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COMPETENCIES POSSESSED BY CHEMISTRY TEACHERS FOR AN EFFECTIVE SERVICE DELIVERY IN CHEMISTRY INSTRUCTION

[1]Dr. Stephen Chinedu Nwafor, [1]Dr. Maureen Chinyere Ezeanya & [2]Nneora Mary Muoneke
[1]Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
[2]Department of Chemistry, Federal College of Education, Obudu, Cross River State, Nigeria
***Corresponding Author's Email:** sc.nwafor@unizik.edu.ng

ABSTRACT
The study examined the competencies possessed by chemistry teachers for an effective service delivery in Chemistry instruction in Aguata Education Zone of Anambra State. Three research questions guided the study. A descriptive survey research design was used in the study. The population for the study consisted of all the 91 Chemistry teachers in the Zone. There was no sampling because the population was deemed manageable. The research instrument was a structured questionnaire based on four-point Likert scale. The overall reliability of 0.86 was obtained for the instrument using Cronbach Alpha formula. Mean and standard deviation was used for data analysis. The findings revealed that Chemistry teachers do not have competence in assessing students' learning; providing feedback and understanding child development and learning theories but they have the competence of creating positive learning environment, differentiating instruction to meet the needs of all students, using technology effectively in the classroom, understanding the use of data to inform instruction and communicating effectively with students, parents, and colleagues. Also, some problems such as lack of access to technology and resources, lack of training and professional development opportunities, large class size among other were noted as problem affecting Chemistry teachers Competence for effective Chemistry instruction in senior secondary schools while it was recommended that professional development opportunities for Chemistry teachers through seminars and conferences should be provided to deepen their knowledge of Chemistry and pedagogy and that teachers should be encouraged to incorporate innovative instructional methods in Chemistry instruction among others in order to improve their competence at the senior secondary school level.

Keywords: Competence, Chemistry, Chemistry teacher, Effective Service Delivery and Chemistry Instruction

Introduction

Competencies are the knowledge, skills, abilities, and attitudes that improve performance both on an individual and organizational level. A person must possess not only the necessary training but also the ability to analyze situations, make decisions, gain experience, and develop their capacity for learning and adaptation. This is especially true for Chemistry teachers. Chemistry is a branch of natural science that involves the study of matter, the changes it undergo and laws that explain these changes. It is widely considered to be the bedrock of science since

advanced study in other scientific fields requires a grasp of its ideas about the composition of matter. Tai, Sadler, and Loehr (2015) agreed, saying that Chemistry serves as a gatekeeper for future study in many other areas of science. According to Gordon, (2021), Chemistry is a science discipline that focuses on the study of matter, including its composition, characteristics, and how it transforms. The knowledge of chemistry can be useful in many other professions, such as geology, astronomy, medicine, pharmacy, and agriculture. Because an increased understanding of chemistry leads to a higher quality of life overall, it is the foundation of other sciences as well as human development. Thus, chemistry is fundamental to long-term national development and growth, which is why it is taught in schools. Chemistry instructions in schools teach students about matter and its transformations. The study of chemistry includes the structure, makeup, characteristics, behaviour, and chemical changes that matter goes through during a chemical reaction. In the words of Ugwoke (2017), the value of chemistry extends beyond classrooms and into everyday activities conducted outside of school walls. These include but are not limited to cooking, washing clothes with soap or detergent, boiling ground-up fresh tomatoes to allow the liquid to dry, seasoning perishable food items with salt to preserve them, and melting ice blocks into liquid water to make drinking water come to mind. Moreover, the knowledge of Chemistry is also important in the industries such food industry, drug production industry, plastic industry, petroleum industry, building industries, road construction industries among others as it can help improve industrial capacity and efficiency.

Competence as human resources according to Podungge et al (2020), can be described as the ability of a person to perform one's role quickly or qualified enough to perform certain roles. Adodo (2013) defined competence in the context of education as a teacher's capacity to demonstrate the skills and information they have acquired via training in the workplace. Consequently, it is thought that improving achievement requires a blend of theoretical conduct and values, practical knowledge, and cognitive skills (Arifin, 2015). As such, it is a criterion that establishes how well an employee serves in carrying out their duties (Ibrahim, Razak & Kenayathulla, 2015). According to Zamri and Hamzah (2019), the benchmark for teachers to meet the demands of the modern classroom is teacher competency and proficiency, which entails acquiring a variety of educational competences and being competent in conducting assessments. Zamri and Hamzah (2019) emphasized that teachers must possess competencies in classroom assessment, curriculum, pedagogy, professional development, and evaluation to provide efficient service delivery and instruction. Teachers' proficiency in Chemistry instruction is a crucial factor in guaranteeing efficient service delivery and accomplishing the necessary learning goals because their proficiency may directly affect students' interest and performance. In a similar vein, Handayani (2017) believed that raising instructors' levels of proficiency in the classroom will help pupils perform more academically. According to Popham (2013),

students' learning orientation is positively impacted by the effectiveness and capacity of teachers in the classroom. Teachers teaching Chemistry must therefore possess exceptional competency in order to design, organize, and significantly influence the learning processes.

There are not many qualified chemistry teachers in the field. This is due to the perception that teaching, regardless of expertise, is a place where graduates go to dump their skills. For these people, teaching is a last resort. As a result, there is a lack of commitment, low job input, and generally low achievement among students, all of which have an impact on the goal of national growth and development. As Ogbazi (2017) opined that the problem of industrial development in Nigeria is that of inadequacy of sufficiently trained human resources and this has been a major constraint on the rate of technological and economic development of the country. In addition, Adeniyi (2013) noted that a country's manpower development depends on the quality of her well qualified teachers. As stipulated in the Chemistry curriculum, the teaching of Chemistry in senior secondary school is expected to enable students to acquire basic theoretical and practical knowledge, acquire basic STM knowledge and skills, apply skills to meet societal needs of employment and wealth among others (NERDC, 2009). These impressive objectives would not be achieved if students were taught by incompetent teachers, who would not be able to fairly and effectively impart Chemistry knowledge, skills, and attitudes to the students while employing the most effective teaching strategies to ensure that the concepts are understood and retained. Hence, all these objectives are to be achieved through the type of skills/competencies possessed by the chemistry teachers. This study therefore determined the competencies possessed by chemistry teachers for an effective service delivery in Chemistry instruction in Aguata Education Zone of Anambra State, Nigeria.

Empirical studies have argued on the need for skilled and competence teachers. For instance, Ngada in Fajonyomi (2017) emphasized that the success or failure of any educational programme rests majorly on the adequate availability of qualified (professional), competent and dedicated teachers. Arifin (2015) carried out a study on the influence of competence, motivation, and organizational competence to high school teacher job satisfaction and performance in Jayapura City, Papua, Indonesia. The findings showed that competence and organizational culture affect positively and insignificantly teacher job satisfaction, also, competence and job satisfaction affect positively and significantly teacher performance, in fact organizational culture just has positive but insignificant effect to job satisfaction. Ezechi and Adukwu (2021) also conducted a study on competences possessed by Biology teacher for effective teaching and learning of biology in Enugu South Local Government Area and averred that a Biology competent teacher need to possessed the required academic qualification like NCE, Degree, M.Sc and PhD, use innovative teaching methods such as demonstration method, discussion method, instructional method, laboratory method, activity based method and collaborative method; and obtained a minimum of 1 years of experience

for effective teaching and learning. Eze (2015) conducted a study on the level of competencies possessed by Agricultural Science teachers in the Junior Secondary Schools. The study revealed that Agricultural Science teachers are moderately competent in planning and implementing instruction, evaluation of instruction and classroom management. On the use of educational Technology for instruction, low competence was indicated. Furthermore, Eze (2015) stated that qualifications and teaching experience were found to be determinants of the teacher's levels of competence. Seweje and Jegede (2017) noted that teachers' ability to teach is not only dependent on their academic background but upon their outstanding pedagogical skill acquired. As Nkwodimah (2013) asserted that the teacher's quality and competency will inevitably be seen in the citizens tomorrow. According to Okebukola in Ngada (2018) inadequate exposure to teaching practice, poor classroom management and control, shallow mastery of subject matter, lack of professionalism among others were observed by over 80% of respondents in a survey research of the view of teachers' lack of competency and weaknesses. From the point of Ajayi (2009) point of view, the professional qualities and competencies of a teacher have to do with: mastery of the subject matter, sense of organization, ability to clarify ideas, ability to motivate students, good imagination, ability to involve the student in meaningful activities throughout the period of teaching, management of the details of learning, frequent monitoring of students' progress through tests, formal and informal, written and oral quizzes. Therefore, the present study assessed the competencies possessed by Chemistry teachers in teaching and learning of Chemistry based on these aforementioned variables, as there exist dearth of literature regarding Chemistry teachers' competence in Aguata Education Zone of Anambra State, Nigeria.

Research Questions

The following research questions guided the study.

1. What are the competencies possessed by chemistry teachers for an effective service delivery in Chemistry instruction?
2. What are the problem affecting Chemistry teachers Competence for effective Chemistry instruction in senior secondary schools?
3. What are the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level?

Research Method

A descriptive survey design was adopted for the study. This design was deemed fit because according to Nworgu (2018) a descriptive survey design is that which "aims at collecting data and describing in a systematic manner the characteristics, features or facts about a given population". The study was carried out in Aguata Education Zone of Anambra State, Nigeria. The population for the study consisted of all the 91 Chemistry teachers in the 50 secondary schools that made up the zone. There was no sampling since the numbers were deemed manageable; hence, all the 91 Chemistry teachers were used for the study.

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The instrument used for collection of data was a 21 items four-point Likert scale structured questionnaire divided into three sections and titled "Questionnaire on competencies possessed by Chemistry teachers for an effective service delivery in Chemistry instruction (QCPCTESDCI)". The instrument was validated by three experts from the Department of Science Education, Nnamdi Azikiwe University, Awka. The reliability indices of 0.89, 0.81 and 0.78 were obtained for Sections A, B and C respectively while the overall reliability index of 0.86 was established using Cronbach alpha formula. The questionnaire was administered to each respondent using face-to-face method. This was to ensure 100% return rate which was achieved. The questionnaire was collected back the same day in which each school was visited. The data collected were analyzed using mean and standard deviation. Any item with mean value equal to 2.5 and above was interpreted as "Agreed" (Accepted) while that from 2.49 and below was interpreted as Disagreed" (Rejected). This analysis was done using Statistical Package for the Social Sciences 25 (SPSS, Version 25).

Presentation of Results

Research Questions One: What are the competencies possessed by chemistry teachers for an effective service delivery in Chemistry instruction?

Table 1: Mean and standard deviation of the levels competencies possessed by chemistry teachers for an effective service delivery in Chemistry instruction

S/N	Item	Mean	SD	Remark
1.	Ability to create a positive learning environment	3.15	0.63	Accepted
2.	Ability to differentiate instruction to meet the needs of all students	3.03	0.58	Accepted
3.	Ability to use technology effectively in the classroom	2.95	0.89	Accepted
4.	Ability to assess student learning and provide feedback	1.92	0.98	Rejected
5.	Understanding of the use of data to inform instruction	2.92	0.62	Accepted
6.	Understanding of child development and learning theories	2.23	0.87	Rejected
7.	Ability to communicate effectively with students, parents, and colleagues	3.23	0.63	Accepted
	Overall mean and Standard Deviation	**2.78**	**0.43**	**Accepted**

Table 1 reveals that items 1, 2, 3, 5 and 7 with the mean scores of 3.15, 3.03, 2.95, 2.92 and 3.23 respectively were accepted since the mean scores were above the cut-points of 2.50. On the other hand, items 4 and 6 with mean scores of 1.92 and 2.23 were rejected. This implies that the Chemistry teachers have the competence of creating positive learning environment, differentiating instruction to meet the needs of all students, using technology effectively in the classroom, understanding the use of data to inform instruction and communicating effectively with students, parents, and colleagues. In contrast, Chemistry teachers do not have the competency in assessing students' learning; and providing feedback and understanding child development and learning theories.

Research Question Two: What are the problem affecting Chemistry teachers Competence for effective Chemistry instruction in senior secondary schools?

Table 2: Mean and standard deviation of the problem affecting Chemistry teachers' competence for effective Chemistry instruction in senior secondary schools

S/N	Item	Mean	SD	Remark
8.	Lack of access to technology and resources	3.26	0.75	Accepted
9.	Lack of training and professional development opportunities	3.26	0.64	Accepted
10.	Lack of student interest in Chemistry	2.46	0.72	Rejected
11.	Large class size and lack of individualized instruction	2.97	0.74	Accepted
12.	Lack of support from school administration	3.05	0.79	Accepted
13.	Lack of parental involvement	2.67	0.77	Accepted
14.	Insufficient time to teach Chemistry effectively	2.82	0.76	Accepted
	Overall mean and Standard Deviation	**2.93**	**0.44**	**Accepted**

Table 2 reveals that item 8, 9, 11, 12, 13 and 14 with the mean scores of 3.26, 3.26, 2.97, 3.05, 2.67 and 2.82 respectively were accepted as they were above the mean cut-off points of 2.50. This indicates that the problem affecting Chemistry teachers competence for effective Chemistry instruction in senior secondary schools include lack of access to technology and resources, lack of training and professional development opportunities, large class size and lack of individualized instruction, lack of support from school administration, lack of parental involvement and Insufficient time to teach Chemistry effectively. Whereas, item 10 with a mean score of 2.46 was rejected, because it was below the 2.50 mean cut-off points. Hence, the respondents agreed that lack of student interest in Chemistry does not contribute to the problems affecting Chemistry teachers' competence for effective Chemistry instruction in senior secondary schools.

Research Question Three: What are the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level?

Table 3: Mean and standard deviation of the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level

S/N	Item	Mean	SD	Remark
15.	Provide professional development opportunities for teachers to deepen their knowledge of Chemistry and pedagogy	3.67	0.53	Accepted
16.	Encourage teachers to incorporate hands-on, project-based learning experiences that allow students to apply their knowledge in a practical way	3.67	0.53	Accepted
17.	Provide access to technology tools and resources that can enhance the teaching and learning of Chemistry	3.62	0.49	Accepted
18.	Encourage Chemistry teachers to incorporate real-world examples in order to help students understand the relevance and practicality of the subject	3.59	0.59	Accepted
19.	Establish clear learning goals and objectives for Chemistry lessons, and use appropriate assessments techniques/tools to measure students' progress and identify areas for improvement	3.56	0.60	Accepted
20.	Encourage the use of peer-to-peer learning and collaboration, to promote student ownership in their learning	3.49	0.51	Accepted
21.	Foster a culture of lifelong learning, by encouraging teachers to continuously update their knowledge and skills in Chemistry	3.54	0.51	Accepted
	Overall mean and Standard Deviation	**2.93**	**0.44**	**Accepted**

Table 3 shows that all the items 15, 16, 17, 18, 19, 20 and 21 were accepted as workable strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level. This is because their mean scores were above the mean benchmark of 2.50. Moreover, the overall mean of 2.93 was obtained which was above the cut-off point mean of 2.50 This implies that the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level are providing professional development opportunities for teachers to deepen their knowledge of Chemistry and pedagogy, encouraging teachers to incorporate hands-on, project-based learning experiences that allow students to apply their knowledge in a practical way, providing access to technology tools and resources that can enhance the teaching and learning of Chemistry, encouraging Chemistry teachers to incorporate real-world examples and applications of Chemistry into their lessons to help students understand the relevance and practicality of the subject, establishing clear learning goals and objectives for Chemistry lessons and using appropriate assessments techniques/tools to measure students' progress and identify areas for improvement, encouraging the use of peer-to-peer learning and collaboration to promote student ownership in their learning and fostering a culture of lifelong learning, by encouraging teachers to continuously update their knowledge and skills in Chemistry.

Discussion of Findings

The findings of the study showed that Chemistry teachers have the competence of creating positive learning environment, differentiating instruction to meet the needs of all students, using technology effectively in the classroom, understanding the use of data to inform instruction and communicating effectively with students, parents, and colleagues. In contrast, Chemistry teachers do not have the competency in assessing students' learning; and providing feedback and understanding child development and learning theories. This is in line with the findings of Eze (2015) which revealed that Agricultural Science teachers are moderately competent in planning and implementing instruction, evaluation of instruction and classroom management while incompetent in using educational Technology for instruction.

The findings of the study revealed that the problem affecting Chemistry teachers competence for effective Chemistry instruction in senior secondary schools include lack of access to technology and resources, lack of training and professional development opportunities, large class size and lack of individualized instruction, lack of support from school administration, lack of parental involvement and Insufficient time to teach Chemistry effectively. This findings is supported by the findings of Bozkuş (2020) that personal rights, workload, respect, education system, school climate are some of the problems affecting teachers towards ensuring effective instruction. Also, the finding is in line with the opinion of Hegwood (2023) who stated that the common

the common challenges faced by teachers in today's classroom include understanding different learning styles, lack of effective communication, staying up to date with learning technology, communicating with parents, pressure from school administrators, creating engaging lesson plans that fit the curriculum, behavior and classroom management, time-consuming administrative work, lack of funding and burnout

The findings of the study showed that the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level are providing professional development opportunities for teachers to deepen their knowledge of Chemistry and pedagogy, encouraging teachers to incorporate hands-on, project-based learning experiences that allow students to apply their knowledge in a practical way, providing access to technology tools and resources that can enhance the teaching and learning of Chemistry, encouraging Chemistry teachers to incorporate real-world examples and applications of Chemistry into their lessons to help students understand the relevance and practicality of the subject, establishing clear learning goals and objectives for Chemistry lessons and using appropriate assessments techniques/tools to measure students' progress and identify areas for improvement, encouraging the use of peer-to-peer learning and collaboration to promote student ownership in their learning and fostering a culture of lifelong learning, by encouraging teachers to continuously update their knowledge and skills in Chemistry. This is in agreement with finding of Ezechi and Adukwu (2021) that teachers' qualifications, experience and the use of innovative teaching methods such as demonstration method, discussion method, instructional method, laboratory method, activity based method and collaborative method are the appropriate competence/skills teachers must possess for effective teaching and learning. This finding also agree with Eze (2015) who asserted that regular training, conferences and seminars should be organized for the teachers to improve their competency.

Conclusion

The researchers concluded that Chemistry teachers have the competency of creating positive learning environment, differentiating instruction to meet the needs of all students, using technology effectively in the classroom, understanding the use of data to inform instruction and communicating effectively with students, parents, and colleagues. Besides, Chemistry teachers do not have the competence in assessing students' learning; and providing feedback and understanding child development and learning theories. Hence, the need for the teachers to improve in these aspects they are lagging behind as this will help the students to improve their Chemistry performance. Moreover, the problem affecting Chemistry teachers competence for effective Chemistry instruction in senior secondary schools among others include lack of access to technology and resources, lack of training and professional development opportunities, large class size and lack of individualized instruction and Insufficient time to teach Chemistry effectively. Furthermore, it was suggested that providing professional development opportunities for

teachers to deepen their knowledge of Chemistry and pedagogy, encouraging teachers to incorporate hands-on and project-based learning experiences that allow students to apply their knowledge in a practical way, providing access to technology tools and resources that can enhance the teaching and learning of Chemistry among others are the strategies for improving Chemistry teachers' competence in Chemistry instruction at the senior secondary school level.

Recommendations

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

1. Chemistry teachers should be trained for effective Chemistry instruction through conferences, seminars and workshops.
2. Innovative instructional methods should be adopted by the Chemistry teachers in order to improve teaching competency.
3. Teachers should use appropriate assessment techniques/tools to measure students' progress and identify areas for improvement and lacks.
4. Chemistry teachers should be encouraged to continuously update their knowledge and skills, even when the government does not provide the necessary training.
5. The government should provide the technological tools and resources while the teachers should ensure access and usage in order to enhance Chemistry instruction.

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