

LABORATORY MANAGEMENT SKILLS AND CHEMISTRY TEACHERS' EFFECTIVENESS IN PUBLIC SECONDARY SCHOOLS IN IHITTE UBOMA LOCAL GOVERNMENT AREA OF IMO STATE

UGORJI Clifford, PhD
School of General Education
Imo State College of Education, Ihitte,
Uboma, Imo State
ugocliff3@yahoo.com
+2348064194862

NWANYA, Franklin Chibuike
Chemistry Education Department
School of Science
Imo State College of Education, Ihitte,
Uboma, Imo State
nwanyafranklin123@gmail.com
+2348152841588

Abstract

The study assessed the relationship between laboratory management skills and teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State. Three research questions and three hypotheses guided the study. The research design adopted was correlation survey research design. The population for the study comprised 1074 teachers in Ihitte Uboma Local Government Area of Imo State. 273 teachers were selected using simple random sampling technique. The instrument for data collection was structured questionnaire developed by the researcher titled "Laboratory Management Skills and Chemistry Teachers' Effectiveness Questionnaire (LMSCTEQ)." Pearson's Product Moment Correlation Statistics was used to test the hypotheses at 0.05 level of significance. The result showed that significant relationship existed between indicators of laboratory management skills and teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State. Based on the findings, it was recommended among others that teachers of chemistry should participate in regular refresher courses, workshops, and conferences to improve their abilities and stay informed on the relevance of LMS in effective chemistry teaching and learning.

Keywords: Laboratory, Management, Skills, Chemistry, Teachers, Effectiveness.

Introduction

The advancement of science and technology necessitates a constant flow of resources and their appropriate use. The laboratories are where you will find these resources. Maduabum as cited in Akani (2015) characterized the school laboratory as a space where science teachers conduct scientific experiments for the benefit of students (learners). Experiments as well as other activities are included in the laboratory activities to assist students in developing scientific abilities. Science laboratory, according to Ezeliora (2001), is a workshop where science is done or where experimental activities are carried out in a safe atmosphere. A laboratory can be indoors, such as the well-designed and equipped rooms found in most schools, or outdoors, such as a riverbank, a workshop, a field, or even a market, where scientific research might be conducted (Igwe, 2003). He also stated that regardless of the type of laboratory used in science education, students should have the same laboratory experience, which includes participating in a series of experimental, observational, and exhibiting activities that allow learners to create understanding of theoretical and practical aspects via problem solving.

Laboratory technique of teaching, as described by Dienye and Gbamanja in Akani (2015), is a two-way process that is carried out by one or even more people using the exercise and scientific approaches, both of which are effective in science teaching. Students can use experimental approaches to seek knowledge when employing the experimental approach. These processes necessitate meticulous data observation and interpretation. It has qualities of inquiry, investigation, and confrontation with the unknown. According to Udonfu (2009) and Omiko (2015), using the lab in science education provides the following advantages:

- Learning development of scientific abilities that can be used to a variety of problem-solving situations (that is acquisition of problem-solving skills). One of the primary purposes of scientific education is to assist students in developing abilities that can be applied to various areas of their lives in the future. As a result, the transfer of such a learning state must share some characteristics with the situation to which it would be applied.
- Through the acquisition of manipulative skills, students are learning to respect and even replicate the job of the scientist.
- Laboratory instruction teaches students/learners more about principles of scientific and technological processes in order to promote awareness of the human enterprise of science and, as a result, to improve the child's creative and cognitive ability.
- When analyzing what science comprises and developing interests, attitudes, and values, it is apparent that a field trip has the most potential for inspiring a lifelong interest in science in pupils when given the opportunity for personal experience by handling real items. Students' interest in science grows as they get more curious about their surroundings and want to learn more about it.

One of the most important science disciplines taught in Nigerian secondary schools is Chemistry. It is a major subject since it contains content that is thought to be critical to the advancement of scientific and technological knowledge. Understanding of chemistry has been widely employed in many aspects of life to better man's living conditions in society. Fertilizers and pesticides, medicines, criminal analysis, and water treatment are among areas where chemistry knowledge is required. Without the availability of equipment and supplies for effective hands - on practice, chemistry knowledge cannot be effectively acquired in school. In most cases, practical activities are carried out in a school laboratory.

Operating in a laboratory environment necessitates a high level of attention as well as a lack of disturbances. This is due to the possibility of extremely hazardous elements being emitted while carrying out work. Many lab materials and equipment also require more care and preservation. They must be stored in a logical arrangement so that they can be retrieved quickly when needed. Equipment and chemical locations should be clearly marked with bold labels on shelves or drawers storing them, and commonly used equipment in chemical laboratories should be placed in the most convenient locations for all laboratory personnel.

From the aforementioned, it is suggested that science instructors and other laboratory personnel need to possess the necessary skills to efficiently run a school laboratory. These abilities are referred to as laboratory management skills (LSM) (Aniayeju, 2010). LMS are technical skills for controlling and maintaining laboratory equipment and resources. According to Chime (2014) ordering, safety, maintenance, and storage or stocking capabilities are examples of such abilities. Each piece of science equipment or material has its own set of characteristics in terms of usability, maintenance, storage, retrieval, and safety, necessitating the acquisition of certain skills by laboratory users (Nnoli, 2013). According to the Nnoli, strong laboratory management knowledge and abilities help science instructors and other laboratory participants to:

- Conduct scientific experiments under strict safety, accountability, and orderly settings.
- Store equipment and chemicals in the laboratory in such a way that they are easy to find.
- Acknowledge that laboratory materials are acquired based on their lifespan, accessibility, and usefulness.

Eze and Akubue (2007) investigated the utilization of laboratory management skills by secondary school science teachers for quality science education in Nigeria. Results of data analysis showed that although the science teachers in Ebonyi State generally utilised the skills of maintenance of equipment and prevention of hazards in the laboratory to a high extent, they were deficient in some of the skills. Beskemi (2006) investigated the supply of equipment and material in chemistry laboratories in senior secondary school in Plateau state. It was reported that a positive relationship existed between supply of equipment and chemistry teachers' service delivery. Bello (2012) investigated the provision of laboratory safety equipment/materials and laboratory management practices in Ilorin Local Government Area. The result of the study showed that 37.7% of respondents reported having insufficient laboratory equipment to go round students during practical. 38.3% complained of laboratory space while 58.9% had inadequate supply of first aid materials for their school science laboratories.

As observed by the researcher, due to their exorbitant costs, the majority of the laboratory's equipment is not readily available. Consequently, most of the instructors were unable to deliver practical chemistry sessions on time. Instead, they wait until the external examination time arrives. Even while it cannot replace the experience students gain when they execute the experiment themselves, dedicated and resourceful chemistry educators' resort to demonstration (Ezeano, 2014). During chemistry practical classes, chemistry teachers need to prepare chemicals and equipment for practical classes with the help of laboratory assistants, as well as clean, wash, and store them just after practical classes. To execute his or her job effectively and efficiently, the chemistry instructor requires laboratory management abilities. It is in the light of this, the researcher investigated the relationship between laboratory management skills and chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State.

Research Questions

The following research questions guided the study:

1. How does ordering skills relate to chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State?
2. What is the relationship between stocking/storage skills and chemistry teachers' effectiveness in public secondary schools?
3. To what extent does safety and maintenance skills relate to chemistry teachers' effectiveness in public secondary schools?

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

H₀₁: There is no significant relationship between ordering skills and chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State.

H₀₂: Stocking/storage skills is not significantly related to chemistry teachers' effectiveness in public secondary schools.

H₀₃: Safety and maintenance skills is not significantly related to chemistry teachers' effectiveness in public secondary schools.

Research Methodology

The study adopted correlation research design. Correlation analysis facilitates determination of the relationships between the independent variables and their influence on the dependent variable. The design helped to examine the relationship between laboratory management skills and chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State. The population of this study comprised all teachers in public secondary schools in Ihitte Uboma Local Government Area of Imo State. There were 1074 teachers in public secondary schools in Ihitte Uboma Local Government Area of Imo State. The study adopted simple random sampling. A total of 273 teachers were randomly selected from public secondary schools in public secondary schools in Ihitte Uboma Local Government Area of Imo State using Taro Yamane's proportion formula.

A self-developed questionnaire titled: laboratory management skills and chemistry teachers' effectiveness (LMSCTEQ) was designed by the researcher. The draft of the questionnaire was trial-tested at Community Secondary School Nsirimo Umuahia South (a public secondary school) in Umuahia South Local Government Area of Imo State. The correlation co-efficient was 0.76.

Questionnaire was administered and retrieved on the spot. Pearson's Product Moment Correlation was used to test the hypotheses.

Testing of Hypotheses

In this section, the hypotheses formulated to guide the study were used. The statistical tool used for the analysis of the hypotheses was Pearson's Product Moment Co-efficient (PPMC) which measured the linear relationship between two variables and is denoted by (r).

Hypothesis 1:

H0₁: There is no significant relationship between ordering skills and chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State.

Table 1: Ordering Skills and Chemistry Teachers' Effectiveness

Variables	Mean	SD	N	df	r	P	Remark	Decision
Ordering Skills	15.45	3.82	273	271	0.72	.02	Sig	Reject Ho1
Teacher's Effectiveness	19.26	4.42						

P<0.05, df= 271

The findings of the Hypothesis One as depicted on table 1 show that a strong, positive and significant relationship existed between ordering skills and chemistry teachers' effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .72$ $df=271$; $p<.05$). Thus, the null hypothesis which stated that there is no significant relationship between ordering skills and chemistry teachers' effectiveness was rejected. It therefore, implies that ordering skills significantly relate to teachers' effectiveness in public secondary schools.

Hypothesis 2:

H0₂: Storage skills is not significantly related to chemistry teachers' effectiveness in public secondary schools.

Table 2: Storage skills and Chemistry Teacher's Effectiveness

Variables	Mean	SD	N	df	r	P	Remark	Decision
Storage skills	14.35	3.47	273	271	0.77	.00	Sig	Reject Ho2
Teacher's Effectiveness	19.26	4.42						

P<0.05, df= 271

The findings of the Hypothesis Two as depicted on Table 2 show that a strong, positive and significant relationship existed between Stocking/storage skills and chemistry teacher's effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .77$; $df=271$; $p<.05$). Thus, the null hypothesis which stated that stocking/storage skills is not significantly related to chemistry teachers' effectiveness in public secondary schools was rejected. It therefore, implies that stocking/storage skills significantly related to chemistry teachers' effectiveness in public secondary schools.

Hypothesis 3:

H0₃: Safety and maintenance skills is not significantly related to chemistry teachers' effectiveness in public secondary schools.

Table 3: Safety and Maintenance and Chemistry Teacher’s Effectiveness

Variables	Mean	SD	N	df	r	P	Remark	Decision
Safety and Maintenance Teachers’ Effectiveness	16.63	3.13	273	271	0.51	.00	Sig	Reject Ho3

P<0.05, df= 271

The findings of the Hypothesis Three as depicted on Table 3 show that a moderate, positive and significant relationship existed between safety and maintenance skills and chemistry teachers’ effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .51$; $df=271$; $p<.05$). Thus, the null hypothesis which stated that safety and maintenance skills is not significantly related to chemistry teachers’ effectiveness in public secondary schools was rejected. It therefore, implies that safety and maintenance skills significantly related to chemistry teachers’ effectiveness in public secondary schools.

Discussion of Findings

The result of hypothesis one showed that a strong, positive and significant relationship existed between ordering skills and chemistry teachers’ effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .72$ $df=271$; $p<.05$). By implication, teachers are expected to have a good level of competence in handling the subject and one of the areas in which the subject teacher has to show high level of competence is his ability to place the right order for the materials or equipment needed for practical classes. This would help the teacher get himself prepared ahead of the lessons to be imparted. The effectiveness of chemistry teachers is a function of getting the right materials ordered for teaching and learning in the chemistry laboratory. The result therefore agreed with the study of (Umunadi, 2009), who found a positive relationship between ordering skills of chemistry teachers and their effectiveness in public secondary schools. He found that effective teaching of chemistry as a subject relies upon the capacity staff development helped teachers create the understanding from experiences with peers and resources and reflect upon those experiences. The findings however disagreed with the report of Beskemi (2006) who investigated the supply of equipment and material in chemistry laboratories in senior secondary school in Plateau state. The result of the study showed that majority of the schools used general laboratory for teaching chemistry, they cannot meet the laboratory conditions for chemistry laboratory.

The result of hypothesis two showed that a strong, positive and significant relationship existed between stocking/storage skills and chemistry teacher’s effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .77$; $df=271$; $p<.05$). The researcher opines those adequate skills of taking inventory and storage of laboratory equipment would contribute to the effective instructional delivery of chemistry subject. The report of this study corroborates with the study of Eze and Akubue (2007) who found a positive relationship between inventory and chemistry’s teacher instructional delivery.

The result of hypothesis 3 revealed that there was a moderate, positive and significant relationship between safety and maintenance skills and chemistry teachers’ effectiveness in public secondary schools in Ihitte Uboma Local Government Area of Imo State ($r = .51$; $df=271$; $p<.05$). Safety practices by chemistry teachers could be through use of fume

cupboard, proper storage of poisonous and dangerous chemicals, labelling of chemical containers and the adequate use of some protective devices such as gloves, safety spectacles, safety shoes and lab coats etc. Chemistry teacher that is conscious of all the aforementioned safety measures may experience effectiveness in his laboratory. This is in line with the study of Bello (2012) who found positive relationship between safety and maintenance and teacher's effectiveness in public secondary schools. The researcher is of the opinion that teachers should equip themselves with the competence needed to ensure adequate safety in chemistry laboratories.

Conclusion

The study examined the correlation between laboratory management skills and the efficacy of chemistry teachers and discovered a positive and significant relationship between LMS indicators and teacher effectiveness. However, it has been established that the science laboratory is critical to science education; its setting is also much different from that of a regular classroom. As a result, proper laboratory equipment and material management should be a norm rather than a choice for chemistry teachers, particularly if chemistry is to contribute as much as possible to national development.

Recommendations

Based on the findings of the study, the researcher made the following recommendations:

1. When traditional material and chemicals are not available, teachers must make careful use of substitutes as part of their cost-cutting efforts in order to ensure students are imparted with the right practical lessons
2. Instructors of chemistry should participate in regular refresher courses, workshops, and conferences to improve their abilities and stay informed on the relevance of LMS in effective chemistry teaching and learning.
3. For teaching chemistry, laboratories should be provided with suitable safety measures; the laboratory's equipment and overall shape of the lab should be properly secured, and teachers must be informed on crisis or emergency control mechanisms.

References

- Akani, O. (2015). Laboratory teaching: implication on students' achievement in chemistry in secondary schools in Ebonyi State of Nigeria. *Journal of Education and Practice*, 6(30), 32-36.
- Aniayeju, P. (2010). Where is the STEM? Reflections on the missing context in science, technology, engineering and mathematics instructions. *51st Annual Conference of the Science Teachers Association of Nigeria (STAN), processing*, 3-15.
- Bello, T. O. (2012). The provision of laboratory safety equipment/materials and laboratory management practices in Illorin Local Government Area. *World Journal of Education*. Retrieved from www.sciedu.ca/wje
- Beskeni, R.O (2006). A survey of the supply of equipment and materials in chemistry laboratories in plateau state Senior Secondary Schools. *Proceedings of the 47th STAN Annual Conference 187-192*.
- Chime, E. O. (2014). Teachers' task involvement and acquisition of laboratory management skills. *Journal of Research in Science Education*, 8(3), 78-83.
- Ezeano, E. (2014). Understanding and acquisition of laboratory management skills. A pedagogical re-orientation for classroom in science education. *Journal of Science Education*, 9(3), 43- 50.
- Eze, C.U. & Akubue, P.A. (2007). Utilisation of laboratory management skills by secondary school science teachers for quality science education in Nigeria. *Nigerian Journal of Functional Education*, 5(1), 38-45.
- Ezieliora, B. (2010). Motivating Secondary School Science Teachers to Face the Challenges of the Third Millennium. *Journal of Science Teachers Association of Nigeria*, 39(1&2), 40-57.
- Nnoli, F. O. (2013). Level of laboratory management skills among science teachers and implications for Science Education. *International Journal of Education Research*, 10(3), 101-115.
- Omiko, A. (2015). Chemistry teachers' attitude and knowledge of the use of Information Communication Technology (ICT) in chemistry Instruction Delivery at the secondary school level in Ebonyi State of Nigeria. *Journal of Curriculum Organization of Nigeria (CON) In print*.
- Ufondu, N.U. (2009). *The role of the laboratory on the Academic Achievement of Students in Biology in Abakaliki Education Zone of Ebonyi State*: Unpublished B.Sc. Ed thesis. Abakaliki, Ebonyi State University.
- Umunadi, K. E. (2009). Teacher utilization of instructional equipment and materials in teaching basic electricity in urban and rural Technical Colleges. *International Journal of Scientific Research in Education*. 2(2), 88-95.