
ASSESSMENT OF LABORATORY MANAGEMENT SKILLS AMONG CHEMISTRY TEACHERS IN OGOJA EDUCATION ZONE OF CROSS RIVER STATE, NIGERIA

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ABSTRACT: *This descriptive survey assessed the most frequently used laboratory management skills among chemistry teachers in secondary schools in Ogoja Education zone of Cross River State, Nigeria. Two null hypotheses were formulated for the study. 220 chemistry teachers were selected via stratified sampling procedure from the population. The Chemistry Teachers Laboratory Management Skills Check List (CTLMSCL) was employed to generate data. Data was analyzed using the descriptive statistics, t-test and repeated measures analysis of variance (ANOVA) at .05 level of significance. Findings indicate that the laboratory management skills mostly utilized are ordering ($x = 29.955$), stocking ($x = 24.636$), maintenance ($x = 21.955$) and safety ($x = 14.682$). It is recommended that teachers should be encouraged to undergo further training to be able to acquire new knowledge and skills in laboratory management.*

KEY WORDS: chemistry teachers, school laboratory, laboratory management skills.

INTRODUCTION

Chemistry is one of the core science subjects taught at the secondary level in Nigeria. It is a core subject because it has contents which are considered to be very necessary for the achievement of scientific and technological development. Chemistry knowledge has been widely applied in many facets of life to improve the living conditions of man in the society. Fertilizers and insecticides, drugs, forensic investigations, water treatment all require application of chemistry knowledge. Many science-based courses offered in the universities require credit pass in chemistry for candidates to gain admission, which again underscores the importance of chemistry in some sciences based courses like medicine, pharmacy, nursing, agricultural science genetic engineering among others.

Chemistry knowledge cannot be meaningfully acquired in school without the provision of equipment and materials for effective practical activities. Practical activities are usually carried out in a school laboratory. A school laboratory is a specially designed room or building for science practical exercises and experimentation (Eshiet, 1993). A school laboratory can also be viewed as a forum for science teachers and their students to interact with materials under controlled conditions, when seeking answers to problems in nature. Working in any school laboratory demands a high degree of concentration as well as freedom from disturbance and distractions. This is because poisonous and dangerous materials may sometimes be released while working in the laboratory. Also many laboratory equipment and materials need special care and protection. They need to be stored in an orderly manner for ease of retrieval when needed. Locations of equipment

and materials need to be properly indicated by means of bold labels on shelves or drawers containing them and frequently used equipment in chemistry laboratory are to be located in the most readily accessible places for all laboratory staff.

All of these suggest that science teachers and other laboratory staff are supposed to have relevant skills that will enable them to effectively manage a school laboratory. These skills are termed laboratory management skills (Eniayeju, 2014).

Chime (2014) defines laboratory management skills (LMS) as technical skills for control and maintenance of laboratory equipment and materials. Such skills include ordering, safety, maintenance and storage or stocking skills. According to Nnoli (2013) every science equipment or material has its own unique characteristics in terms of utility, maintenance, storage, retrieval and safety which requires laboratory users to have some relevant skills to function effectively. In the author's view, good knowledge and display of laboratory management skills enable science teachers and other laboratory users to:

- i) Carry out laboratory experiments under control conditions of safety, accountability and orderliness.
- ii) Keep equipment and materials in the laboratory in a manner that guarantee ease of retrieval.
- iii) Recognize that equipment or materials for use in the laboratory are ordered under conditions of durability, availability and functionality.

Asiyai (2015) ascribed frequent dilapidation, breakage and misuse of laboratory equipment and materials to deficient skills and poor knowledge of laboratory management skills among science teachers. Ezeano (2014) maintained that effective utilization of laboratory management skills will reduce the risks of laboratory accidents and thus increase laboratory safety. Babajide (2016) also alluded that good application of laboratory management skills may guarantee laboratory safety, eliminate or minimize risks and hazards associated with laboratory practices and experimentation. Undoubtedly, standard laboratories at the secondary school level have common features but subject-specific laboratories have related features that distinguish one from another. All these features have to be managed by each subject teacher irrespective of gender role. Some studies however have shown conflicting reports on gender role in the utilization of laboratory management skills. For instance a study by Tsmango (2016) indicated no gender differences in utilization of laboratory management skills in the aspect of stocking and ordering among physics teachers. A related study by Okwo and Otubar (2015) showed that more male science teachers than females utilized, stocking, maintenance and safety from among the laboratory management skills. Such inconsistency in reports on gender role in the utilization of laboratory management skills, coupled with the persistent public outcry on the poor state of secondary school science laboratories across Nigeria has provoked this current study which sought to assess the laboratory management skills most frequently utilized by secondary school chemistry teachers in Ogoja Education Zone of Cross River State.

Purpose of the study

The study sought to:

- i) Determine the aspects of laboratory management skills most frequently utilized by chemistry teachers.
- ii) Find out if gender is an influential factor in the utilization of laboratory management skills.

Research questions

- i) Which aspects of laboratory management skills that are most frequently utilized by secondary school chemistry teachers?
- ii) How is gender a factor in the utilization of laboratory management skills?

Hypotheses

The following null hypotheses guided the study and were tested at $p < 0.05$ level of significance.

- i) The utilization of laboratory management skills does not differ significantly among secondary school chemistry teachers.
- ii) Gender is not a significant influential factor in utilization of laboratory management skills among chemistry teachers.

METHOD

The study adopted the descriptive survey design. The population of the study comprised four hundred and forty-nine (449) secondary school chemistry teachers in public schools in Ogoja Education Zone of Cross River State, Nigeria.

The study sample, drawn through stratified sampling technique comprised two hundred and twenty (220) chemistry teachers (123 males and 97 females). The stratification was on the basis of gender (male & female) and local government areas namely; Bekwarra, Obudu, Obanliku, Ogoja and Yala in Ogoja Education Zone.

Instrument for data collection

A modified likert scale type instrument titled Chemistry Teachers Laboratory Management Skills Check List (CTLMSCL) was used for data collection. The study instrument was designed based on four laboratory management sub-skills viz ordering, stocking, safety and maintenance skills. Each sub-skill contain eight items of measure with score values of 4 points for very large extent (VLE), 3 points for Large Extent (LE), 2 points for Small Extent (SE) and 1 point for Very Small Extent (VSE). The instrument was thereafter validated by two specialists in chemistry and one expert in measurement and evaluation all in Cross River University of Technology, Calabar. The reliability of the instrument, estimated to be 0.87 using the cronbach alpha method within SPSS package was considered good enough to collect credible and reliable data for the study.

Data analysis

The descriptive statistics, independent t-test and repeated measures analysis of variance (ANOVA) were employed to analyze the data.

RESULTS

Research question 1

What aspects of laboratory management skills that are most frequently utilized by secondary schools teachers. Table 1 shows the descriptive statistics of the four sub-skills utilized by chemistry teachers.

Table 1: Descriptive statistics of laboratory management skills utilized by chemistry teachers

Name of laboratory skill	Mean x —	Std dev.	Std. error	Minimum	Maximum
Ordering	29.955	1.464	.099	27	32
Stocking/storage	24.636	2.084	.140	20	28
Safety	14.682	2.102	.142	10	18
Maintenance	21.955	2.082	.140	18	26

Expected Mean = 20

The results in table 1 show that the mean for ordering skills ($x=29.955$) is the highest, followed by stocking/storage skill ($x = 24.636$), maintenance skills ($x = 21.955$) and the least safety skill ($x=14.682$). The implication therefore is that ordering skill was the most frequently utilized laboratory management skill and the least being safety skill.

Hypothesis One

The utilization of laboratory management skills does not differ significantly among chemistry teachers. To find out whether there is significant difference in the utilization of the laboratory management skills among chemistry teachers, repeated measures (treatment) ANOVA was carried out as presented in table 2.

Table 2**Repeated measures ANOVA on utilization of laboratory management skills by skill type**

Source of variation	Sum of squares	df	Mean square	f-value	P-value
Corrected model	29997.157	879	34.126	8.532*	.023
Intercept	457732.841	1	457732.841	114,433.103*	.000
Skill type	26659.432	3	8886.477	2221.619	.000
Persons	709.659	219	3.240	.810	.923
Error	2628.068	657	4.000		
Total	487730.000	880			
Corrected total	29997.159				

*Significant at .05 level, $p < .05$

The result in table 2 shows that the p-value (0.23 & .000) associated with the computed f-value (8.532, 114433.103 & 2221.619) for the corrected model, intercept and skill type, respectively are less than .05 hence significant. The p-value (.923) associated with the computed F-value (.810) for individual (person) differences is greater than .05. This means that the differences due to person is not significant. However to locate which pair means was responsible for significant result with respect to skill type, the fisher's least significant difference (LSD) test was carried out and the results are presented in table 3.

Table 3**LSD multiple pair-wise comparisons of the levels of utilization of laboratory management skills by skill type**

Skill type	Ordering	Stocking	Safety	Maintenance
Ordering	29.955**	5.319*	15.293*	8.000*
Stocking	.000	24.636	9.954*	2.681*
Safety	.000	.000	14.682	7.273*
Maintenance	.000	.000		21.955

*Significant at .05 level, $p < .05$ ** Values along main diagonal are obtained mean (\bar{x}) for the utilization of laboratory management skills, above it are mean difference (MD) and below it are corresponding p-values.

The results in table 3 show that the p-values (.000) associated with all the mean differences ($2.681 \leq MD \leq 15.273$) are less than .05. This means that all the paired comparisons are significantly different. One can therefore conclude that there is significant difference in the utilization of laboratory management skills among secondary school chemistry teachers.

Hypothesis 2

Gender is not a significant influential factor in utilization of laboratory management skills. To find out if there are gender-based differences in the utilization of laboratory management skills, the independent sample t-test was applied with gender as the independent variable. The results are shown in table 4.

Table 4: Independent t-test for influence of gender on utilization of laboratory management skills among chemistry teachers

Mtg. skill			Mean (\bar{x})	Std. dev.	Std. error	Mean diff.	t-value	p-value
Ordering	Male	123	30.667	1.183	.108	1.567	9.325*	.000
	Female	97	29.100	1.307	.131			
	Total	220	29.955	1.464	.099			
Stocking	Male	123	24.917	2.069	.189	.617	2.205*	.029
	Female	97	24.300	2.062	.206			
	Total	220	24.636	2.084	.140			
Safety	Male	123	14.667	2.295	.209	.033	.117	.907
	Female	97	14.700	1.856	.186			
	Total	220	14.682	2.102	.142			
Maintenance	Male	123	21.417	2.148	.196	1.183	4.367*	.000
	Female	97	22.600	1.809	.181			
	Total	220	21.955	2.082	.140			

* Significant at .05 level, $p < .05$

The result in table 4 show that for utilization of ordering and stocking skills, the mean scores for male teachers ($\bar{x} = 30.667$ & 24.917) are higher than those of female teachers ($\bar{x} = 29.100$ & 24.300). However for safety and maintenance skills, female teachers were superior with mean

scores ($x = 14.700$ & 22.600) as against male teachers with mean scores ($x = 14.667$ & 21.417) respectively. The p-values (.000, .029 & .000) associated with the computed t-values (9.325, 2.205 & 4.361) for ordering, stocking and maintenance skills respectively are less than .05 while the p-value (.907) associated with the computed t-value (.117) for safety skill is higher than .05. These results show that there are significant gender-based differences in the utilization of ordering, stocking and maintenance skills but not for safety skill.

DISCUSSION

The result showed that ordering skill was the most utilized laboratory management skill among the chemistry teachers while the least utilized was the safety skills. The frequency in utilization increases from ordering to stocking, to maintenance and then the least is safety skill. The difference in utilization was significant. The observed difference may be associated with the teacher quality as many non-chemistry teachers are often assigned to teach chemistry without specialization in the area. Therefore, the difficulty in the management of a subject specific laboratory by a non-qualified teacher may not be completely ruled out. This is in line with Nnoli (2011) who observed that good knowledge of subject matter will guarantee proper management of a subject specific laboratory. The result also showed significant gender-based differences in the utilization of three out of the four laboratory management skills namely; orderly, stocking and maintenance in favour of the male chemistry teachers. However for safety skill, the difference in utilization was not significant. The result agrees with the study by Okwo and Otubar (2015) which showed that more male science teachers than females utilized stocking, maintenance and safety skills. The result is however contrary to Tsmango (2016) who reported that gender is not a significant factor in the utilization of laboratory management skills.

CONCLUSION/EDUCATIONAL IMPLICATION

The science laboratory is very central to the teaching and learning of science. Its environment too differs significantly from the traditional classroom. Therefore, adequate management of laboratory equipment and materials should be a rule rather than option to chemistry teachers, especially if chemistry is to make its maximum contribution to education and well-being of the Nigeria society.

Recommendations

- 1) Teachers should be encouraged to attend workshops, refresher courses and seminars in order to be exposed to new frontiers of knowledge and skills in laboratory management.
- 2) Qualified chemistry teachers should be employed to ensure that requisite knowledge and skills are deployed to the management of chemistry laboratories.
- 3) Capacity building in areas of laboratory management organized by either federal or state government should take into cognizance gender-inclusiveness so that both male and female teachers benefit equally and thus eliminating mainstreaming in science and technology education.

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