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Assessment of Science Teachers Awareness of the Legal Implications on Safety in Relation to Laboratory Activities

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Abstract

The study aimed at assessing science teacher awareness of the legal implication on safety in relation to laboratory activities. Eight research questions formed the basis of the study while three null hypotheses were tested at 0.05 level of significance. A sample of ninety science teachers was obtained using stratified random sampling techniques dichotomised into rural - urban on the one hand and male-female on the other hand. The sample was also trichotomised into biology, chemistry and physics teachers. A questionnaire made up of twenty items was developed and responded to using a five point likert rating scale. The items were face validated and reliably obtained using Pearson. Research Questions 1- 8 were answered using means and standard deviations while the hypotheses were tested using one-way ANOVA for H_{01} and Z-score for H_{02} and H_{03} . Science teachers whether in holistic terms, at the trichotomised level or at the dichotomised level were minimally aware of the legal implications of safety in the context of laboratory activities. At the three levels of operation, no significant differences were obtained. Recommendations based on the major findings were proffered.

Introduction

Science laboratories are designed ostensibly to make them safe places for teaching and learning. However, the sustainability of this assumption may fall short of expectation unless adequate fore-thought and planning are put in place to cushion down the ever rising demands on the laboratories. Everett and Jenkins (1977) for

instance were worried that with the favourable disposition dispensed on the open-ended method of investigation, it might not be too easy to draw the line between worthwhile experiments and hazardous exploration. In addition, experimentation for the twenty first century is likely to make increasing use of radioactive and X-ray sources, high voltages, lasers and a wide range of bacteriological materials. The need and ability to undertake a greater number and variety of sophisticated experiments has its concomitants, i.e. the corresponding ability of a legally-minded and sophisticated twenty-first century parent to question the 'magister dixit' image of the teacher especially in matters that affect the welfare, comfort and safety of his children. Herein lies the problem.

There is, therefore, a felt-need for the science teacher to acquaint himself with the legal implication of safety and also to silhouette his laboratory operations within a prescribed modus operandi if not approved by law, by the dictates of common - sense approach. Evarett and Jenkins (1977) had suggested that on appointment to a school, a science teacher should normally sign a written contract defining the agreement between him and the employing authority and supplied with a copy of his contract together with access to any regulations referred to therein. Barrell (1970) had warned that it was the teacher's responsibility to report to the employer, the need for the rectification of any anomalous equipment such as a faulty fume cupboard, or a defective electricity outlet.

Elgin (1977) cautioned science teachers to take cognisance of student's age, ability, aptitude and experience before subjecting them to laboratory exercises. For hazards associated with a particular experimental technique, Everton (1982) advised that forewarning regarding the dangers inherent in such techniques should be high-lighted. Powell-Smith (1985) bemoaned a situation where students were exposed to experiments not commensurate with their age, recommending that the teaching/learning situation should be designed in such a way as to remove or minimise hazards.

The DES Safety and Works Act (1974) proffered solutions on what science teachers should do when confronted with a real laboratory accident involving his students. The recommendations include seeking legal advice from a lawyer and professional advice from a Professional Association to which he belongs. In addition, he might as well consult an eye-witness such as a laboratory assistant or a technician before submitting his report to avoid contradiction with its inescapable embarrassment. Robinson and Amiens (1977) had called on science teachers to acquaint themselves with experimental work and various storage practices that are controlled by law and that they must, even in college exhibitions avoid dabbling into the use of explosive mixtures. Everett and Jenkins (1977) had added that even with the prescribed use of toxic, carcegenous, flammable and radioactive materials approved by law, science

teachers must undertake to show great care and caution over their use, and for out-of-school activities such as field-trips, the teacher must ensure that before undertaking the trip, the activities, for obvious reasons must be approved as an official school function by the relevant employer. It is necessary for this researcher to add that the science teacher must find out from the post-primary Management Board (PPMB) whether an indemnity against any claim for damages made on behalf of such a student, whether on an approved course, or engaged in a listed activity has been made. Finally, Science teachers are advised to register with Professional Associations in the absence of which they must insure themselves privately (Powell-Smith, 1985).

With an ever increasing sophistication on the part of parents on their rights and the corresponding legal awareness on same, it is likely that the incandescence of parental wrath may assume extreme manifestation in the twenty first century i.e. if their children are injured in a laboratory operation, no matter how inadvertent the circumstances. Central to and bearing direct impingement of the parental scourge is the science teacher who through ignorance of his right may be implicated legally. The study, therefore, aims at sensitising teachers to the need to become aware of the legal implications of safety.

The study was designed to determine

1. the extent to which science teachers have acquainted themselves with the legal implications of safety in science laboratories?
2. the extent to which Biology teachers have acquainted themselves with the legal implications of safety in the biology laboratory.
3. the extent to which chemistry teachers have acquainted themselves with the legal implication of safety in the laboratory.
4. the extent to which physics teachers have acquainted themselves with the legal implications of safety in the physics laboratory.
5. the influence of gender on the extent to which science teachers have acquainted themselves with the legal implication of safety in science laboratory
6. the influence of location on the extent to which sciences teachers have acquainted themselves with the *legal implications of safety in science laboratories*

The following research Questions form the basis of the study:

1. To what extent have science teachers acquainted themselves with the legal implications of safety in science laboratories

2. To what extent have biology teachers acquainted themselves with the legal implications of safety in the Biology laboratory?
3. To what extent have chemistry teachers acquainted themselves with the legal implications of safety in the chemistry laboratory?
4. To what extent have physics teachers acquainted themselves with the legal implication of safety in the physics laboratory?
5. How far have female science teachers acquainted themselves with the legal implication of safety in science Laboratories?
6. How far have male science teachers acquainted themselves with the legal implication of safety in Science Laboratories?
7. To what extent have science teachers located in Urban oriented schools acquainted themselves with the legal implication of Safety?
8. To what extent have science teachers located in rural oriented schools acquainted themselves with the legal implication of safety?

Hypotheses: Three Hypotheses were tested at 0.05 level of significance:

1. Academic background of the Science Teachers is not a significant factor influencing the extent to which they have acquainted themselves with the legal implications of safety in accordance with the determined mean ratings.
2. The significant difference in gender relationship between male and female science teachers on the legal implications of safety and in accordance with their mean ratings is zero.
3. There is no significant difference between science teachers based in urban located schools and their counterparts based in rural located schools on the extent to which they have acquainted themselves on the legal implications of safety and in accordance with their mean ratings.

Materials and method

The design is a survey involving ninety science teachers on how knowledgeable they are on the legal implications of safety. Specifically the study sought to find out the influences of academic background, gender and location on same. In addition the study involved science teachers who teach biology, chemistry and physics at the SS level and in all Local Government Areas of Enugu Zone.

Sample of ninety science teachers was obtained as follows: Six out of the nine local Government areas were obtained by means of a table of random numbers. By simple stratified random sampling technique eighteen secondary schools were obtained, ten

in the Rural areas and eight in the urban zones. The Rural-Urban dichotomy was determined by the satisfaction of the following fulfilments for an Urban setting: Good network of Roads, a fairly predictable and a fairly uninterrupted supply of portable water, electricity and telephone lines and a settlement with the urban trappings of good effluent disposals, street names, Street numbers and the presence of sophisticated commercial, finance, medical, ecclesiastical, industrial, educational and security/ Parasecurity centres. Out of a total of the eighteen secondary schools in both rural and urban settings, forty five science teachers were selected from the urban located schools and forty five teachers from schools located in the rural areas by balloting without replacement. By a similar mode of operation, forty five male science teachers and an equal number of female science teachers were selected. Finally, thirty chemistry teachers, thirty biology teachers and thirty physics teachers were randomly selected.

Only the questionnaire was employed for data collection. It was of two types: response by science teachers to items based on the Supply type/data blank and response by science teachers to items based on select type/check list.

The twenty item questionnaire related to knowledge relevant to the legal implications of safety in relation to laboratory activities was answered using a five point Likert Rating Scale as follows:

- 5 = most extensive awareness exhibited
- 4 = extensive awareness exhibited
- 3 = moderate awareness exhibited
- 2 = minimal awareness exhibited
- 1 = ignorance exhibited

Test - retest estimate on reliability was obtained by administering a test on a relatively small group of eighteen science teachers drawn from Igboeze north and south Local Government Areas, in Nsukka Zone of Enugu State. The two sets of scores were correlated after an interval of one month. A correlation coefficient of 0.89 was obtained.

Research Questions 1-8 were answered using means and standard deviations. Hypothesis I was tested at 0.05 level of significance using ANOVA. Hypotheses 2 and 3 were tested at the same level of significance using Z score.

The extent to which science teachers manifested awareness of the legal implication of safety in relation to laboratory activities was computed and interpreted using the following range of means:

Above 3.50 = Exhibition of Extensive awareness,

2.50 - 3.50 = " Moderate awareness

1.50 - 2.49 = " Minimal awareness

Below 1.50= " Ignorance

Results and discussion

The presentation of data and results was organised around the research questions and statistical hypotheses that guide the study.

Research Question one: *To what extent have science teachers acquainted themselves with the legal implications of safety in the Science laboratory?*

Table I: The means and standard deviations of the various ways by which Science teachers have acquainted themselves with the legal implication of safety

S/No	Legal Implication on Safety	X	S.D	Interpretation
1	The teacher takes the initiative in reporting in writing any 1.42 hazards which it is the responsibility of the employer to rectify e.g. faulty fume cupboard, defective out-let for gas, water and electricity	1.42	0.23	Ignorance
2	The teacher reports in writing all accidents involving students	1.83	3.32	Minimal Awareness
3	Necessary precautions should be observed to ensure that students embark on experiments commensurate with their age, ability and experiences	2.35	0.81	Minimal Awareness
4	Laboratory rules and regulation should be made available to Students	2.61	0.97	Moderate Awareness
5	Fore-warning of all hazards associated with a particular Experiment, technique or material should be given	2.88	0.78	Moderate Awareness
6	The teaching - learning situation should be designed in such a way as to remove or minimise such hazards	3.15	0.48	Moderate Awareness
7	In the event of an accident it is advisable to seek medical advice unless the teacher considers it unnecessary	3.56	0.29	Extensive Awareness
8	Eye - witnesses present during the accident, (A laboratory assistant, a technician) should be consulted before the teacher makes a final submission of his report	1.44	0.26	Ignorance
9	Legal advice should be sought before the teacher finally submits his report	1.33	0.31	Ignorance
10	Professional advice from one of the professional associations such as Science Teachers Association of Nigeria (STAN) or Chemical Association of Nigeria (CAN) must be sought before the teacher finally submits his		0.35	Ignorance

	report			
11	For out-of-school activities such as field trips, the teacher must ensure that before undertaking the trip the activities must be approved as an official school function by the employer	3.77	0.21	Extensive awareness
12	It must be found out from the Post Primary School Management Board (PPSMB) whether an indemnity against any claim for damages made on behalf of such a student while he is on such an approved course has been provided	1.92	0.24	Minimal Awareness
13	It must be found out from the same Board whether an indemnity against any claim for damages made on behalf of such a student engaged in a listed activity has been provided	1.18	0.25	Ignorance
14	Parents should sign an indemnity against any claims made on behalf of the student in the course of a teacher conducting an out-of-classroom activity	1.12	0.15	Ignorance
15	Parents should sign an indemnity against any claims for damages made on behalf of the student while he is on such an approved course	1.23	0.18	Ignorance
16	Science teachers who are not members of a professional association should either do so or insure themselves privately	1.45	0.37	Ignorance
17	Teachers should acquaint themselves with the various experimental work that is controlled by law	2.00	0.59	Minimal awareness
18	Science teachers should acquaint themselves with the various correct practices controlled by law	1.56	0.46	Minimal Awareness
19	Even in college exhibitions science teachers must avoid dabbling into the use of explosive mixtures	1.67	0.32	Minimal Awareness
20	Science teachers must undertake to show great care and caution over the prescribed use of toxic, carcinogenic, flammable and radioactive materials approved by law	2.34	0.97	Minimal awareness
	Overall mean	2.05		Minimal awareness

Research questions two, three and four

To what extent have (i) Biology teachers, (ii) Chemistry teachers and (iii) Physics teachers acquainted themselves with the legal implications of safety?

Table 2: Means and Standard deviations depicting the extent to which academic background has influenced science teachers' awareness of the legal implications of safety

	Biology	Chemistry	Physics
X	2.07	2.19	1.91
S. D.	0.60	0.78	0.31
N	30	30	30
Interpretation	Minimal awareness	Minimal awareness	Minimal awareness

Research question five and six

How far has gender influenced the extent to which science teachers have acquainted themselves with the legal implication of safety?

Table 3: Means and standard Deviation depicting the extent to which gender has influenced science teachers' awareness of the legal Implications of safety

	Male Science Teachers	Female Science Teachers
x	2.03	2.11
S. D.	0.63	0.96
N	45	45
Interpretation	Minimal awareness	Minimal awareness

Research questions seven and eight

How far has location influenced the extent to which science teachers have acquainted themselves with the legal implication of safety?

Table 4: Means and Standard Deviation Depicting the Extent to which Location has Influenced Science Teachers awareness of the Legal Implication of Safety

	Urban Location	Rural Location
X	2.18	1.98
S. D.	0.88	0.59
N	45	45
Interpretation	Minimal Awareness	Minimal Awareness

Hypothesis

A One t 0.05 level of probability academic background of the science teacher is not a significant factor influencing the extent to which science teachers have acquainted themselves with the legal implication of safety.

Table 5: Background Not Significant Influence on Legal Implication of Safety

Source of variation	Sum Square	df	Variance Estimate	fcal	f table	Decision
Between group	26.78	2	13.39	1.17	3.15	Not significant
Within group	9.98	87	11.47			

Hypothesis Two

At 0.05 level of probability gender is not a significant factor influencing the extent to which science teachers have acquainted themselves with the legal implications of safety

Table 6: Gender not significant influence on legal implications of safety

Variables	X	S. D	N	Zeal	Table Decision	
Male sciences teachers	2.03	0.63	45	0.47	2.00	Not significant
Female sciences teachers	2.11	0.96	45			

Hypothesis Three

At 0.05 level of probability location is not a significant factor influencing the extent to which science teachers have acquainted themselves with the legal implication of safety.

Table 7: Location not significant influence on legal implications of safety

Variables	X	S.D	N	Zeal	table	Decision
Urban	2.18	0.88	45	1.25	2.00	Not
Rural	1.98	0.59	45			significant

Below are the major findings of the study.

1. Overall, science teachers are minimally aware of the legal implications of safety in the context of laboratory activities.
2. Irrespective of the science teachers specialised calling, all categories of teachers are minimally aware of the legal implications of safety with chemistry having the best overall mean score and physics the least.
3. Female Science teachers have a better overall mean score than their male counterparts on the extent of awareness on the legal implications of safety even where both categories are minimally aware of such implications on laboratory activities.
4. Teachers located in urban areas have a better overall mean X score than their Rural counterparts on the legal implications of safety. However, awareness of such legal implications of safety on laboratory activities for both categories of teachers was minimal.
5. At 0.05 level of probability, academic background, gender and location, independent of each other, were not significant factors influencing the awareness of science teachers on the legal implication of safety.

Science teachers are minimally aware of the legal implication of safety. This finding vindicates the fears of Everett and Jenkins (1977) who were worried that future experimental sophistication associated with the increased use of bacteriological materials, lasers, high voltages, X-rays etc. does not appear to be matched by science teachers' awareness on the implications attached thereto. DES, Safety and the works Act (1974) and Elgin (1977) seemed to embellish the point further when they warned that Science Teachers must take cognisance of students' age, aptitude, experience

and ability during laboratory activities in order to avoid unpleasant surprises resulting from lack of such awareness and the spill-over legal concomitants. The findings agree with those of Robinson and Amiens (1977) who had cried out on lack of sensitisation to the legal aspects of safety and who in an attempt to redress the situation had called on science teachers to acquaint themselves with experimental work and the various storage practices that are controlled by law.

In spite of the minimal legal awareness for all science teachers, chemistry had the best overall mean score, physics the least. Perhaps the fact that the learning of secondary school chemistry is froth with the greatest danger, followed by biology and with physics bringing up the rear, one would expect the respective teachers to show a corresponding measure of caution to stem the tide.

Female Science teachers were more legally aware than their male counterparts. It would appear that women are brought up under a stricter envelope or muffler of traditional norms and expectations. Morality compliments law; the one without the other is moribund and if vice versa, impotent.

Science teachers located in urban Areas had a better overall mean score than their counterparts located in Rural Areas. Perhaps exposure to an Urban milieu with its in-built trappings of political and socioeconomic structures may well account for an attestable level of legal armour needed to sharpen the survival instincts of an urban dweller.

Conclusion and recommendations

With the ever increasing sophistication attendant on the procurement and utilisation of laboratory materials for laboratory activities coupled with a corresponding sophistication of a new generation of parents bent on litigation even at a harmless skin - shallow cut on their children's finger, it has become necessary to sensitise science teachers on their rights based on the legal implication of safety.

Being a relatively new area of research, it is being suggested that workshops replicated in clearly and predictably defined period be mounted for science teachers on the legal implication of safety based on laboratory activities. Legal luminaries both of the bar and bench should as the occasion arises be integrated into the workshop as resource persons.

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