

## TEACHERS' PERSPECTIVES OF CHEMISTRY EXAMINATIONS FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION IN ARUSHA REGION, TANZANIA

Prosper Msambazya

Department of Chemistry, Dodoma Secondary School, P.O BOX 32, Dodoma – Tanzania

<https://doi.org/10.54922/IJEHSS.2025.1068>

*Received: 18 July 2025/Published: 25 August 2025*

### ABSTRACT

This study examined secondary school teachers' perceptions of the chemistry examinations administered as a part of the Certificate of Secondary Education Examination in Tanzania. Utilising qualitative research approach and multiple case research design, data were collected through in-depth interviews with 14 chemistry teachers teaching Form 4 across public and private secondary schools in Arusha region of Tanzania. The findings revealed that chemistry practical and theory examination papers for the Certificate of Secondary Education Examination differ in terms of validity of the items, examination administration approach, topic distribution, students' attitudes, and contents coverage during the teaching and learning process. The study found that the items for the chemistry practical and theory examinations for the Certificate of Secondary Education Examination are valid in terms of content and construct validity; however, the content validity and construct validity in the practical paper were higher than in the theory examination paper. On the basis of these findings the study recommends that the National Examinations Council of Tanzania review the Chemistry Certificate of Secondary Education Examination format, especially the topic's distribution between practical and theory examinations. The study concludes that the performance gap between chemistry practical and theory examination papers for the Certificate of Secondary Education Examinations is caused by ineffective preparation of students under competence-based curriculum, lack of regular in-service training programmes, examination coverage scope, and ineffective implementation of formative assessment.

**Keywords:** Teachers' Perceptions; Secondary Education Examinations; Chemistry Practical Examination; Chemistry Theory Examinations.

### 1. INTRODUCTION

#### 1.1 Background Information

Assessment is a backbone of educational systems that functions as not only as a measure of students' achievement but also as a reflection for teaching and learning process (Levy-Feldman, 2025). In practice, it impacts the 'how, what, how many and when' regarding the teaching and learning process (Ojukwu, 2016). This demonstrates that, effective assessment of science education including chemistry subject as a component of natural science is a vital. Remembering that the purpose of science education is to teach and assess students in a way that helps them develop into adults who will investigate the world as scientists using experiment, logic, and evidence (Alberts, 2022). According to Fuentealba (2011), assessment is a powerful tool that can enhance learning and education and if effectively conducted it improves the quality of education and supports students learning.

For a number of years, teachers' perceptions about assessment through examinations in science subjects including chemistry have been a global concern. Teachers possess varied perceptions upon examinations. In India, for instance, teachers perceive the examinations as an important measure of their teaching effectiveness (Nair et al., 2018). However, in the United States, students perceive examinations as an opportunity to demonstrate their knowledge and compete with their peers (Ibrahim et al., 2019). Across Sub-Saharan Africa, literature demonstrate that there is a significant relationship between teachers' perception of the role of examination on students' academic achievement (Lumadede et al., 2020). Moreover, In Tanzania, teachers perceive examinations as an important aspect for evaluating the effectiveness of their teaching and identifying areas where improvements could be made (Susan, 2004). However, teachers express their concern about the lack of practical skills emphasised in national examinations (TibyeHabwa et al, 2018).

In Tanzania, the Certificate of Secondary Education Examination (CSEE) serves as the primary gateway for students transitioning from Ordinary Level to Advanced Level studies or vocational training (MoEST, 2023). The candidates in Tanzania sit for two chemistry papers in the Certificate of Secondary Education Examinations (CSEE); 032/1 chemistry 1, a theory paper, and 032/2 Chemistry 2, a practical paper. The theory examination paper consists of three sections (A, B, and C) with a total of 11 items and 100 percentage total weights. In the theory paper, all questions in sections A and B are compulsory, but for section C, candidates are required to choose two questions from the alternatives given. On the other side, the practical examination paper comprises two compulsory items with a weight of 50 marks. There are three alternatives in chemistry's actual practical papers (Chemistry 2A, Chemistry 2B, and Chemistry 2C). The alternatives are provided depending on the number of candidates in a particular examination centre; a maximum of 100 candidates require an alternative actual practical paper (NECTA, 2022).

The candidates' item response analysis (CIRA) report shows that, there is an academic performance gap between chemistry practical and theory examinations for the CSEE. The reasons and solutions behind this situation require investigation. In this context, teachers' who are direct practitioners in chemistry assessment are essential in providing insight into what leads to such an academic performance gap between chemistry theory and practical examinations for the CSEE. If the situation remains unaddressed, students' performance in the chemistry theory examination for the CSEE will remain a problem. Therefore, this study sought to investigate teachers' perspectives of chemistry examinations for the CSEE which is a summative assessment at the ordinary level. Specifically, the study investigated teachers' perceptions of the two chemistry papers (practical and theory examination papers). The study explored the teachers' perceived reasons for the academic performance gap between chemistry practical and theory examinations for the CSEE.

## 1.2 Statement of the Problem

The summative assessment of science subjects, including chemistry, has become a challenge in various countries, including Tanzania. Unsatisfactory students' performance has been experienced for several years. In Tanzania, the general student's performance in science subjects is demanding, and it varies from one subject to another. The academic performance of students in Chemistry for the Certificate of Secondary Education Examination appears to be better than that of other science subjects (NECTA, 2023). However, evidence indicates that students perform more poorly in chemistry theory papers than in practical papers. A study by Mwakalinga (2021) indicated that, although Tanzania adopted a competency-based curriculum, the process of teaching and learning

in chemistry is still relying more on a conventional approach to teaching dominated by a teacher-centred approach with less emphasis on practicals. The practice has affected students' performance in chemistry examinations, particularly theory examination papers. The performance gap between chemistry practical and theory examination papers in the CSEE raises a question. The government of Tanzania, through the Ministry of Education, Science, and Technology (MoEST), has made different efforts, such as supplying teaching and learning facilities, in order to combat the challenges that affect students' performance, especially in national examinations. Despite the government's efforts, students' performance in chemistry theory examination papers is still a problem. Therefore, this study investigated teachers' perspectives of chemistry examinations for the Certificate of Secondary Education Examination in Arusha region of Tanzania.

### 1.3 Objectives of the Study

The main aim of this study was to investigate teachers' perspectives of the chemistry examinations administered under the Certificate of Secondary Education Examinations. Specifically, the study sought to investigate teachers' perceptions for the two chemistry examination papers (practical and theory) for the Certificate of Secondary Education Examination in Tanzania. The study also aimed to explore teachers' perceived reasons for the academic performance gap between chemistry practical and theory examinations for the Certificate of Secondary Education Examination.

## 2. METHODOLOGY

This study adopted a qualitative research approach with a multiple case research design. The approach enabled the researcher to study the topic in a natural setting in an attempt to gain participants' perceptions of the phenomenon (Cohen et al., 2007). The qualitative data helped to obtain in-depth information through interviewees and focus group discussions whereas the quantitative approach brought breadth to the study by supporting it with data through questionnaires (Creswell, 2014). Furthermore, it enabled a researcher to delve deeply into complex phenomena, offering rich, detailed insights into various context or situation (Yin, 2018). According to Ary (2010) multiple case study as a study by which inquiries aim at learning closely various cases at the same time as part of one study looking for a certain effect. The study was conducted in Arusha region. The region is located in the northern part of Tanzania, it lies at an approximate latitude of 3.3869° S and longitude of 36.6829° E. This study was composed of 14 chemistry teachers teaching Form 4, who participated in face-to-face interviews. In analysing the data, thematic analysis was applied whereby the researcher transcribed the data. After transcription, the data were reduced and summarised in a way that could be easily understood (Braun & Clarke, 2006).

## 3. RESULTS

The study had two research questions under investigation. In-depth interviews were conducted with chemistry teachers teaching at ordinary level. The findings are presented in accordance to the research questions.

### 3.1 Teachers Perceptions of Chemistry Examinations for the Certificate of Secondary Education Examination

Responding to the first research question that investigated teachers' perceptions of chemistry examinations for the Certificate of Secondary Education Examinations, specifically practical and theory examination papers. The findings revealed that chemistry practical and theory examination papers for the CSEE differ in terms of validity of the items, examination administration approach, topic distribution, students' attitudes. Table 3.1 provides a summary for the teachers' perceptions.

**Table 3.1**

*Teachers Perceptions on Chemistry Practical and Theory Examinations*

| Theme                               | Teachers' Perceptions                                                                                                                                  | Frequency<br>(n) | Percentage<br>(%) |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|
| Validity of the items               | The content validity and construct validity in the practical paper are higher than in the theory examination paper                                     | 10               | 71.4%             |
| Examination administration approach | The practical paper is administered by an actual approach, while the theory examination is administered by a theoretical approach (abstract in nature) | 9                | 64.3%             |
| Topics distribution                 | The Practical examination covers very few topics ( $\approx 3$ ), while theory exam covers almost the whole syllabus ( $\approx 27$ topics)            | 12               | 85.7              |
| Students attitude                   | Students perceive practical examination paper as easy and enjoyable where as students' fear theory exams due to difficulty and broad scope             | 11               | 78.6%             |

*Note:* Field data (2024)

Table 3.1 shows a critical difference in the structure and administration of chemistry practical and theory examination papers. Teachers observed that the content validity and construct validity of the practical examination are notably higher (71.4%) compared to the theory paper, since the practical items directly measure the intended skills and competencies. In terms of administration, findings suggest that the practical paper is conducted through an actual performance-based approach, whereas the theory examination relies heavily on a theoretical assessment mode (64.3%). This limits the authenticity of students' demonstration of knowledge and skills. Moreover, teachers emphasised disparities in topic coverage, where the practical paper examines only a few topics, whereas the theory paper runs almost the entire syllabus. This concern was raised by 85.7% of respondents. This imbalance was further reflected in students' attitude that the practical examination is widely perceived as easier and more enjoyable, while the theory paper induces fear and anxiety due to its difficulty and wide scope (78.6%). Therefore, these findings suggest that while practical examinations offer stronger validity and a more engaging assessment

experience, the theory examinations, despite their comprehensive coverage, disadvantage students by overwhelming them with breadth rather than enabling depth of understanding. Detailed findings under each aspect have been demonstrated in the subsequent sections.

### 3.1.1 Validity of examination items

The findings from interviews with chemistry teachers revealed that the items for the chemistry practical and theory examinations for the CSEE are valid in terms of content and construct validity; however, it was found that the content validity and construct validity in the practical paper were higher than in the theory examination paper. Through interviews, it was reported by chemistry teachers that the practical paper items are linked to real-life situations, and the candidates have the ability to provide correct responses compared to those in the theory examination. This was expressed as having an effect on the student's performance. For example, one participant was quoted that:

...the level of accuracy of the examination items in the chemistry practical and theory examination papers is high in both papers; however, the degree to which the examination items relate to the real-life situation differs significantly with respect to the two examination papers. For instance, when a candidate is examined on qualitative analysis items in a practical paper, say identifying the cations and anions available in a particular salt sample, the situation is applicable even in-home context when talking about electrical charges. This is different from theory examination items, whereby the candidates are required to explain the phenomenon in an abstract manner.

The responses from the respondents reflect the differences between the two chemistry papers in terms of construct and content validity. In the practical paper, the candidates are likely to provide the right responses to the items because the items are linked to real-life situations through actual practical, irrespective of the items in the theory examination papers.

Other respondents indicated that not all contents displayed in the CSEE format are presented in the chemistry theory examination papers of the Certificate of Secondary Education Examinations. However, for the practical paper, almost all contents informed in the CSEE format are presented in the examination.

### 3.1.2 Examination administration approach

Findings from teachers' interviews revealed that the difference in examination administration approaches on the two chemistry examinations has an influence on students' performance. The practical paper is administered by an actual approach, while the theory examination is administered by a theoretical approach. It was reported that it is easier for the students to translate knowledge and present the contents in examinations when senses are used, such as seeing, touching, or smelling. One participant reported:

It is easier for the students to translate knowledge when they use their senses. In practical papers, students can touch substances to identify their texture, see colour changes, or smell some products. For example, in rate of reaction, hydrochloric acid or nitric acid is reacted with sodium thiosulfate to produce white sulphur precipitates. It is easy for the candidate to demonstrate the phenomenon that occurred in the reaction to produce the precipitates on the practical paper, which is not possible for the theory examination.

The respondents indicated the influence of actual observation on students' performance. This implies that the administration approach of the two chemistry papers (practically and theoretically) has resulted in a range of students' performance. To uplift students' performance in the Chemistry CSEE, specifically the theory examination, it is important for the teachers to use experiments and demonstrations when teaching the concepts that are being examined theoretically. This has the role of reinforcing the concepts taught. Tesfamariam et al. (2014) highlighted that practical work leads to better learning of chemistry concepts. This is because practical work allows students to use all five senses during learning because, while they are experimenting, they can see, hear, touch, taste, and also smell the products of their experiments (Köller et al., 2015).

### 3.1.3 Topics distribution in chemistry examinations

The findings from the interviews with teachers revealed that topic distribution in chemistry practical and theory examinations for the CSEE varied significantly. For the practical paper, it was reported that only two topics are presented in the examination, and the topic of volumetric analysis is constantly repeated in the practical paper. The findings showed that teachers don't support the current practice of examining only two topics in the practical paper; instead, they had a perception of including more topics in the practical paper. During interviews, one participant reported that:

There are three topics that are usually examined in practical papers: volumetric analysis, chemical kinetics, and qualitative analysis. Out of these three topics, volumetric analysis appears in every paper. Previously, chemical kinetics and qualitative analysis were alternated in such a way that, if Chemistry 2A had chemical kinetics, then Chemistry 2B would have qualitative analysis. But in recent years, the items have been constructed from volumetric analysis and chemical kinetics for all alternatives. This makes it easy for the students to predict what will come in their paper. In my opinion, I suggest including more topics in the practical paper.

The interviewed respondent indicated that having a compulsory question provided repeatedly on one topic is an advantage for the examined candidates. This implied that students have a great chance of predicting the examination items.

Generally, the responses from the interviewed chemistry teachers revealed that the number of topics examined in the theory paper is larger compared to those in the practical paper. The findings reflected an unbalanced topic distribution between the two chemistry papers. In spite of examining a large number of topics in the theory paper, not all topics are being examined in Chemistry CSEE. Kirei and Maro (2020) advocated that it is important for the examinations to include all the topics in the curriculum because of the quality of instructional activities in the classroom, including exposure to the teaching and learning materials and coverage of the curriculum content. Proper distribution of topics in examinations demonstrates validation of the instrument representing each measured construct (Miller et al., 2013).

### 3.1.4 Students' attitude

Through interviews, chemistry teachers reported that there is a variation in students' attitudes towards the two administered chemistry examinations in the Certificate of Secondary Education Examinations. It was explained that students have a positive attitude towards practical examinations and a negative attitude towards theory examinations. It was demonstrated that a positive attitude towards practical examinations is influenced by actual performance, whereas a

negative attitude towards theory examinations is influenced by the mental construct that the paper is difficult and is accompanied by abstract items.

The respondents evidenced that students' attitudes towards the two chemistry examinations of the CSEE have impacted their performance. The nature of the examinations and their administration approach has impacted students' attitudes. According to the expectancy-value theory, a student's attitude towards examinations can be explained by two main factors: the student's expectations of success and the value that the student places on success. These include beliefs about the student's own ability for the examination, expectations for success in the examination, and the usefulness and importance of the examination (Wigfield & Eccles, 2000).

Developing a positive attitude towards chemistry examinations is essential for improving students' performance. Literatures have confirmed that attitudes are linked with academic achievements. Salta and Tzougraki (2004) found that there is a correlation between students' achievement in chemistry and their attitude. Students who have a less positive attitude almost invariably obtain lower examination marks (Bennett et al., 2001). It is a fact that the nature of the two chemistry papers in the CSEE differs, but it is important for the candidates to hold a positive attitude on both practical and theory examinations. However, students generally have a positive attitude towards practical work, resulting in a positive attitude towards practical examinations (Sneddon & Hill, 2011).

### **3.2 Teachers' Perceived Reasons on the Academic Performance Gap between Chemistry Practical and Theory Examinations for the CSEE**

The second research question of this study focused on exploring teachers' perceived reasons for the academic performance gap between Chemistry practical and theory examinations for the CSEE. On this research question, the data were collected through interviews with Form 4 chemistry teachers. The findings from interviews revealed that students' performance gap between chemistry practical and theory examinations for the CSEE is caused by four major reasons. The reasons reported by the participants were the introduction of Competency-Based Curriculum (CBC), lack of regular In-Service Training programmes (INSET), examination coverage scope, and ineffective implementation of formative assessment.

The candidates' item response analysis report (CIRA) was analysed and the results showed that, although the overall performance in chemistry is higher than that of other science subjects, the performance in chemistry theory examination is low compared to that of chemistry practical examination. Furthermore, the candidates' item response analysis report showed that, when the items are constructed from the same topic and administered in the national examinations' chemistry practical and theory papers, they are well performed in the practical paper but poorly performed in the theory paper (see Table 3.2).

**Table 3.2***Chemistry Candidates' Item Response Analysis for CSEE from 2020 to 2023*

| Year | Candidates' performance |           |         |           |        |           |
|------|-------------------------|-----------|---------|-----------|--------|-----------|
|      | Good                    |           | Average |           | Poor   |           |
|      | Theory                  | Practical | Theory  | Practical | Theory | Practical |
| 2020 | 14.5%                   | 52.8%     | 24.4%   | 36.5%     | 61.1%  | 10.7%     |
| 2021 | 2.8%                    | 69.2%     | 17.1%   | 24.3%     | 80.1%  | 6.5%      |
| 2022 | 19.9%                   | 51.8%     | 14.6%   | 37.3%     | 65.5%  | 10.9%     |
| 2023 | -                       | 53.52%    | -       | 37.61%    | -      | 8.87%     |

Source: (NECTA, 2020 - 2023)

From Table 3.2, the analysis was done for the topic of Chemical Kinetics, Equilibrium and Energetic and the analysis revealed the anomaly whereby, chemistry candidates performed poorly in chemistry theory examinations than in the chemistry practical examinations. The reasons behind this situation have been explained in the next subsections.

### 3.2.1 Introduction of competence-based curriculum

The findings from interviewed chemistry teachers revealed that students' preparation after the adoption of competency-based curricula is still a challenge. The participants reported that students are not prepared enough to accommodate the items provided under CBC. This has influenced the low performance of students in the theory papers. Further findings revealed that the theory paper contains some questions that are abstract in nature and are supposed to be examined practically. The following response from a chemistry teacher indicated that the nature of the questions has influenced the performance gap between the two Chemistry papers.

...after the introduction of CBC, it has been a challenge for the students to perform the theory examination items under the application of knowledge. The students still prepare themselves to answer the contents taught, but not the competence. Teachers' understanding of CBC is also still a challenge; Chemistry teachers do not prepare students enough to answer the questions under CBC. Some Chemistry teachers are still teaching and assessing by traditional methods, which affect the student's ability to accommodate the questions under CBC.

The response from the participant evidenced that there is a challenge to the adoption of a paradigm shift from content-based curriculum to competency-based curriculum. The candidates seem to have a deficiency in assessment mode in light of CBC. This has created a performance gap between practical and theory examinations.

The importance of developing competence among students reflects the expectancy-value theory that students' achievements are associated with the dual importance of competence-related beliefs and values in explaining children's motivation (Studer & Knecht, 2016). Developing competences in students specifically during the teaching and learning process has a great influence on students' achievements in their examinations, including Chemistry CSEE.

### 3.2.2 Lack of regular in-service training programmes

The interview findings from chemistry teachers revealed that regular in-service Training programmes (INSET) are not conducted regularly to update chemistry teachers with the new changes in the education system. It was reported that teachers do not update themselves through

continuing professional development, and in-service training programmes are rarely provided by the government. This has made chemistry teachers lag behind on the new approaches to teaching, which in turn affects students' performance in Chemistry CSEE. For example, one of the interviewed Chemistry teachers said:

I have now had 7 years' experience, but it was only this year that I went for the INSET programme, which was done for 5 days. I found the training very interesting; if such programmes could be done regularly, teachers would be knowledgeable about the new changes in the education system, such as CBC.

The responses from the interviewed respondents indicated that professional development programmes are provided rarely, however, they have an essential role in preparing teachers to adopt new educational changes, which in turn will improve students' academic performance.

### 3.2.3 Examination coverage scope

The findings from interviews with chemistry teachers revealed that a range of content coverage between Chemistry practical and theory examinations in the Certificate of Secondary Education Examinations has created a performance gap. It was reported that the theory paper has a larger content coverage scope compared to the practical paper. This has caused students to perform lower in the theory paper and created a performance gap between the two chemistry examinations for the CSEE. One participants said:

The difference in students' performance between the practical and theory papers in Chemistry is caused by a variation in the distribution of the examined contents between the two papers. The theory paper has a wider coverage of contents compared to the practical examination. This creates difficulties for the students in mastering the contents. Eventually, this causes poorer performance in the theory examinations than in the practical examinations, creating a performance gap. (Interviewed, Chemistry Teacher T1, School A, 2023).

The response from chemistry teacher implied that the performance gap between practical and theory papers are caused by a range of contents between the two chemistry papers. This has made it possible for the students to make intensive revisions for one paper regardless of the other. The response from the interviewed teacher reflected that even student's preparedness on the two chemistry papers varies because of a range in the examination content coverage. This indicated that the scope of examination content coverage created a difference in performance between Chemistry practical and theory examinations.

### 3.2.4 Ineffective implementation of formative assessment

The findings from interviews revealed that formative assessment is not implemented effectively. It was reported that, in Chemistry, there are different experiments under each topic and subtopic, but most Chemistry teachers do not teach them because they are not examined practically in NECTA examinations. The ignored experiments are usually designed into theory items in NECTA examinations. This makes it difficult for the students to attempt the questions. Most of the interviewed chemistry teachers acknowledged that effective formative assessment is not properly conducted by teachers. For example, one of the interviewed chemistry teachers, disclosed:

In my opinion, the performance gap in chemistry examinations is caused by the ineffective implementation of formative assessment. This is because there are different activities that need to be assessed in classroom situations, but they are

ignored by teachers. There are questions that are provided in the theory paper that were to be taught in class experiments. Therefore, it is better to have a follow-up that will require teachers to discuss with students all the activities and experiments found in the syllabus.

The response from chemistry teacher above has reflected on the tendency of Chemistry teachers to select some activities available in the CSEE syllabus for teaching and assessing. The situation has impacted the students' performance, especially in theory examinations. These responses indicated that formative assessment is not effectively conducted, which in turn affects students' performance.

#### 4. DISCUSSION

The finding links the validity of examinations with students' achievements. Zamanzadeh et al. (2015) explained that, during the setting of an examination, content validity is an important factor to be observed and begins in the earliest development of an instrument or examination. Literature has evidenced that a valid examination has a direct linkage with the good performance of candidates (Newton, 2006). Likewise, Miller et al. (2013) explained that the content validity should validate every item in the examination and should contain all measures to be examined. This is due to the fact that examination content validity is about the relevance of the representation of the whole syllabus (Yaghmaei, 2003). Therefore, for the Chemistry CSEE, the findings of this study have informed us that not all contents presented in the syllabus are being examined, especially practically oriented activities. The need to ensure content validity for the two Chemistry papers is of great significance.

Correspondingly, the findings resonate with the study of Tibyehabwa (2018), which assessed the content validity of the National Examination Council of Tanzania (NECTA) Chemistry practical examination for secondary education and found that approximately 81.7% of the interviewed Chemistry teachers perceived the existing national Chemistry practical examination as invalid, compared to 18.3% of teachers who thought the examination was valid. Challenges of content validity in national examinations are not unique to the Tanzanian context. Zeina (2010) in Lebanon investigated the content and substantive evidence of validity of the Lebanese National Examinations (LNE) in Chemistry National Examination (CNE) for Grade 12 Life Sciences Section over three years for Chemistry certification and found that the LNE do not measure the content of the Grade 12 Chemistry Curriculum (G12CC) adequately enough. In line with the findings of this study and the corroborated studies, validity in examinations is very important, especially in summative examinations.

Literatures reflect that students perform higher on practical items due to the influence of actual observation. A study by Mwangi and Kibui (2015) on the effect of chemistry practicals on students' performance in public secondary schools found that there was a positive relationship between the use of chemistry practicals and learners' performance in Chemistry. This means that students are likely to perform better when they practice examination items. Again, Ogunleye (2014) investigated the relationship between students' prerequisite knowledge and attitudes towards Chemistry practicals and their performance and found that prerequisite knowledge had strong positive relationships with students' performance ( $r = 0.53$ ). This informs us that it is important to shift from theoretical teaching and assessment to practical teaching and assessment, especially in science subjects including chemistry.

Moreover, Akani (2015) investigated the roles of the laboratory in students' academic achievement in chemistry and found that the use of the laboratory helps to develop scientific attitudes in the students towards the learning of Chemistry, especially practicals. This evidence shows that students have a positive attitude towards practicals, which in turn results in a positive attitude towards practical examinations. The findings contradict the report produced by the Kenya National Examinations Council (KNEC) (2013), which reported that, while the number of students taking Chemistry in secondary schools has been high, their performance in practical examinations is lacking. The report indicated that the weakness shown by the students was a lack of serious exposure to practical work (KNEC, 2013). This informs us that, although students may have positive attitudes towards practical work and practical examinations, it is important to expose them to practical activities regularly in order to maintain their interest and attitude. For the theory examinations, which are viewed with a less positive attitude, measures can be taken to uplift students' attitudes, particularly on abstract items. This can be done by providing regular demonstrations and hands-on activities in classroom sessions so as to reinforce the concepts examined theoretically, which will in turn improve students' performance.

Furthermore, the findings of this study corroborates that of Komba and Mwandaji (2015), who investigated the issues surrounding the implementation of CBC in Tanzania and found that 86% of the interviewed teachers did not have a proper understanding of the objectives of CBC. Again, the study of Chacha and Onyango (2022) on the challenges faced by teachers in implementing CBC in Tanzanian public secondary schools revealed that there is a shortage of qualified and competent Chemistry teachers to enhance the implementation of CBC. However, Makunja (2016) recommended that teachers be given the opportunity to participate in the formulation or review of the curriculum. Therefore, it is evidenced that the performance gap of students for the two Chemistry papers in the Certificate of Secondary Education Examinations is influenced by the ineffectiveness of preparing students to attempt questions under CBC.

Consistently, Susana (2004), in her study on the effect of continuing professional education on science teachers' competence, advocated that professional development for teachers was limited, inconsistent, and uneven and did not meet the modern standards of science education. Together with the corroborated studies, imply that INSET programmes are not properly and evenly conducted, creating an impact on students' academic performance, especially when adopting new education reforms. In light of these findings, Makunja (2016) recommended that the MoEST has the role of ensuring favourable conditions for teachers in order to practice their teachings effectively, which includes embarking on INSET programmes.

Nevertheless, Tibyehabwa and Fulment (2018) found that there is a gap in examination content coverage between Chemistry practical and theory examinations, whereby practically examined topics covered a lower percentage than theory examinations. This implies that there is a challenge to the balance in examination content coverage between Chemistry practical and theory examinations in the CSEE, creating a performance gap. In line the findings of this study, teachers and students have to cooperate in implementing formative assessment to improve performance, particularly in theory examinations. Hattie and Temperly (2007) explained that formative assessment with appropriate feedback is the most powerful moderator in the enhancement of achievement. Studies have evidenced that formative assessment significantly increases the academic achievement of students (Wylie & Ciafalo, 2010). Thus, it is important for chemistry teachers to implement effective formative assessment activities. According to Kariri et al. (2022) very few science teachers implement formative assessment effectively. However, it is important

to remember that effective formative assessment requires the seriousness of both teachers and students. Teachers have to facilitate the formative activities, and students have to take more serious approaches to learning and work harder.

## REFERENCES

- Akani, O. (2015). Laboratory Teaching: Implication on Students' Achievement in Chemistry in Secondary Schools in Ebonyi State of Nigeria. *Journal of Education and Practice*, Vol (6) 30 pp206-213 2015.
- Alberts, B. (2022). *Why science education is more important than most scientists thinks*. *Journal of European Biochemical Societies*, 596(2), 149-159. <https://doi.org/10.1002/1873-3468.14272>
- Chacha, J., & Onyango, D. (2022). Challenges Faced by Teachers in Implementing Competence-Based Chemistry Curriculum in Public Secondary Schools in Nyamagana District, Mwanza, Tanzania. *JRIIE*, Vol.6(1), 2022. <https://jriiejournal.com/wp-content/uploads/2022/03/JRIIE-6-1-034>.
- Dawadi, S., Shrestha, S., & Giri, R. (2021). Mixed methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*, 2(2), 25-36 DOI: <https://doi.org/10.46809/jpse.v2i2.20>
- Fuentealba, C. (2011). The role of assessment in the student learning process. *Journal of Veterinary Medical Education*, 38(2), 157–162. <https://doi.org/10.3138/jvme.38.2.157>.
- Hattie, J., & Temperley, H. (2007). The power of feed-back. *Review of Educational Research*, 77(1), 81–112.
- Ibrahim, M. E., Al-Shahrani, A. M., Abdalla, M. E., et al. (2019). *The effectiveness problem-based learning in Acquisition of Knowledge*. *Acta Informatica Medica*, 26(2), 2019.
- Kariri, K. A., & Cobern, W.W. (2022). *Investigating high school science teachers' readiness for implementing formative assessment practices*. EURASIA.
- Kenya National Examination Council, (2013). *Kenya Certificate of Secondary Examination Annual Report*. Nairobi.
- Komba, S.S., & Mwandangi, M. (2015). Reflections on the Implementation of Competence Based Curriculum in Tanzanian Secondary Schools. *Journal of Education and Learning*; Vol. 4, No. 2; 2015.
- Levy-Feldman, I. (2025). *The role of assessment in improving education and promoting educational equity*. *Education Sciences*, 15(2), 224. <https://doi.org/10.3390/educsci15020224>.
- Lim, W.V., Lim, L.R., Tan, R.Y., & Soh, A.S. (2020). *Government trust, perceptions of COVID-19 and behaviour change: cohort surveys, Singapore*. Bulletin of the World Health Organization. <https://pubmed-ncbi-nlm-nih-gov>.
- Lumadede, H. U., Shiundu, J. O., & Poipoi, M. W. (2020). Teachers' perceptions of the role of examination on students' academic achievement in public secondary schools, Kakamega County, Kenya. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 25(5, Series 9), 35–52. <https://doi.org/10.9790/0837-2505093552>.
- Makunja, G. (2016). Challenges facing teachers in implementing competence-based curriculum in Tanzania: The case of community secondary schools in Morogoro Municipality. *International Journal of Education and Social Science*; 3(5): 30 – 37.

- Millar, R. (2013). *Analysing practical activities to assess and improve effectiveness: The Practical Activity Analysis Inventory (PAAI)*. York: Centre for Innovation and Research in Science Education. University of York. Available <http://www.york.ac.uk/depts/educ/research/ResearchPaperSeries/index.htm>.
- Mwangi, J. T., & Kibua, A.W. (2015). *Effect of chemistry practicals on students' performance in chemistry in public secondary schools of Machakos and Nairobi counties in Kenya* [Doctoral dissertation, University of Nairobi].
- Nair, M. K., Leena, M. L., George, B., Sunitha, R. M., Prasanna, G. L., & Russell, P. S. (2018). A panchayat level primary-care approach for adolescent services. *Indian Journal of Pediatrics*, 79 (Suppl. 1), s6-s10.
- NECTA. (2022). *Certificate of secondary education examination format. National Examination Council of Tanzania*. Ministry of Education, Science and Technology.
- Newton, P., Baird, J., Goldstein, H., Patrick, H., & Tymms, P. (2006). *Contextualizing the comparability of examination standards*, In (Eds.). London: QCA.
- Ogunleye, B. O. (2014). Prerequisite knowledge and attitudes to chemistry practical as correlates of students' performance and practical skills in senior school chemistry. *Niger-Delta Journal of Education*, 6 (1 & 2), 80-88.
- Ojukwu, M. O. (2016). *Perception of students on causes of poor performance in chemistry in external examinations in Umuahia North Local Government of Abia State*. *International Journal of Education & Literacy Studies*, 4(1), 67–74. <https://doi.org/10.7575/aiac.ijels.v.4n.1p.67>.
- Saunders, M.N. (2012). *Research methods for business students*, Pearson Education India.
- Susana, J. N. (2004). *The effect of continuing professional education on science teachers' competence at secondary schools in Tanzania* (Thesis). University of Georgia.
- TibyeHabwa, R.P., Revelian, T., & Fulment, A. (2018). Examination content validity: Case study of national examination chemistry practical with in-service chemistry teachers in Dodoma (M), Tanzania. *International Journal of Advanced Research and Publications*, 3(7), 2018; 31-38.
- TibyeHabwa, R.P., Revelian, T., & Fulment, A. (2018). Examination content validity: Case study of national examination chemistry practical with in-service chemistry teachers in Dodoma (M), Tanzania. *International Journal of Advanced Research and Publications*, 3(7), 2018; 31-38.
- Wylie, E. C., & Ciafalo, J. (2010, April). *Documenting, diagnosing, and treating misconceptions: Impact on student learning*. Paper presented at the meeting of the American Educational Research Association Conference, Denver, CO.
- Yaghmaei, F. (2003). *Content validity and its estimation*. <https://ir-library.ku.ac.ke/handle/123456>.
- Zamanzadeh, V., Rassouli, M., Abbaszadeh, A., Majd, H. A., Nikanfar, A., & Ghahramanian, A. (2015). Details of content validity and objectifying it in instrument development. *Nursing Practice Today*, 1(3), 163-171.

---

**AUTHOR'S BIOGRAPHY**



**Prosper Msambazya** is a science educator in Tanzania. He has been working in various government and private institutions in Tanzania as a science educator in secondary schools and a tutor in teachers' college. His teaching career runs from a Diploma in Science Education at Klerruu Teachers College, a Bachelor of Education in Science at the University of Dodoma, and a Master of Education in Science Education at the University of Dar es Salaam, and he is currently a Doctoral student at the Central China Normal University (China). His areas of interest in research are science education, educational technology, and professional development, as well as curriculum and instruction.