

Competencies Possessed and Utilized by Chemistry Teachers for Effective Teaching of Chemistry in Secondary Schools in Nsukka Education Zone of Enugu State

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Abstract: - Teacher's competence in teaching and learning is an important factor in determining the success of a teaching session. This study investigated the competences possessed and utilized by secondary school chemistry teachers in Nsukka Educational Zone. Three research questions and one hypothesis guided the study. The population comprises of all the 53 chemistry teachers in all the public secondary schools in Nsukka Educational Zone. The entire population was used as the sample. A researcher structured questionnaire was the instrument which was subjected to both validation and reliability with a reliability coefficient of 0.93. Mean and standard deviation were used for answering the research questions while t-test was used for testing the hypothesis. The findings of the studies among others reveal that chemistry teachers are not competent in designing and conducting chemistry practical. Also chemistry teachers do not have the competence of evaluating chemistry practical at the levels of affective and psychomotor domains. Based on these findings, recommendations were made.

I. INTRODUCTION

Teachers have a daily influence on the lives of students and therefore they are often held to high standard. In the midst of all of their responsibilities, they are required to serve as models and demonstrate ethical behaviours as they, interact with students, colleagues, parents and others.

Teacher's competency in teaching and learning is an important factor in determining the success of a teaching session. The ability and wisdom in handling learning activities will have a direct impact on students' active involvement in learning activities. Therefore, the development of teachers' competencies involving the efforts of fostering positive attitudes is a major agenda to strengthen the teaching profession and to ensure grate development of the education quality in many countries around the world.

Competency in teaching refers to the ability of a teacher to exhibit on the job skills and knowledge gained as a result of training (Adodo 2013). These skills and knowledge prescribed in the learning programme are apparently calculated by the curriculum planners to relate and to be instrumental to the achievement of the desired education objectives.

In the teaching of chemistry, teachers are expected to have a good level of competence and mastery of the subject matter before introducing it to the students. This will enhance effective teaching of the subject in the secondary schools. Chemistry teachers need to develop the interest and attitude of the students through his/her method of teaching.

The teachers as experts who have good exposure and experience in chemistry are expected to foster the adjustment of students, matching curricular offerings to levels of mental development, understanding students' basic cognitive and social problems, making curricular specifications relevant and motivating the students to learn (Avwiri 2011). The main objective of teaching chemistry in secondary schools is to enable the students to develop their knowledge and skills in chemistry science and project their efforts in education so as to be useful to themselves and the society in general. For this reason, students have to appreciate the subject and pay special attention to its teaching. Giving the students opportunity for developing manipulative skills that will enable them to function effectively in the society within the limits of their capacity through the different methods of teaching based on the teacher's competence, will encourage them and make the learning process effective.

The study of chemistry enables learners to understand the world around them. The most interesting aspect of chemistry is that it applies to our daily lives. In other words, chemistry is a real life science subject. Due to the importance of chemistry to national development, the revised chemistry curriculum (2009) has the following amongst others as the objectives which are in support for effective teaching and learning of chemistry.

- To enable students acquire basic theoretical and practical knowledge and skills.
- To enable students acquire Science, Technology and Mathematics (STM) knowledge and skills.
- To develop measurable level of competence in ICT applications that will engender entrepreneurial skills.
- To enable students apply skills to meet social needs of creating employment and wealth.

All these objectives are to be achieved through the type of skills possessed by the chemistry teachers. It call that chemistry teachers should not be ignorant of applied production skills as one of their objectives in teaching so that learning will become effective and relevant to the learner. Chemistry as a subject requires practical training as well as theoretical studies. To be competent therefore chemistry teachers need to be efficient in designing, planning and implementing their lesson.

This study therefore intends to investigate the competencies possessed and utilized by chemistry teachers in the teaching and learning of chemistry in a bid to make for effective teaching and learning of chemistry in Nigeria.

The location of a school may sometimes affect the competencies possessed and utilized by a chemistry teacher. The location of a school is classified into two namely rural and urban schools. A teacher may be endowed with some attributes and competencies which can be hampered by the circumstances surrounding the place his/her school is situated. This study is also geared towards finding out whether there is any significance influence of location on the competencies possessed and utilized by chemistry teachers in designing and conducting of chemistry practical/experiments.

Statement of Problem

Truth in science can only be proven through practical and experimentation. In most of the secondary schools in Nsukka Education Zone, it is observed that chemistry student's involvement is still low in conducting experiments and they are not effectively guided by the teachers. This has resulted to poor achievement of the students in their examinations and their inability to obtain the correct result in experiments. This lead to poor outcome on the part of the students. This is because the lesson will be useless and will not have any impact on students' behavioural change.

This study therefore examined the competences possessed and utilized by the chemistry teachers for effective teaching and learning of chemistry in Nsukka Educational Zone of Enugu State.

Purpose of the Study

1. To investigate the competences possessed and utilized by chemistry teachers in planning and delivering chemistry theory lessons.
2. To ascertain the competences possessed and utilized by chemistry teachers n designing and conducting of chemistry practical.
3. To ascertain the competences possessed and utilized by chemistry teachers in evaluating of chemistry theory and practical.

Research Questions

1. What are the competences possessed and utilized by chemistry teachers in planning and delivering of chemistry theory and practical.

2. What are the competences possessed and utilized by chemistry teachers in designing and conducting practical.
3. What are the competences possessed and utilized by chemistry teachers in evaluating chemistry theory and practical.

Hypothesis

1. Competencies possessed and utilized by chemistry teachers in designing and conducting practical/experiment in chemistry in significantly independent of location ($p < 0.05$).

II. METHOD

The research design for this study is survey which has been found to be appropriate in determining practices of a specific population. The area of the study in Nsukka Educational Zone of Enugu State. The population consists of all the forty eight (48) chemistry teachers in all the fifty nine (59) public secondary schools in Nsukka Educational Zone. This population is made up of seven urban schools with fourteen chemistry teachers and fifty two rural schools with thirty four chemistry teachers (PPSMB Enugu, 2019). Due to the small nature of the population, the entire population was used as the sample i.e. the sample size is 48.

The instrument used for data collection is a structured questionnaire designed by the researcher. The instrument which was validated by two experts in science education in University of Nigeria, Nsukka was also subjected to a reliability test and the reliability coefficient is 0.83. Mean and standard deviation were used to answer the research questions and t-test used in testing the hypothesis. The mean score of 2.5 was used as the cut off mean.

III. RESULTS

Research Question One

What are the competences possessed and utilized by chemistry teachers in planning and delivering of chemistry theory and practical?

Table 1: Mean and Standard Deviation scores of responses on the competences possessed and utilized by chemistry teachers in planning and delivering of chemistry theory and practical

S/N	Items	\bar{x}	S.D	Decision
1.	I am proficient in setting and stating of specific objectives of the lessons I teach in chemistry.	3.21	1.01	Agree
2.	Structuring teaching steps are not difficult to me	3.00	1.13	Agree
3.	I have a good master of most of the topics in secondary school chemistry	2.31	1.16	Disagree
4.	As a chemistry teacher, I have the ability to select and use appropriate instructional materials to concretize my chemistry lessons	2.86	0.71	Agree
5.	I use a variety of teaching methods depending on the topic I teach	2.60	1.30	Agree

6.	Considering that there are individual differences among students, I always try as much as possible to individualize my lessons	2.29	0.94	Disagree
7.	Students are free to ask questions which are being attended to during teaching and learning of chemistry in my class	3.30	0.84	Agree

Table 1 above shows the responses of chemistry teachers on the competences possessed in planning and teaching of chemistry theory and practical. The mean responses of questionnaire items 1, 2, 4, 5 and 7 (3.21, 3.00, 2.86, 2.60 and 3.30) were above the cut off mean of 2.5. The implication of this is that chemistry teachers have the competency of setting and stating objectives, structuring teaching steps, selecting and using appropriate instructional materials using a variety of teaching methods and answering students' questions in the class. The mean responses of items 3 and 6 (2.31 and 2.29) are below the cut off mean indicating that the respondents do not have mastery of most of the topics in secondary school chemistry and they lack the competence of individualizing their lessons.

Research Question Two

What are the competences possessed by chemistry teachers in designing and conducting experiments/practical in chemistry?

Table 2: Mean and Standard deviation scores on the competences possessed by chemistry teachers in designing and conducting experiments/practical in chemistry

S/N	Items	\bar{x}	S.D	Decision
8.	I am competent in pre-laboratory planning of providing materials and equipment to be used for teaching chemistry practical	2.90	1.00	Agree
9.	There is the high level of proficiency of handling equipment and installing apparatus in me	2.29	1.14	Disagree
10.	I have the ability to clearly explain the procedures of most of the practical done in chemistry to students	2.27	1.09	Disagree
11.	Conducting of real experiments in chemistry is easy to me	2.06	1.04	Disagree
12.	I always guide students during practical lessons	3.11	1.15	Agree

Table two shows the responses of chemistry teachers on the competences possessed in designing and conducting chemistry practical. The mean responses of items 8 and 12 (2.90 and 3.11) were above 2.5 cut off point indicating that the respondents agreed that they are competent in pre-laboratory planning of providing materials and equipment to be used for practicals as well as guiding students during practical. However item 9, 10 and 11 have mean responses (2.29, 2.27 and 2.26) which are below the threshold of 2.5. The implication is that the respondents are not competent in

handling and installing apparatus, explaining the procedures of most of the practicals done in chemistry and conducting of real experiments in chemistry.

Research Question Three

What are the competences possessed and utilized by chemistry teachers in evaluating practical/experiments in chemistry?

Table 3: Mean and Standard deviation of response on the competences possessed and utilized by chemistry teachers in evaluating practical/experiments in chemistry

S/N	Items	\bar{x}	S.D	Decision
13.	Evaluating of chemistry practicals have become part of me	3.20	0.96	Agree
14.	I am very competent in choosing appropriate evaluation technique that matches my stated specific objectives	3.15	0.97	Agree
15.	I am capable of documenting and keeping a good record of evaluation	3.05	1.16	Agree
16.	I ensure that all evaluations done are being scored I have a high ability of evaluating students' practical skills with respect to:	3.07	0.89	Agree
17.	Cognitive skill	3.13	1.08	Agree
18.	Affective skill	2.10	1.19	Disagree
19.	Psychomotor skill	2.33	1.19	Disagree
20.	I can produce detailed psychomotor document of an evaluation of psychomotor skills of chemistry students during practicals	2.39	0.83	Disagree

From table 3 all the mean responses except for item 18, 19 and 20 were above the threshold of 2.5 with mean scores 3.20, 3.15, 3.05, 3.07 and 3.13. The implication is that the respondents agreed that they are competent in choosing appropriate evaluation techniques, documenting and keeping a good record of evaluation, scoring of evaluations, producing detailed documentation of evaluation and evaluating students cognitive skills in chemistry practical. However, questionnaire item 18, 19 and 20 have mean response of 2.10 and 2.33 and 2.39 which were below the threshold of 2.5 indicating that the respondents are not competent in evaluating the affective and psychomotor skills of students during practical and they cannot produce detailed document of evaluation of psychomotor skills of chemistry during practicals.

Hypothesis One

Competencies possessed and utilized by chemistry teachers in designing and conducting practical/experiment in chemistry is significantly independent of location ($P < 0.05$).

Group	N	Mean	S.D	df	T	p-value	remark
Rural	34	2.90	0.22	46	-0.217	0.829	NS
Urban	14	2.73	0.26				

The result of table 4 showed that there is no significant difference in the competencies possessed and utilized by chemistry teachers in the urban and rural schools in designing and conducting practical/experiment in chemistry since the p-value of 0.829 is greater than 0.05 level of significance. This showed that the hypothesis that the competencies possessed by chemistry teachers in designing and conducting practical/experiment in chemistry are significantly independent of location is retained.

IV. DISCUSSION OF THE FINDINGS

From research question one which ascertained the competences possessed by chemistry teachers in planning and delivering of chemistry theory and practical lessons, it was found that chemistry teachers are competent in setting and stating objectives, structuring teaching steps, selecting and using a variety of teaching methods and attending to students questions in the class. It was also found that the respondents agreed that they do not have a mastery of most of the topics is secondary school chemistry and also, they lack the competence of individualizing their lessons. The inability of chemistry teachers to have a good mastery of the topics in secondary school chemistry poses a lot of problems in the teaching and learning of chemistry as it will invariably affect the academic achievement of the students they teach. This is because such teachers cannot give what they don't have. Also their inability to individualize their lessons may be due to the increased student – teacher ratio where a chemistry teacher is expected to teach many students in a class. Such teachers will actually find it difficult to attend to their individual needs. This finding is in line with that of Erin and Alicia (2009), who stated that designing learning instructions, setting goals and structuring teacher steps are important in teaching and learning of science.

With respect to research question two which sought to find the competences processed by chemistry teachers in designing and conducting experiments/practical in chemistry, it was found that the respondents agreed that they are competent in pre-laboratory planning of providing materials and equipment to be used for practical as well as guiding students during practical. However, it was also found that the respondents agreed that they are not competent in handling and installing apparatus, explaining the procedures of most of the experiments carried out to students and conducting of real experiments in chemistry. When chemistry teachers are incompetent in manipulating equipment and conducting practical, it will also affect the quality of scientist that will be produced in future. In stressing the need for chemistry teachers' competence in conducting practical, Fathiah (2007) stated that a chemistry teacher should have a high level of

proficiency in handling equipment and installation of apparatus as that are part of their job scope. If teachers have problems in manipulating the laboratory equipment, they will also face problems in teaching and assessing the experiment.

From the analysis of research question 3 that investigated the competences possessed and utilized by chemistry teachers in evaluating practical/experiments in chemistry, it was revealed that the respondents agreed that they have the ability to choose appropriate evaluation technique, documenting and keeping a good record of evaluation, scoring of evaluation and evaluating student's cognitive ability in practical. However the respondents agreed that they are incompetent in evaluating the affective and psychomotor skills of chemistry students during practical. There is need for teachers to take cognizance of the ability of the students to follow the correct steps of the experiment and also the interest and attitude they show towards chemistry practical. In this case it is not just getting the correct answer that matter in performing experiments rather the affection and the manipulative skills should also be considered and evaluated. Students that demonstrate high proficiency in affective and psychomotor skills may just need little assistance by the teacher for them to excel in their cognitive skills.

From the hypothesis tested it was found that location has no influence on the competencies possessed and utilized by chemistry teachers in the designing and conducting of chemistry practical/experiments. This finding is contrast with Eya (2016) who found that school location have a significant influence on the students mean rating on the level of acquisition of science process skills.

Chemistry as a subject requires practical training as well as theoretical studies. Therefore to be competent, teachers need to be efficient in planning and implementing the lesson. Apart from that, chemistry teachers need to possess the practical skills needed in designing and conducting of practicals. The country needs more scientific minded people to accomplish the national mission of being counted among the list of developed countries. In view of this, students need to be nurtured to love science and to positively practice scientific culture.

V. RECOMMENDATIONS

In view of the findings from this study, the following recommendations were made:

1. There should be regular organization of conferences, seminars and workshops for chemistry teachers in the areas of designing and conducting practical as well as how to handle some of the common equipments.

2. Chemistry teachers should be intimated on how to carry out the evaluation of students affective and psychomotor skills in practical classes.
3. It is widely known that a resource constraint exists in secondary schools with regard to provision of equipment and chemical apparatus. There should therefore be a combined effort of the government and the private sectors in the provision of science equipment in schools.
4. In case of subsequent recruitment of chemistry teachers in secondary schools, there should be much interest placed in employing qualified chemistry teachers. There should also be more chemistry teachers posted to the rural schools.

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