



Challenges Faced by Teachers in Implementing Competence-Based Chemistry Curriculum in Public Secondary Schools in Nyamagana District, Mwanza, Tanzania

James Chacha & Daniel Onyango

St. Augustine University of Tanzania

Email for correspondence: jameschacha671@gmail.com

Abstract: Curriculum implementation is an activity which teachers perform in order to acquire the nation's education objectives. Competence-based curriculum requires teachers to carry out the duty of guiding learners and letting them engage actively in various activities in the process of teaching and learning. The main focus of this study was to investigate challenges faced by teachers in the implementation of CBC, specifically the influence of teachers' competence. The study used a mixed research approach and a convergent parallel design. It drew a sample of 133 respondents using both probability and non-probability sampling process from a population of 38,848 individuals. Data was collected using primary sources of research instruments such as closed and open ended questionnaire and interview guides. The reliability was tested and the coefficient $r = 0.8$ allowed the researcher to use the tools. Quantitative data collected was analyzed by the use of Statistical Package of Social Science version 21 presented in tables through frequency and percentage while qualitative data was coded and analyzed thematically through narratives. The findings of the study revealed that many public secondary schools in Nyamagana district do not have enough qualified and competent chemistry teachers which are very important in enhancing the implementation of competence-based curriculum in chemistry subject. The study recommends that the government, with its stakeholders, through community involvement, should provide adequate funds for recruiting more chemistry teachers and keep on giving teachers frequent capacity-building training through workshops and seminars to upgrade their qualifications in both content and pedagogy.

Keywords: Assessment mode, Competence based curriculum, Instructional materials, Lesson planning, Teacher competence, Public secondary schools

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1. Introduction

Chemistry is one among the natural science disciplines. It takes a very important place in the current society and the world at large (ACS, 2017). In life, chemistry supports nearly each facet. Basically, the final aim of learning chemistry is to increase knowledge of the people on the structure, composition, properties, and changes of matter into different situations. The objectives of teaching chemistry subject are geared towards designing and running experiments, being able to understand symbols, formulae and equations. Additionally, acquiring the skills, knowledge and principles that are generally required to explain daily social issues and appreciate the application of this scientific knowledge in exploiting natural resources and ensure environmental conservation (MOEVT, 2010). The core competence of chemistry syllabus is to enable students to be able to build understanding in the subject by conducting different experiments and activities, use chemical formulae, equations and symbols for communication in Chemistry; exploit their chemistry subject perception, principles and skills to find a solution for problems occurring every day, applying skills from science and technology to keep and use the environment in a sustainable manner (MOEVT, 2010). Chemistry provides a variety of learning experiences being in a state of proper equilibrium which can enable students to develop unavoidable knowledge of science. Through learning chemistry, learners can also develop their skills, values, processes and attitudes together with improving their comprehension enclosed firmly in the pattern of science. The world of natural science education and other interrelated features for individual development and contribution in science and technology are necessary (Ituma, 2012). Chemistry knowledge is needed in order to produce goods of quality and provide services. Chemistry is an obligatory requirement in order to register for studies into important scientific occupations like engineering, pharmacy, medicine, agriculture and biotechnology (Njagi and Silas, 2015; Mwangi, 2016).

Again, the knowledge of chemistry blends well with other scientific disciplines like agriculture, biology and physics. Therefore, it adds value, especially in understanding other science subjects. Despite the observable importance of Chemistry and the supplementary need for proper application of its designed curriculum, effective chemistry education has not yet been achieved worldwide (Anditi et al. (2013).

According to Broman, Ekborg and Johnels (2011, a good number of students, in Sweden were not familiar with chemistry subject relevance which caused a great failure in the number of students taking chemistry based courses at higher levels of education and training. This was as a result of their perception that chemistry is a teacher-centered subject. It is interesting to note that students pursuing chemistry specializations acknowledge the

observation and still are satisfied with courses under the subject. Despite this, both teachers and students agreed that the pertinence of chemistry requires adjustment by making alignment of its content to daily life and emphasizing more on laboratory and practical work.

Using the experience from South Africa, a number of factors affecting application of chemistry curriculum were identified. These included insufficient practical training, low quality laboratory equipment and lack of relevant textbooks, lack of professional conduct among teachers, insufficient capacity building programs and lack of training. There is an evidence of scarce laboratory attendants or use of unqualified personnel in most schools, and there has been lack of safety equipment like first aid kits in cases of accident in the laboratory environment (Ijidiye, 2015).

Education stakeholders in Tanzania, including policy makers, political scientists, politicians, teachers and others hold the opinion that Tanzanian education system is more of a competence-based curriculum than content-based curricula. However, there is very little evidence that the approaches to teaching and learning in the competence-based curricula have facilitated attainment of quality secondary school education. This study is motivated by several other studies that have been done in Tanzanian context to understand the gap between policy statements and the practice with regard to competence-based curriculum operation (Timothy, 2011; Kahwa, 2009; Shemweleka, 2008) though there were few studies which focused on the impact of competence-based chemistry curriculum on the quality and learning outcomes in secondary schools. The desire for industrialization and quest for sustainable development has necessitated the government of Tanzania to invest in science subjects so as to prepare future engineers and scientists who will run the established industries. Chemistry as one of the science subjects is perceived by the government as an important subject because it provides a variety of learning experiences over which students can develop important scientific knowledge, improve their comprehension, skill set development processes, values and attitudes surrounded in the scope of scientific education and other interrelated aspects for personal development and contribution towards a scientific and technological world (Ituma, 2012). Because of this, the Government of Tanzania has been spending huge sums of money to improve Chemistry teaching among teachers and students since the establishment of competence-based curriculum.

However, in Nyamagana District secondary schools, the implementation of competence based curriculum is still inadequate. Effective implementation of competence – based curriculum gives a chance to learners to participate in different activities by using their senses including touching and doing activities themselves. Through participating in various activities, it is believed that learners

improve their learning and thus perform better in their examinations. However, basing on the summative form four national examination results, it seems that competence based curriculum has not been appropriately implemented since majority of the candidates pass with weak marks while a good number of those candidates fail or get division zero which is supported by Sumra (2006) who argues that there exists no connection between the concept of competence-based curriculum and what is expected from it. The study referred to students' final examinations because it is the means through which majority of the stakeholders, including parents and students, realize the academic performance of learners and the school in general. In addition to that, despite other factors such as support from parents and adequacy of teaching and learning resources implementation of curriculum plays a big role in the performance of learners academically.

Table 1: Nyamagana District, Analysis of Summative Form Four National Examination 2018- 2020

Year	Students	Failed	Percent
2018	1774	659	37.15
2019	1986	409	20.59
2020	1955	215	11.00

Table 1 shows that 2018, 2019 and 2020 results had that 659 students (37.15 percent); 409 students (20.59 percent) and 215 students (11 percent) respectively, failed the competency-based chemistry examination. Although the trend shows improvement. Still, this contextual information raised the question of whether there were some challenges which teachers faced in the implementation of competence-based chemistry curriculum in public secondary schools. The curriculum was expected to produce improved performance in students' examination results as a result of improved learning.

The major aim of the society and the government with respect to education is to make sure that education is improved and maintain the quality for learners to get the intended outcomes of learning (MoEST, 2017). However, the quality of education in the country, including Nyamagana district has been in doubt and according to the national examination council of Tanzania, majority of the candidates pass but with weak marks as they get division four while others in good numbers get division zero. Kazungu, (2013) states that the quality of education has been going down daily in the country causing a lot of complaints and the public outcry while Kambuga and Dadi, (2015) stated that teaching and achievement have not yet improved. This caused the government to shift from teacher centered approaches of teaching to competence based teaching with an expectation that it could improve the quality of teaching and students'

examination performance. This shift involved the shift from content based curriculum to competence based curriculum. Competence based curriculum was introduced with the expectation that learning would be improved through teaching by giving learners a chance to participate in learning through doing various teaching and learning activities.

In addition to that, the Government of Tanzania (GoT) has made several efforts in an attempt to improve teaching and learning in Chemistry discipline, yet the outcomes aren't satisfactory. Some of these efforts include the launching of Education II Projects like;

Teacher Education in Sub-Saharan Africa (TESSA), Science Education for Secondary Schools (SESS), Test of Engineering Aptitude Mathematics and Science (TEAMS) and Education Sector Development Plan (ESDP) to improve Chemistry teaching and learning (ADF, 2007; Semali and Mehta, 2012; Strimel et al., 2019; MoEST, 2017). However, most of the assessments provided to learners including those in Nyamagana district are paper-pen tests. Consequently, performance in the district and the nation at large has not satisfactorily improved, which may cause the vision of the future of citizens in a sustainable scientific world not to be achieved. Unsatisfactory implementation of competence based curriculum in secondary schools in Nyamagana district is realized through the National Examination Council where majority of the candidates who sit for chemistry examination in their form four national examinations get weak passes and others fail totally, which hinder them from joining further studies with the subject combinations. This kind of performance of learners is attributed to the persistent use of lectures as the main teaching method, teaching chemistry theoretically without practical exercises and using paper-pen tests as the only method of assessing learners' competence which are contrary to the expectations of competence based curriculum implementation (Abisay and Ming-Kun, 2020). This situation, in turn, is likely to create a room whereby citizens could not be competitive in a global market. This study raises the need to carry out this study whose main focus is to investigate the challenges faced by teachers in the implementation of competence-based chemistry curriculum in public secondary schools in Nyamagana District.

2. Literature Review

A thorough review of both theoretical and empirical literature was done in the process of conducting this study. Theories related to the study and works done by researchers were critically passed through and organized for this study. The study was guided by two theories; the Constructivist Theory (Brunner, 1966) and the theory of curriculum implementation by Gross (1971). The use of these two theories enabled offsetting of weaknesses of the constructivist theory by the strengths of the curriculum implementation theory. The Constructivist Theory asserts that learning is a process of creating new ideas based on

the present or the previous knowledge. In this ground, learners select and transform information, construct hypothesis and make meaning out of the evidence and skills depending on a reasoning (Bruner, 1966). This theory assumes that learners come to the classroom with their knowledge and experience. Their previous knowledge enables them to assimilate the new information, accommodating/adapting to it or alter what they already know in order to match the new understanding required. As such, learning process involves interaction between learners whereby teachers play their role as facilitators. The theory suggests that learners must engage themselves in an active learning process instead of being left to remain as passive observers and listeners. Therefore, the learners should be given an opportunity to participate in physical actions, and activities which require to be done using their hands to engage their mind and brain (Bruner, 1966). The application of competency-based chemistry curriculum in classroom through doing experiments leads to interactive learning process as suggested by the constructivist theory. Gross et al (1971) using the theory of curriculum implementation opined that curriculum application is a function of the five conditions which are existing in the process of implementation. These conditions are: the implementers and receivers' attitude and other stakeholders of the new curriculum as well; the support given by the managerial staff; the sufficiency of facilities and equipment (Instructional materials); the level of clear knowledge school organization members have concerning the range, limits and everything that is included in the curriculum; the amount of abilities school organization members have and the knowledge and skills required for them to be able to accomplish the curriculum, present plans of the organization and the readiness to use time and energy for curriculum accomplishment.

Gross (1971) asserts that any curriculum program depends on three critical elements. These elements are ability of teachers, their convenience and the use and management of support facility resources. In terms of the ability of teachers as the implementers of the curriculum innovation, they should be given thorough training in order to enable them act on the curriculum appropriately. Under the availability and uses of resources apart from being available in schools they must be relevant to the new curriculum.

Influence of Teachers' Competence in the Implementation of Competence-Based Chemistry Curriculum

Chen and Wei (2015) conducted a study to investigate the influencing factors for the use of chemistry curriculum materials in China. The purpose of this study was to identify factors that affect familiarization of the curriculum requirements for the new secondary school chemistry curriculum, in particular in China. The study focused on the idea that the relationship between the teachers and the curriculum content in any given social setting affected the outcomes in a classroom. A designed

study that followed an explanatory approach was conducted, and six chemistry teachers were included in the study for an experiment drawn from four secondary schools. Within-class observation and interview methods were used for data collection. The data analysis and results showed that there were seven factors that affected teachers' adaptations to curriculum content, and these included the pedagogical content knowledge of teachers, external examinations, time limitations, teaching resources, the size of the class, belief about science, and peer coaching. Given all the factors, pedagogical content knowledge, external examinations, and time limitations were found to be significant and hence influenced adaptations of curriculum content.

The daily increase in the number of students in secondary schools due to free primary and secondary education programs has, to some extent, resulted in a financial burden on schools for adding more classes in order to host more students. This increase in classrooms, combined with the hiring of more teachers, resulted in an increase in teachers' workload (MOEVT, 2010). However, currently, the problem is not recruitment of teachers but the government's ability and may be absence of priority to employ more teachers, as there are many teachers who have been recruited but have not been employed for years now, despite the shortage of teachers in schools.

Copriady (2014) conducted a study on the teacher's competency effect in teaching and learning chemistry subjects through laboratory practices, designing, implementing, and evaluating learning-by-doing or experiments to boost the quality of teaching and learning practical chemistry. The study used a questionnaire to collect data on the four aspects of the previously discussed competencies. A total sample of 234 chemistry teachers was randomly drawn from Indonesia. Findings showed that competency to design, plan, implement, and evaluate practical training was average. A comprehensive approach is needed to improve competency. Modern laboratory equipment was to be acquired. Creativity by teachers should be embraced and make practical science more meaningful and significant. In relation to the current study, teachers need to have enough competence in the subject and the methods and techniques to be applied in implementing a competence-based chemistry curriculum. In this current study, teachers' competence for implementing a competence-based chemistry curriculum refers to teachers' being competent in the subject content and methods and techniques that can help him or her deliver content to learners. The majority of the teachers were seen to have insufficient competence in both content and methods and techniques for implementing the new competence-based chemistry curriculum. In addition to that, competence in chemistry subject does not mean practical part only; the teacher needs to be competent practically and theoretically, which most teachers do not fit.

The study further explores that in the Indonesian environment, the government had set standards to determine the quality of education delivered according to

the requirements of laws governing the education sector. The government sets these standards in relation to the curriculum, competence and quality of teachers, school structure, organization of the learning process, and assessment technique. All these efforts are taken to ensure standards are maintained and quality is assured, thus science subjects are recommended to be given more attention so as to develop scientific-driven students' minds. Some of the common science subjects are biology, physics, and chemistry. Almost all science courses involve both theoretical content and practical training. Therefore, to have competent teachers and instructors, there needs to be efficient design, planning, and implementation of the lesson. Additionally, science teachers need to develop the proper tools to conduct frequent assessments in practical training and laboratory experiments.

Okono et al. (2015) establish that teaching workload has a significant impact on the preparation and competence of material delivery within and across classes daily. This is the reason behind teachers having to allocate the same hours to attend to other duties apart from teaching. The other duties teachers have to engage in are such as planning for the next class, assessment process, script marking and assignments, providing guidance to students' behaviour, counselling students, and improvisation of resources. Unmanageable workloads can affect time taken to cover the syllabus, learning process, and curriculum application due to the fact that teachers with more workload are likely to conduct fewer experiments as opposed to their peers with fewer lessons. Hence, learners acquire limited competence due to lack of or inadequate practice of knowledge and skills.

In their study about promoting science subject choices for secondary school students in Tanzania, Awang et al. (2013) argued that in shaping the success of a teaching and learning session, teachers' competence in teaching and learning is a vital factor. Teachers' wisdom and ability to engage in the learning process have direct effects on students' active participation in the learning process. Therefore, the act of developing teachers' competence, including the efforts of promoting positive attitudes, was the main plan in order to improve and build a strong teaching profession for great improvements in educational quality in different countries globally. However, as has already been expressed, a teacher's wisdom and ability to engage students in learning does not enable the teacher to present to learners all that learners need. The teacher should also have competence in the content of the subject itself. For developing teachers, both content and techniques must be considered for effective implementation of the competence-based chemistry curriculum.

Kisima (2015) evaluated the success of the implementation of competency-based assessment (CBA) in the chemistry subject in secondary schools in Singida Municipality, Tanzania. A cross-sectional survey and case study designs were adapted in this study. The study was guided by five evaluation questions which aimed at

determining the teacher's perceived knowledge in implementing CBA, the usage of CBA strategies and related skills, the teachers' and students' attitudes towards implementation of CBA, challenges encountered, and possible solutions. Hypotheses were tested on significant differences for effective implementation of CBA. Findings from Kisima's study suggest that most chemistry teachers are faced with limited knowledge and lack of skills set in implementing the competency-based assessment. It was also revealed that chemistry teachers had rarely applied CBA and its associated skills. Also, it was noted that chemistry teachers and students had positive attitudes towards the implementation of CBA. Further, the study alluded that the implementation of CBA was hampered by a number of factors, including lack of training for in-service chemistry teachers, insufficient teaching and learning resources, and lack of well-equipped chemistry laboratories. Results of hypotheses testing indicated that usage of CBA strategies did not differ significantly among teachers with different working experiences and usage of CBA strategies did not differ significantly among teachers with different professional qualifications. Therefore, it was recommended that comprehensive CBA in-service training should be organized for chemistry teachers. Also, educational stakeholders should ensure the presence of enough teaching and learning resources in secondary schools to enhance effective implementation of CBA in the chemistry subject.

The results from this study imply that chemistry teachers lack competence in both content knowledge, the techniques and skills necessary for implementing and assessing the implementation of a competence-based chemistry curriculum. As a result, government policy on the implementation of competence-based curriculum should consider teacher recruitment to be focused on the provision of content and techniques that enable teachers to implement the curriculum with ease.

Timothy (2011) in the study on an assessment of competence-based curriculum implementation in teaching and learning ordinary level physics in Singida Municipality identified that there was a limited level of implementation of competence-based practical lessons in the course of teaching science subjects despite the fact that teachers had been attending in-service capacity-building training programs on the subject. This trend was attributed primarily to the heavy teaching workloads assigned to the majority of science subject teachers. In general, using competence-based experiments in teaching necessitates thorough preparation and laboratory trials of the experiment by the teacher prior to the actual lesson. A pile of workloads may compel the teachers to avoid practical-based teaching deliberately or because of lack of adequate preparation, hence opting for the lecture method in the course of curriculum implementation. Also, other factors may interplay in the whole process. For instance, the length of a lesson planned, resting time between lessons, the teacher's second subject, and other administrative responsibilities may interfere with curriculum

implementation. However, the limited level of competence-based practical lessons can not only be attributed to heavy teachers' workloads but also the absence of laboratory technicians in schools, which makes teachers carry loads that are not theirs. This brings a call to the ministry of education, science and technology to recruit and employ laboratory technicians in each secondary school.

In addition to that, Nkya et al. (2021) in their study on the implementation of competence-based curriculum in Tanzania argue, citing King (2013), that teachers are not sufficiently prepared to implement competence-based curriculum from the universities and add that the majority of the teachers in Tanzania do not have enough skills to implement classroom activities as prescribed in the curriculum of secondary education because they still apply the traditional content-based approach. This means that teachers lack competence in implementing a competence-based curriculum, and as a result, learners are not engaged in various activities in the classroom, which causes them to complete their secondary education without the necessary competencies to be applied in real-life situations in society. It is this kind of teaching which also contributes to the majority of the learners' unsatisfactory performance in their final examinations.

Despite international and national earnest activities aimed at improving processes concerned with the learning of chemistry in Tanzanian secondary schools, some challenges facing it have been observed. Recent observations on the direction of activities involved in the learning of chemistry competency-based syllabus show that teachers lack knowledge of science content and pedagogy (Setter et al., 2012). The challenge of inadequate knowledge and pedagogy in the teaching of the subject has been worsened by lack of professional development programmes, particularly in rural schools (Setter et al., 2012). Moreover, the students' items response analysis made by examiners revealed that the general performance of the students in Form Two National Assessment (FTNA) from the years 2015 to 2017 was average. The expectation was that the performance would be higher than the average. The average performance of the students could be attributed to the challenge of insufficient chemistry competence among the students due to incompetent teachers. However, examiners recommended that special attention should be given to chemistry teachers, particularly in-service training (NECTA, 2014). As a result, teachers require in-service training and workshops geared toward professional development in order to contribute to the new curriculum innovation and implementation.

The national examinations council and the institute of curriculum development in Tanzania have to include the project work content that could be examined and assessed into the formal syllabus for chemistry for secondary schools. The recommendations added that management boards of public secondary schools have to hire extra teachers for science departments where the teachers for

science practical based subject assume other responsibilities.

3. Methodology

This study employed mixed methods and the convergent parallel research design as the framework for guiding data collection, interpretation of the results and data analysis. The targeted population had a total of 38,848 respondents. The sampling procedures employed in selecting the required sample for the study were probability and non-probability. Under probability sampling, stratified and simple random sampling were used to select students from five (5) public secondary schools. Under non-probability sampling, purposive sampling procedure was used to select the DEO, Heads of schools and Chemistry teachers because of their uniqueness in the area. The study used a sample of 133 respondents involving one (1) DEO, (5) heads of schools, 69 students as well as 58 chemistry teachers from the five (5) public secondary schools in Nyamagana District. Interview and questionnaire were used in data collection. Data from such respondents as heads of schools and DEO were interrogated using interview guide questions. Open and closed ended questionnaires were directed to teachers and students. Analysis of quantitative data was done using the Statistical Package for Social Sciences (SPSS) Version 21 while the analysis of data from closed items of questionnaires was done using inferential and descriptive statistics and then presented in frequencies and percentages in tables. Qualitative data was coded as collected from the open-ended questionnaires and in-depth interviews were summarized to get categories-themes and descriptions given in narratives.

4. Results and Discussion

The major aim was to investigate the challenges faced by teachers in the implementation of competence-based chemistry curriculum in public secondary schools in Nyamagana District.

One of the challenges was to find out how teachers' competence influence effective implementation of chemistry curriculum in selected public secondary schools. Questionnaires and interviews conducted had questions which needed respondents to say if teachers' competence affected the implementation of competence based curriculum.

Influence of Teachers' Competence on the Implementation of a Competence-Based Chemistry Curriculum

The study was to determine whether teachers' competence had an influence on the effective implementation of a competence-based chemistry curriculum in public secondary schools in Nyamagana District. Using the Likert scale of five, the degree of agreement with the statement was determined by: SA - Strongly agree, A -

Agree, N - Neutral, D - Disagree to SD - Strongly disagree, as shown in table 2.

The results from chemistry teachers' questionnaire indicated that teachers' qualification, Chemistry teachers

with higher qualification and Chemistry teachers with longer years of services influence effective implementation of chemistry curriculum. To arrive to this generalization, a number of variables were tested during the field study and presented as follows in table 2:

Table 2: Teachers' Responses on the Influence of Teachers' Competence in the Implementation of a Competence-Based Chemistry Curriculum (n= 58)

Items	SA	A	N	D	SD
Teachers' qualification influences chemistry curriculum implementation	23(39.7%)	20(34.5%)	4(6.9%)	7(12.1%)	4(6.9%)
Chemistry teachers with higher qualification implement the chemistry curriculum	18(30%)	14(24.1%)	11(19%)	7(12.1%)	8(13.8%)
Chemistry teachers with more years in service implemented the syllabus satisfactorily	19(32.8%)	20(34.5%)	8(13.8%)	7(12.1%)	4(6.9%)
Teachers' in-service training Influence chemistry curriculum implementation	33(50%)	24(36.4%)	9(13.6%)	-	-
Chemistry teachers who attend frequently in-service training teach well by giving clear explanation of scientific concept	50(75.8%)	3(19.7%)	2(3%)	1(1.5%)	-
Chemistry teachers with more years of teaching experience teach well	48(72.7%)	12(18.2%)	6(9.1%)	-	-
New employed chemistry teachers teach well	15(22.7%)	26(39.4%)	24(36.4%)	1(1.5%)	-

The researcher asked chemistry teachers if teachers' qualification influenced chemistry curriculum implementation. Responses presented in table 2 showed that 23(39.7 percent) strongly agreed, 20(34.5 percent) agreed, 4(6.9 percent) were neutral, 7(12.1 percent) disagreed and 4(6.9 percent) strongly disagreed. Since the majority 43(74.1 percent) of respondents agreed that teachers' qualification influences effective implementation of competence-based chemistry curriculum, this implies that it is a crucial factor for effective implementation of competence-based chemistry curriculum in Tanzania. This is supported by Njagi and Silas (2015) who postulated that unqualified teachers handling chemistry practical wrongly lower performance. This means that teachers have to be qualified in both content and pedagogy for them to implement competence-based curriculum effectively as Kisima (2015) notes that limited knowledge and short of skills set for implementing competence based curriculum are the challenges which cause chemistry teachers be unable to implement competence based curriculum appropriately. However, in respect to the 15 (25.9 percent) of those who were neutral and those who disagreed, not all qualified teachers have enough competence for implementing chemistry curriculum satisfactorily. Thus chemistry practical activities should be handled by laboratory technicians who are also missing in majority of the schools and thus forcing teachers to do that task.

Higher teachers' qualification influence chemistry curriculum implementation.

Table 2 revealed that teachers' qualification in general influences the implementation of chemistry curriculum, the researcher wanted to know specifically if chemistry teachers with high qualifications influenced the implementation of chemistry curriculum. Responses indicated that 18(31 percent) strongly agreed, 14(24.1 percent) agreed, 11(19 percent) were neutral, 7(12.1 percent) disagreed and 8(13.8 percent) strongly disagreed. It means that chemistry teachers with higher qualification influence the implementation of competence based chemistry curriculum effectively compared to those with low qualification. Qualification implies enough ability in both content and pedagogy since according to the constructivism theory, a learner needs to be involved in various activities in the process of teaching and learning. This is supported by Komba and Mwandangi (2015) who when citing Wangeleja (2007) and Kalugula (2000), argue that the teaching of competence based curriculum needed the understanding of teachers in both content and pedagogy for them to be able to engage learners in different activities in lessons. Therefore, qualification in both content and pedagogy are inseparable in the implementation of competence based curriculum.

Teachers' years of service gained experience on implementation of chemistry curriculum. The aim was to establish if experience of chemistry teachers influenced curriculum implementation in the subject. When respondents were asked, 19(32.8 percent) strongly agreed, 20(34.5 percent) agreed, 8(13.8 percent) were neutral, 7(12.1 percent) disagreed and 4(6.9 percent) strongly disagreed. This implies that

teachers with high experience in the teaching career influenced the implementation of competence-based chemistry curriculum compared to those with low or without experience.

As depicted in table 2 teachers' qualification, Chemistry teachers with higher qualification and longer years of services implement chemistry curriculum in a satisfactory manner. This is because experienced and qualified personnel perform better than none or semi-skilled individuals. During the study the researcher wanted to know if teachers' qualification, chemistry teachers with higher qualifications and long years of working experience served as indicators for effective implementation of chemistry curriculum in public secondary schools in Tanzania.

During the interview with heads of schools for example, to determine whether teachers' competence has influence on effective implementation of competence-based chemistry curriculum. The head of school "T" revealed that:

Most of qualified chemistry teachers have low or lack competence in preparing the chemical reagents and different chemical solutions for laboratory experiments this causes their students to learn chemistry subject theoretically without doing practical activities and this is the most challenge which face teachers in school (Interviewee, November 2021)

This is also evidenced by Setter et al. (2012) who believed that teachers have inadequate knowledge, content and pedagogy in science. They believed that the challenge of inadequate knowledge, content and pedagogy in teaching of chemistry subject has been worsened by lack of professional development programmes particularly in rural and urban public secondary schools. From this experience therefore, it is clear to say that there is unsatisfactory implementation of chemistry curriculum due to inadequate knowledge and experience of teaching chemistry subject. To implement competence based curriculum in chemistry subject effectively, teachers should be trained frequently to allow them remain abreast in the teaching career with high knowledge and skills.

Teachers' in-service training contributes significantly to the improvement and implementation of chemistry curriculum. Investigating the effectiveness of chemistry teachers who frequently attend in-service training on competence based chemistry curriculum; 50(75 percent) of respondents who were asked this question strongly agreed, 13(19.7 percent) agreed, 2(3 percent) were neutral and 1(1.5 percent) disagreed. This implies that chemistry teachers who frequently attend in-service training such as workshops, seminars and short courses get adequate skills and knowledge for implementing learner-centered curriculum in chemistry subject. During the interview one of the heads from school "S" revealed that:

No chemistry teacher has attended the training concerning the implementation of learner-centered curriculum. The seminar which was conducted for five days at the Regional level on

the implementation of competence based curriculum, only three teachers attended. The three teachers who attended the seminar were a Biology teacher, English Language teacher and Civics teacher. Teachers who attended the seminar came back to their schools and facilitated their fellow teachers including chemistry teachers on the ways of preparing students questions and lesson plans according to framework of competence based curriculum (interviewee, November 2021)

This finding from the head of school "P" was similar to that of the District Education Officer who asserted:

In our district, teachers' in-service training for the implementation of competence based curriculum was conducted only once for five days and it included only three teachers from each school in thirty public secondary schools. The seminar mixed both science and social science teachers and most chemistry teachers didn't get the chance to attend instead they received the second hand information on the ways of constructing student questions and lesson plans according to the requirement of

competence based curriculum as introduced in 2005 (interviewee, November 2021)

Another head from school "R" observed that:

Heads of schools and educational officers would like their teachers to attend in-service training and professional development training so as to improve their competencies but the obstacle for running such programmes arises as a result of lack of funds. Since chemistry teachers didn't get a chance to attend the in-service training, thus most of chemistry teachers lack relevant knowledge and skills when delivering chemistry lesson under CBC framework (interviewee, November 2021).

These responses are crucial and consistent with Shkak and Hassan (2020), who argue that inadequate teacher education and training for supporting quality curriculum implementation is a major problem hindering the realization of competence-based curriculum.

The researcher asked the students the questions in order to get the views if chemistry teachers who are competent influence the CBC implementation.

Table 3 Students' Responses on the Influence of Teachers' Competence on the Implementation of a Competence-Based Chemistry Curriculum n= 66

Teachers' competence influence	SA	A	N	D	SD
Teachers' experience influence Chemistry curriculum implementation	48(72.7%)	12(18.2%)	6(9.1%)	-	
Newly employed teachers influence Chemistry curriculum implementation	15(22.7%)	26(39.4%)	24(36.4%)	1(1.5%)	-

Responses from respondents who were asked these questions indicated that 48(72.7 percent) strongly agreed, 12(18.2 percent) agreed and 6(9.1 percent) were neutral. This means more chemistry teachers with high experience of teaching the subject influence the implementation of that particular subject curriculum as compared to less experienced teachers. However, this was contrary to the response from one head of public secondary schools. During the interview the head of school "Q" said:

In the school, effective implementation of competence-based chemistry curriculum does not depend on the number of years that chemistry teachers has been teaching, but on the abilities of chemistry teacher to deliver the lesson to the learners and his/her commitment to the teaching profession. However, chemistry teachers who have attended in-service training on implementation of competence-based chemistry curriculum do better than chemistry

teachers who have not attended the in-service training.

This implies that teaching for a long time does not make a teacher to be competent in implementing competence based curriculum. This is supported by Kanyonga et al. (2019) who note that in spite of the fact that the competence based education and training curriculum has been implemented for about sixteen years in technical colleges in Tanzania, there is no clear indication that trainers implement it appropriately or not. This implies that if trainers cannot implement it appropriately trainees can do worse in their process of implementing it. As such, long time of teaching does not guarantee well teaching of that curriculum.

The researcher asked students with the aim of determining the competency of newly employed teachers in implementing chemistry curriculum. Respondents who were asked this question 15(22.7 percent) strongly agreed, 26(39.4 percent) agreed,

24(36.4 percent) were neutral while 1(1.5 percent) disagreed. This implies that if newly employed chemistry teachers are well trained with all aspects of competence based curriculum from teachers' colleges and universities they can be able to implement chemistry curriculum successfully. However, this is not always the case since some teachers can leave colleges and universities without enough competence of implementing the curriculum. For example Kanyonga et al. (2019) comment that secondary school teachers do not implement the competence based curriculum appropriately because of having inadequate competence which emanates from their trainers' little awareness and understanding about the competence based approach. This is also supported by the 38 percent of respondents who were neutral and those who disagreed with the statement which is similar to the study done by Nkya et al. (2021). In their study on perceptions, challenges, and prospects in the implementation of competence-based curriculum, which notes that the majority of the teachers indicated inability in implementing competence-based curriculum since more than 70% had not attended in-service training.

5. Conclusion and Recommendations

5.1 Conclusion

With regard to the research objective, results indicated that teachers' qualifications, chemistry teachers' with higher qualifications, and chemistry teachers who have been in service for many years are expected to influence positively the implementation of competence-based chemistry curriculum. However, the study indicated that for teachers to implement a competence-based curriculum, they should have qualifications in both content and pedagogy. Because of teachers' inadequacy in qualifications in both content, pedagogy and the absence of training, teachers were unable to implement

the curriculum effectively. The main challenge hindering the provision of training for quality implementation of the curriculum chemistry subject is inadequate funds, whereby the money set aside for educational purposes is not enough to conduct in-service training.

The study indicated that teachers' qualifications, such as chemistry teachers with higher qualifications and teachers of chemistry who have been in service for many years, should have a positive influence on the implementation of the competence-based chemistry curriculum. On the other hand, the study also indicated that not every qualified or experienced teacher can implement a competence-based chemistry curriculum very effectively due to lack of appropriate methods and techniques for implementing that curriculum. Yet it was found that the implementation of a competence-based chemistry curriculum was ineffective due to lack of competence in pedagogy and, to some extent, content for most chemistry teachers.

5.2 Recommendations

In order to implement a competence-based chemistry curriculum effectively, the Ministry of Education, Science and Technology, school owners and other stakeholders should keep on giving teachers frequent capacity-building training to upgrade their qualifications. Again, if enough budgets for educational services are set and made adequate, then implementing a competence-based chemistry curriculum will be easy and possible to the greatest extent. The researcher recommends that the government, school owners, and other stakeholders provide enough funds to hire qualified teachers and facilitate in-service training regularly for effective implementation of the competence-based chemistry curriculum.

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