
**CHALLENGES ENCOUNTERED BY CHEMISTRY TEACHERS IN
TEACHING PRACTICAL CHEMISTRY IN SECONDARY SCHOOLS
IN ENUGU EAST LOCAL GOVERNMENT AREA OF ENUGU STATE**

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Abstract

The understanding of chemistry is nearly impossible without the realization of practical experiments. This paper investigated the challenges encountered by chemistry teachers in teaching practical chemistry in secondary schools in Enugu East Local Government Area. The study was guided by four research questions and one null hypothesis. The population of the study comprises of all the fifty three chemistry teachers in the entire twenty six (26) Private and ten Government owned secondary schools in Enugu East Local Government Area of Enugu State. Simple random sampling technique was used to sample out thirty six (36) teachers out of the fifty three teachers that constitute the population. The instrument for data collection is a structured questionnaire. Data collected were analyzed using arithmetic mean and standard deviation for answering the research questions and t-test for testing the hypothesis. The results among others showed that the teachers' factors that impede the teaching of chemistry practical in secondary schools include:

unwillingness of some chemistry teachers to conduct practical and incompetence and lack of manipulative skills by some chemistry teachers. The students' factors include students' perception of chemistry as a difficult subject and students' being discouraged by the poor performances in chemistry in external examinations. Based on these findings, some recommendations were made.

Chemistry has been identified as a very important science subject and its importance in scientific and technological development of nations has been widely reported (Adesoji and Olatunbosun, 2008). Adesoji pointed out that it was as a result of the recognition given to chemistry in the development of the individual and the nation that gave rise to making it a core-subject among the natural sciences and other science related courses in Nigerian education system.

Ketevan (2015) pointed out that understanding chemistry is impossible without the realization of practical experiments. In chemistry teaching, the practical part is used for teaching new concepts and also for repeating already learnt lessons. So, it is appreciable to use practice with theory as often as possible for understanding the subject. Motswiri (2004) observed that classroom practices in most secondary school chemistry lessons are characterized by chalk-and-talk and with little practical work. Some science educators argue that practical work should involve learner-centered learning environment which will engage students in knowledge construction as opposed to teacher-centered environment which involves information absorption (Gravoso, 2008).

Chemistry practical teaching cannot be achieved effectively without the science laboratory. Oxford English Dictionary (3rd ed.) defines the science laboratory as a facility that provides controlled conditions in which scientific or technological research, experiments and measurements may be performed. Hofstein and Lunetta (2004) identified that laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities. Laboratory work involves more interaction of students. Students perform experiments with the help and instructions of a teacher. They are able to develop practical skills and students are actively learning. Differently from demonstrational lessons, students have to have some educational background about the experiment they are planning to do and mandatorily, they must observe safety rules (ketevan, 2015). He also added that teachers have to examine how ready students are for each experiment, what they already know and what they should know to perform experiments correctly and successfully.. The laboratory is also a place where students are supposed to develop many manipulative and cognitive skills otherwise known as scientific skills. More advantages of laboratory work depend on the principle of "learning from practice" theory. When students can develop practical skills

of planning and performing chemical experiments, motivation of learning chemistry increases and students with more joy participate in lessons.

Effective teaching of practical chemistry which laid emphases on bench-work in Nigerian secondary schools, is of uttermost importance to students, teachers, parents and the government. However, chemistry teaching should develop in the students manipulative and experimental skills to make him or her confident in conducting experiments and or researches. Students should do practical work of conducting experiments, reporting their observations and making inferences or conclusions, thus, developing their scientific knowledge and experimental skills and at the same time arousing and maintaining interest of the students in the subject. Hence, practical work involves the students in observing, counting, measuring, experimenting and recording observations. The aim of practical according to Eze (2000) is to inculcate into the students the habit of drawing conclusions based on observation and experimentation. Exposure of students to practical work enables them to develop scientific skills.

Secondary school chemistry teachers have been faced with some challenges in the teaching of chemistry practical in their schools. These problems, ranging from the environment, the students, the school and even the teacher himself in one way or the other contributes immensely to the problems of teaching chemistry practical. Chemistry as a major science subject requires special interest and attention. The teaching of chemistry practical to uninterested students and students that are not physically, morally and cognitively prepared to learn chemistry in a chemistry laboratory situated in an unfit environment will be an unrealizable venture. In this vein, Johnston (1991) commented that the laboratory is regarded as an information overloaded place, resulting in students with little "brain space" in order to process information. Considering the importance of practical in effective teaching and learning of chemistry, this study therefore tries to find out the challenges encountered by chemistry teachers in the teaching of practical chemistry in our secondary schools.

Statement of Problem

The teaching and learning of chemistry is not only done in the classroom but also in the laboratory. There has long been a belief in science education that laboratory has the potential to become a place in which the theory is tested in a practical truth. In schools, science laboratory is the most appropriate place for students to learn how to research, organize, clarify and measure all the sciences. Most researchers agree that practical work is an important activity in school science but there are variations in the importance, roles and purpose if practical works are done in the classroom.

Effective practical chemistry teaching requires that teachers have the knowledge, skills, attitudes, and ability to apply science in the laboratory. This view supports that teachers should have the scientific competence and manipulative skills associated with psychomotor. To improve the quality and quantity of the adoption of

practical chemistry learning, chemistry teachers are required to master laboratory management skills and motivation to apply practical method in learning chemistry.

Students' poor performance in practical chemistry in West African Senior School Certificate Examinations has become a serious problem to both the students and the society. This is evident particularly from chemistry paper1 (practical), WAEC Chief Examiner's report. The chief examiner's report (2010) stated that chemistry students' poor performance in this aspect of chemistry over the years arises from students' poor knowledge of fundamental principles and procedure and lack of exposure to practical work. This problem of poor performance by the students needs to be solved, certainly by first tackling the problems faced while teaching chemistry practical in secondary schools. The problem of this study is therefore to find out those problems encountered by secondary school chemistry teachers in the teaching of practical chemistry.

Purpose of the Study

The main purpose of the study is to identify the challenges encountered by teachers in teaching chemistry practical in secondary schools.

The study specifically sought to:

1. ascertain the teachers' factors that impedes the teaching of chemistry practical in secondary schools.
2. find out the students' factors that affects the teaching of chemistry practical in secondary schools.
3. expose the environmental factors that hampers the teaching of chemistry practical in secondary schools.
4. find out whether gender has any influence on the challenges encountered by chemistry teachers in the teaching of chemistry.

Research Questions

The following research questions guided the study

1. What are teachers' factors that impede the teaching of chemistry practical in secondary schools?
2. What are the students' factors that affect the teaching of chemistry practical in secondary schools?
3. What are the environmental factors that hamper the teaching of chemistry practical in secondary schools?
4. What is the influence of gender on the problems encountered by chemistry teachers in the teaching of practical chemistry?

Hypothesis

H₁: There is no significant difference ($p < 0.05$) between the challenges encountered by male and female chemistry teachers in teaching practical chemistry in secondary schools.

Methodology

This study is a survey research. This survey research design is aimed at identifying the challenges encountered by chemistry teachers in teaching chemistry practical in Enugu East Local Government Area. The study area is Enugu East Local Government Area in Enugu State. The population of the study consists of all the fifty three (53) chemistry teachers in the twenty six (26) private secondary schools and ten (10) Government secondary schools in Enugu East Local Government Area (PPSMB 2017). There are fifty three (53) chemistry teachers in all the private and government owned secondary schools in Enugu East made up of 32 males and 21 females. The whole fifty three teachers (53) were used as the sample. The Instrument for Data Collection is a structured questionnaire. It is divided into two sections titled; A and B. Section A focused on the personal data of the respondents, while section B is developed based on the research questions and hypothesis posed. The items in section B of the questionnaire were structured on a modified four (4) point likert scale. The research instruments were subjected to validation by two experts in science education in University of Nigeria, Nsukka. Their observations and suggestions guided the development of the final copy of the instrument. The data collected were analyzed and interpreted using arithmetic mean and standard deviation for answering the research questions and t-test for testing the hypothesis.

Results

The results were presented in tables in sequential order based on the research questions and hypothesis

Research Question 1:

What are teachers' factors that impede the teaching of chemistry practical in secondary schools?

Table 1: Mean Ratings and Standard Deviation of the Chemistry Teacher's Responses on the Teacher's Factors that Impede the Teaching of Chemistry Practical in Secondary Schools?

S/N	ITEMS	SA	A	D	SD	N	FX	X	SD
1	Unwillingness of some chemistry teachers to conduct practicals.	30	21	2	-	53	187	3.53	0.5

2	Some chemistry teachers are incompetent and lack manipulative skills.	33	20	-	-	53	192	3.62	0.5
3	Some teachers who are not graduates of chemistry equally teach chemistry.	31	22	-	-	53	190	3.58	0.5
4	Lack of skill to improvise unavailable laboratory equipment and materials.	44	9	-	-	53	203	3.83	0.4

Table 1 above shows the mean marks calculated from the result of the response of the respondents. Items 1,2,3 and 4 have mean marks of 3.53,3.62,3.58,3.83 and standard deviations of 0.5,0.5, 0.5and 0.4 respectively. The mean scores are all above the mean out-off mark of 2.5 and are all accepted. The standard deviation scores of 0.5,0.5,0.5 and 0.4 respectively are low which means that the individual data point did not deviate much from the mean scores This therefore, indicates that all the listed items are teacher's factors that impede the teaching of practical chemistry in secondary schools.

Research Question 2:

What are the student factors that affect the teaching of chemistry practical in secondary schools?

Table 2: Mean Ratings and Standard Deviation of the Chemistry Teacher's Responses on the Student's Factors that Affect the Teaching of Chemistry Practical in Secondary Schools?

S/N	ITEMS	SA	A	D	SD	N	FX	X	SD
1	Most students perceive chemistry as a difficult subject with many theories.	40	13	-	-	53	199	3.75	0.5
2	Students who offer chemistry easily get discouraged by the poor outcome of their results.	35	18	-	-	53	194	3.66	0.4
3	Students' sudden loss of interest in chemistry retards effective chemistry practical teaching.	39	14	-	-	53	198	3.74	0.5
4	Students' inconsistency in attendance to practical classes affects the teaching of chemistry practical.	41	12	-	-	53	200	3.77	0.5
5	Some students, especially female ones who lack mathematical proficiency see chemistry uninteresting when complex calculations are involved.	22	30	1	-	53	180	3.39	0.3

Table 2 above shows that the mean scores of items 1-5 are 3.75,3.66,3.74,3.77,3.39 and standard deviations are 0.5,0.4,0.5,0.5 and 0.3 respectively. All the five items were

accepted by the respondents since their mean scores exceeds the mean cut-off mark of 2.5. The standard deviation scores are also low showing that the individual data points did not deviate much from the mean scores. The results of the analysis therefore shows that all the five items listed are student's factors that affect the teaching of practical chemistry.

Research Question 3:

How do environmental factors hamper the teaching of chemistry practical in secondary schools?

Table 3: Mean Ratings and Standard Deviation of the Chemistry Teacher's Responses on the Environmental Factors that Hamper the Teaching of Chemistry Practical in Secondary Schools?

S/N	ITEMS	SA	A	D	SD	N	FX	X	SD
1	Poor chemistry teaching environment that do not properly accommodate students during practical chemistry teaching.	27	25	1	-	53	185	3.49	0.5
2	Laboratories situated around a noisy and busy environment affect the teaching of practical chemistry	43	10	-	-	53	202	3.18	0.5
3	Chemistry teaching environment that are thoroughly cleaned and broken vessels properly removed before teaching to make for easy movement during chemistry practical's	39	13	1	-	53	177	3.34	0.5
4	Chemistry laboratories with slippery flows are good for teaching practical chemistry	42	11	-	-	53	201	3.79	0.5
5	Inadequate water supply affects the proper teaching of chemistry practical.	20	33	-	-	53	179	3.38	0.5
6	Inadequate source of light hampers the teaching of chemistry practical.	18	35	-	-	53	177	3.34	0.5

From table 3 above, items 1,2,3,4,5 and 6 with mean scores of 3.49,3.18,3.34,3.79,3.38 and 3.34 and standard deviation of 0.5,0.5,0.5,0.5,0.5 and 0.5 respectively are all accepted as environmental factors that affect the teaching of practical chemistry in secondary schools since their mean scores are above the cut-off point of 2.5. The standard deviation scores are all low showing that the individual scores are close to the mean scores.

Research Question 4:

What is the influence of gender on the challenges encountered by chemistry in the teaching of practical chemistry in secondary school?

Table 4: Mean Ratings and Standard Deviation of the Chemistry Teacher's Responses on the Challenges Encountered by Male and Female Teachers in Teaching Practical Chemistry in Secondary Schools?

	ITEMS	MALE								FEMALE							
		SA	A	D	S D	N	FX	X	S.D	S A	A	D	S D	N	FX	X	S.D
1.	Most chemistry teachers are in teaching profession not by choice, but they also consider it as an awaiting ground for better jobs.	21	10	1	-	32	116	3.63	0.5	12	9	-	-	21	75	3.57	0.5
2.	Some chemistry teachers are incompetent.	23	9	5	5	32	119	3.72	0.4	10	11	-	-	21	73	3.47	0.4
3.	Some teachers who are not graduates of chemistry equally teach chemistry.	10	22	-	-	32	106	3.31	0.3	8	13	-	-	21	58	2.76	0.3
4.	Lack of adequate laboratory equipment affects his teaching of chemistry practical.	22	10	-	-	32	118	3.68	0.3	14	7	-	-	21	77	3.66	0.5
TABLE 2																	
1.	Most students perceive chemistry as a difficult subject with many theories.	20	12	-	-	32	116	3.63	0.5	10	11	-	-	21	73	3.48	0.5
2.	Students who offer chemistry easily get discouraged by the poor outcome of their results.	19	13	-	-	32	115	3.59	0.5	9	12	-	-	21	72	3.43	0.4
3.	Students' sudden loss of interest in chemistry retards effective chemistry practical teaching.	24	8	-	-	32	120	3.75	0.4	15	6	-	-	21	78	3.71	0.5
4.	Students' inconsistency in attendance to practical classes affects the teaching of chemistry practical.	21	10	1	0	32	114	3.56	0.5	7	14	-	-	21	70	3.53	0.5

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5.	Some students, especially female ones who lack mathematical proficiency see chemistry uninteresting when complex calculations are involved.	6	26	-	-	32	102	3.19	0.3	2	19	-	-	21	65	3.01	0.3
TABLE 3																	
1.	Chemistry teaching environments do not properly accommodate students during teaching.	18	14	-	-	32	114	3.56	0.4	8	12	1	-	21	70	3.33	0.4
2.	Noisy environment retards students' concentration while teaching.	23	9	-	-	32	119	3.72	0.4	10	11	-	-	21	73	3.48	0.4
3.	Chemistry teaching environments should be thoroughly cleaned and broken vessels properly removed before teaching.	24	8	-	-	32	120	3.75	0.3	13	7	1	-	21	75	3.57	0.5
4.	Conducive learning environment promotes teaching.	20	10	1	-	32	111	3.56	0.4	15	6	-	-	21	78	3.71	0.4
5.	Inadequate water supply affects the proper teaching of chemistry practical.	15	17	-	-	32	111	3.47	0.4	9	12	-	-	21	72	3.43	0.4
6.	Inadequate source of light hampers the teaching of chemistry practical.	17	15	-	-	32	113	3.53	0.5	7	14	-	-	21	70	3.33	0.3
	Grand mean and standard deviation of items in table 3							3.58	0.4							3.43	0.42

From table 4 above the grand mean rating of 3.58 on the challenges encountered by male teachers in teaching practical chemistry is higher compared to that of females with a mean of 3.43 and standard deviation of 0.42.

Hypothesis Test

Hypothesis 1: There is no significant difference ($p \leq 0.05$) in the challenges encountered by male and female teachers in teaching chemistry practical in secondary schools.

Table 5: The t-test Analysis on the Differences in the Scores of Male and Female Chemistry Secondary School Teachers

Gender	N	X	SD	T-cal.	T-critical
Male	32	3.58	0.40	0.83	2.009
Female	21	3.43	0.42		

From table 4 above males have a mean score of 3.58 and standard deviation of 0.40 while the female have mean scores of 3.43 and standard deviation of 0.42. The t-test in table 5 yielded a t-calculated value of 0.83 which is less than the critical t-value of 2.009 at a 0.05 significant level. The null hypothesis is therefore accepted and the alternative hypothesis rejected showing that there is no significant difference in the challenges encountered by male and female teachers in teaching practical chemistry in secondary schools.

Discussion

The result of the data analyzed in table 1 reveals that the respondents agreed that unwillingness of some chemistry teachers to conduct practicals, some chemistry teachers are incompetent and lack manipulative skills, some teachers who are not graduates of chemistry but equally teach chemistry, lack of skill to improvise unavailable laboratory equipment and materials are the various teacher's factors that impede the teaching of chemistry practical in Enugu east local government secondary schools. Practical chemistry has suffered great negligence in many private and public schools due to the above factors. A situation where a chemistry teacher is devoid of the knowledge and skill to manipulate the laboratory equipment or even a worst scenario, when the equipment are not available and are not even improvised by the teacher, the practical aspect of chemistry is simply ignored. Eze (2001) seem to support the above findings when he reported that physical facilities such as classroom, laboratories are abysmally inadequate, unmaintained and lack requisite apparatus and equipment. The abundance of materials and equipment for teaching and learning of chemistry practicals may not be enough to bring about better performance of the students without a competent chemistry teacher. According to Ali (2001), these materials will hardly be helpful if the teacher does not use them effectively and efficiently

In table 2 the result of the data analyzed showed that some of the student's factors that affect the teaching of practical chemistry include that: most students perceive chemistry as a difficult subject with many theories, discouragement faced by students at the poor outcome of their results, sudden loss of interest in chemistry, inconsistency in attendance of chemistry practical class and lack of mathematical proficiency in practical chemistry calculations. Chemistry students are usually faced with these challenges and this impacts serious negative perception and phobia in their understanding and practice of chemistry practicals.

However, the above findings are in agreement with the assertion of Olotu (1999) where he observed that in some secondary schools in Nigeria where basic principles of science are taught in preparation for further education, many students are not interested in the practical aspect of science but the theoretical aspects. He further said that students had to be persuaded to attend practical classes. In connection to this, Amaefule (2001) reported that many students perceive chemistry as a difficult subject because of its many theories which prove difficult to comprehend by some students. Also in support of this findings, Obande (2003) however, opined that the fear of mathematics is often transferred to chemistry which involves one form of calculation or the other.

In table 3 the result of the analyzed data shows that the environmental factors that hamper the teaching of chemistry practical in secondary schools includes: noisy environment, poor chemistry laboratory environment and inadequate supply of water and light. The science environment is that which is expected to be calm and conducive for the purpose of scientific activities. A laboratory environment cannot fulfill its aim when it lacks the required atmosphere and requisite supply of water and light.

The finding from table 4 and the hypothesis testing in table 5 reveals that there no significant difference in the challenges encountered by male and female teachers in the teaching of practical chemistry. This contradicts the findings of Adigwe (2002) whose finding showed that males excellent over females in the areas of problem understanding and in constriction execution

Conclusion

The actualization of science education goals precisely chemistry will continue to be a mirage if the challenges that teachers encounters while teaching chemistry practical in senior secondary school are not reduced to the barest minimum or eradicated from the system. This will lead to country's production of graduates who lack the knowledge, skills and competence to explore the resources of the nation.

Recommendations

Based on the results of the study, the following recommendations are hereby offered;

1. Since chemistry is an experimental subject, greater emphasis should be placed on the practical aspect or balanced emphasis on the theoretical and practical aspects. Therefore, government and parents should work hand in hand to build appropriate laboratories for effective learning and these laboratories should be adequately equipped with necessary materials for instructions so that practically related concepts are better taught and better understood by the students.
2. To teach chemistry, science teachers are supposed to pass through the required and adequate training with emphasis on how to effectively carryout chemistry practical instructions to enhance students interest and achievement in chemistry classes.

3. Students should be given orientation on the importance of being consistent in attending chemistry practical classes and also the dangers associated with missing it, so as to ensure that they take it seriously.
4. In building the chemistry science laboratory, it should be sited in an environment that is free from disturbances like loud noise and also conducive enough with constant light and water supply.

References

- Adigwe J.C (2002). Difficulties in chemical problem solving among Nigerian Students. *Research in science and technical education* 10(2) 187-201
- Aktamins, H. And E. Acar, E.(2010). The Effect of Laboratory Practices in Science Teaching Course on Development of Prospective Science Teachers' Self-Regulation Skill. *Procedia Social. Behavioural. Science.*, 2: 5549-5553.
- Ali, A. (2002). Science, Technology and Mathematics Education as tools for Poverty Alleviation. *Keynote address Presented at the 2nd National Conference of the School of Sciences*. Federal College of Education, Eha-Amufu, 27-30 November.
- Amaefule, A. A. (2000). The Comparative Effects of two Teaching Methods on Students' Achievement in Chemistry. *Gombe Technical Education Journal*, 2(1), 23-29.
- Amaefule, A. A. (2000). The Effects of the three Teaching Methods on Students' Achievements in Chemistry. *Unpublished M. Ed Thesis*, Abubakar Tafawa Balewa University Bauchi.
- Byers, W., (2002). Promoting active Learning through small Group Classes. *Univ. Lab. Chem. Educ.*, 6:28-34.
- Eze, A. E. (2001). Science Education for self Employment . *An Unpublished paper Presented at the National Conference of the Department of Science and Computer Education, ESUT Enugu*.
- Eze, C. U. (2000). Constraints to Effective Teaching of Chemistry Practical in SSS. *Journal of Science and Computer Education ESUT*, 1 (1), 35-45.

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- Gravoso (2008), Design and use of Instructional Materials for Student Centered Learning: A Case in Learning Ecological Concepts. –*Asia-Pacific Educational Research*, 17:109-120
- Hoftein, A. & Lunetta, V.N. (2004). The Laboratory in Science Education: *Foundation for the 21st Century. Science Education*, 22-54.
- Johnstone, K. (1991). High School Science Teachers Conceptualizations of Teacher and Learning: *Theory and Practice. Of European. Journal. Technical. Education*. 14:65-78.
- Ketevan K. (2015). Practical Lessons of Chemistry at Secondary School. *Proceedings of Iser 8th, international conference, Istanbul Turkey*, 10th October.
- Mokhtar, B.A., (2007). Scientific Problem of Teachers' Work: Impact on Awareness and Scientific Laboratory Safety practices. *Ph.D. Thesis*, National University of Malaysia, Malaysia.
- Motswiri, M. J. (2004), Supporting Chemistry Teachers in Implementing Formative Assessment of Investigative Practical Work in Botswana. Thesis. University of Twente, Enschede. Retrieved from <http://doc.utwente.nl/4824/thesis-motswiri.pdf>.
- WAEC 2002, 2004, 2009,2010 and 2016 Statistical Results. *WAEC Chief Examiner's Reports*.