiments; however, these respondents may have inhaled the chemical in the course of pipetting while the 33.3% of the respondents that swallowed base during pipetting in science experiments poses hazards to the teaching and learning of science considering the health condition of the respondents.

Table 4.2

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
2	Have you inhaled toxic chemicals during quantitative analysis while performing practical in chemistry ?	30	62.5%	18	37.5%

Form table 4.2 it shows that 30 respondents which are equivalent to 62.5% agreed that most of science students have inhaled toxic chemicals during quantitative analysis while performing practical in chemistry through 18 respondents disagreed I.e 37.5% fraction, of the percentages. It could be observed therefore, that the 62.5% who agreed have seen that there are hazard science students faces in their course of performance experiment(s).

Table 4.3

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
4	Are science students expose to contagious disease(s) during their practical especially Biology practical?	19	39.5%	29	60.5%

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

Table 4.3 could be observed that 29 respondents which is 60/5% of the entire respondents were not in support that science students are exposed to contagious diseases during their practical especially Biology. Significantly, 19 respondents which is an equivalent of 39.5% of the entire respondents supported the motion of hazards of contagious diseases by science students. It can be observed that the 39.5% which faces these hazards of the fraction that studies science poses havoc to the society.

Research Question 2: What are the effects of environmental and occupational hazards on teaching and learning of science.

Table 5.1

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
5	Do you feel uncomfortable when inhale gas and chemical in the science laboratory?	42	87.5%	6	12.5%

Table 5.1 shows that 87.5% out of the 48 respondents feel uncomfortable when they inhale gas and chemical in the laboratory which means hazard faced by the percentage connoting their insecurity in studying science though 12.5% of the respondents are not faced by this hazard.

Table 5.2

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
6	Can exposure and handling result in environmental and occupational hazards in science teaching and learning?	19	39.5%	29	60.5%

It can be inferred from table 5.2 that 29 of the respondents which is equivalent to 60.5% agreed that exposure to chemical and handling of it unproductively exposes science students to chemical hazards detrimental to their health due to lack of safety measures.

Table 5.3

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
7.	Does technological advancements have any adverse hazards on occupation in learning science?	22	45.8%	26	54.2%

Table 5.3 shows 54.2% disagreement and 45.8% agreement. It shows a difference of 84% agreement between the respondents that science advancement have adverse hazards on the occupation of teachers and on the learning of learners. Nevertheless, although 54.2% disagreed, the 45.8% of the respondents opined that science advancement e.g. G.S.M. usage through radiation exposure, chemical weapons and machine radiations at home, at the hospitals, at school etc, could be hazardous to human health leading to a decline in the teaching and learning of science in Nigeria.

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

Research Questions 3: What are the factors necessitating environmental and occupational hazards in teaching and learning of science?

Table 6.1

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
8.	Do you agree that ignorance can necessitate environmental and occupational hazards in learning?	44	91.7%	4	8.3%
9.	Can carelessness contribute to occupational hazards in the learning of science in the case of laboratory interaction?	39	81.3%	9	18.7%

From table 6.1, it can be inferred that ignorance and carelessness contribute to environmental and occupational hazards identified with the teaching and learning science due to the 91.7% and 81.3% of the 44 and 39 respondents who agreed with the motion of the research question 8 and 9 respectively.

Table 6.2

S/N	ITEM	NO OF YES	% OF YES	NO OF NO	% OF NO
10.	Is your science laboratory hazardous to your health.	14	29.2%	34	70.8%

Table 6.2 shows that 34 respondents which is equivalent to 70.8% were of the opinion that their science laboratory was not hazardous to their health while 14 of the respondents equivalent to 29.2% opined that theirs is hazardous to their health. Although 70.8% attested safety of their laboratory, they may not be abreast of some hazardous ways they are exposed to in their supposed hazard-free laboratories. This can be viewed that if a maintenance culture is not maintained, the 70.8% could be drastically reduced to hazardous laboratories.

4. CONCLUSION

Based on the statistical analysis of the data and the results obtained, it is clear that the questionnaire-based findings are that: environmental and occupational hazards affects the teaching and learning of science. It revealed that both teachers and learners of science are faced with hazards detrimental to teaching and learning which invariably discourages students with the opportunity to develop interest in some science vocations. It gives students wrong perceptions about science vocations e.g. medicals profession as a complicated and tedious vocation, that engineers are susceptible to falls from heights, infections and infestations by hospital workers etc.

Recommendations

From the analysis and summary of the data collected, it is evident that multifarious factors surround the environment and occupation of science teaching and learning in Ankpa Local Government Area and by extension, Nigeria. The following recommendations have been recommended:

1. Government attention should be drawn to science teachers and students by identifying that they are exposed to hazards with a view of improving the health safety measures of the individuals concern.
2. Also, the Ministry of Education per se should endeavour to employ educationally qualified teachers who have sound knowledge and awareness of safety measures adopted in science.
3. Due to the fact that ignorance and carelessness can necessitate environmental and occupational hazards, there should be seminars and conferences for both teachers and students to create awareness of hazards to probably face in the course of teaching and study with a view of proferring measures to these hazards.

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

4. Despite the risk involved in science professions and the environmental degradation in terms of exposure to dangers, teachers and management of schools should not be discouraged to encourage science teaching and learning by providing necessary equipment for effective teaching and learning.

TEACHERS' QUESTIONNAIRE

Name of School: ……

Please tick or write in appropriate column as it applied to you.

A. Sources of Environmental and Occupational Hazards

1. Have you noticed inhale of chalk particles or whiteboard ink odour as sources of environmental and occupational hazards to your teaching? Yes [ ] No [ ]
2. Are chemicals handled in the course of teaching science one of the sources of environmental and occupational hazards? Yes [ ] No [ ]
3. Are students' misbehaviour during science practical hazardous to teaching and learning of science? Yes [ ] No [ ]
4. Can parents' attitudes serve as a source of hazards to the performance of students' learning of science? Yes [ ] No [ ]

B. **Effects of Environmental and Occupational Hazards**

5. Environmental and occupational hazards affects teachers' efficiency in teaching and learning of science. Yes [ ] No [ ]
6. Does environmental and occupational hazards affect content coverage of science teaching and learning? Yes [ ] No [ ]
7. Can threats from students serve as environmental and occupational hazards affecting teaching and learning of science? Yes [ ] No [ ]
8. Does your office setting affect your effective teaching and learning of science? Yes [ ] No [ ]
9. Is science advancement hazardous to science teaching and learning? Yes [ ] No [ ]
10. Does chemical exposure and handling result to environmental and occupational hazards in science teaching and learning? Yes [ ] No [ ]

STUDENTS QUESTIONNAIRE

Name of School: ……

Please tick or write in appropriate column as it applied to you.

1. Have you swallowed base during pipetting in volumetric analysis before? Yes [ ] No [ ]
2. Have you inhaled toxic chemical during quantitative analysis while performing practical in Chemistry? Yes [ ] No [ ]
3. I am discouraged studying science because science students inhale chemical when they are in the laboratory and during their chemicals. Yes [ ] No [ ]
4. Are science students exposed to contagious diseases during their practical especially Biology? Yes [ ] No [ ]
5. Do you feel uncomfortable when you inhale gas and chemical in the laboratory? Yes [ ] No [ ]
6. Can chemical exposure and handling result to environmental and occupational hazards from you learning science? Yes [ ] No [ ]
7. Does technological advancements have any adverse environmental and occupational hazards in science teaching and learning? Yes [ ] No [ ]
8. Do you agree that ignorance can necessitate environmental and occupational hazards in science tesching and learning? Yes [ ] No [ ]
9. Can carelessness contribute to environmental and occupational hazards in the science in the laboratory? Yes [ ] No [ ]
10. Is your science laboratory hazardous to your health? Yes [ ] No [ ]

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

Funding

This study has not received any external funding.

Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Achor E.E. (2006) Issues in Science and Society 2nd Edition, Nsukka- Nigeria: Great Ap Express Pub. Pp 1-6
2. Akeem T.Y. (2009) Health and Environmental Hazards (www.nigerians. Com/articles)
3. Alexander et al (1987) The teaching of Science as equipment. Massachusetts: Hazards University Press. Pp 46-47.
4. Arun Garg (2009) "Chemical Risks" Microsoft® Encarta ® 2009 [DVD]
5. Bajah S.T. Onwu G. et al (2000) Senior Secondary School Chemistry Textbook 3. Lagos-Nigeria: Longman/Lukab Pub. Pp 226.
6. Carl S. (2009) International perspectives on Science Springer Pub. co. (www.wikipedia.com)
7. Chibiko G.O (1994) Curriculum Theory and Planning. Onitsha-Nigeria: Uni-world Educational Pp. 58-59.
8. Daniel Emeribe et al (2010) Nigeria: Labour Ministry moves to tackle Emerging workplace Hazards. (www.allafrica.com/20100520022/html)
9. Encarta Encyclopedia Microsoft 2009 [DVD]
10. Ferret E.D. et al (2005) Introduction to Health and Safety in construction. London-Italy: Elsevier Butterworth-Heinemann Pp. 1-2, 49, 222-225, 259-267.
11. Grolier Students Encylopedia (2004) Pyramid Scientific Instrument. Danburry-Thailand. Pp.51-54.
12. https://courses.lumenlearning.com/suny-hccc-research-methods/chapter/chapter-1-science-and-scientific-research/
13. https://www.biozone.com/bio/ozone-layer
14. https://www.meslinenigeria.com-journals
15. https://www.scienceagogo.com/news/2008
16. https://www.springerlink.com/hazards/chemistry
17. https://weebly.com. Advanced Information - Science and Technology
18. McGraw-Hill Encylopedia of Science and Technology 9th ed, Vol. 9 (ICE LEV) New York McGraw-Hill U.S.A. Pp. 117-124.
19. Neil Campbell (1996) Biology 4th Edition New York-Paris: Benjamin/Cummings Inc. U.S.A. Chambers Harrah Pub. Pp. 45-47
20. Peter M.B (1999) Chambers Dictionary of Science and Technology Benjamin/Cummings Inc. U.S.A. Chambers Harrah Pub. Pp. 45-47.
21. Richard J.W. (2000) The Medical and Health Encylopedia. U.S.A: Ferguson Deluxe Edition Chicago Pp. 514-522.
22. World Book Encylopedia (2004) (17) (S-N) Chicago World Book Inc. (www.worldbook.com) Pp. 191-204.
23. World Health Organization (WHO) (1997) Health and Environment in Sustainable Development. Pp. 1, 57-59
24. Zimmerman, Michael et al (2009) "Environment" Microsoft ® Encarta Co-operation.

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS