Students' Perceptions on the Use of Computer Simulation in Teaching and Learning of Non-metals Topic in Bagamoyo District Secondary Schools, Tanzania

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Abstract: *There have been significant changes in the educational system around the world, and the use of various modern technologies has been implemented to influence students' academic achievement positively. However, this is not the case for most Tanzanian secondary schools. Therefore, this study investigated students' perceptions of the use of computer simulations in the teaching and learning of the non-metal topic at Bagamoyo District Secondary Schools in Tanzania. The study used student questionnaires as a data collection tool. The study involved 245 respondents. The findings revealed that the use of computer simulations significantly improved student learning. Further, findings reported that simulations helped simplify understanding of abstract scientific concepts, making lessons more interactive and effective. These results underscore the value of integrating technology into science education, particularly in enhancing conceptual understanding. The study concludes that computer simulations are a powerful tool for improving chemistry learning in secondary science education. It recommends that educational institutions adopt computer simulations as part of the curriculum, infrastructure gaps to guarantee equitable access to technology.*

Keywords: *Non-metals, Chemistry subject, Simulations, Motivation, Engagement.*

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1. Introduction

Significant improvements have been made to the educational system worldwide, and the usage of many contemporary technologies has been used to improve students' academic performance and course completion (Dorji, 2020). Teachers at the school level instruct students who will likely live in a technologically advanced society in the future (Assi, 2019). It is anticipated that computer technology will permanently alter how teachers and students learn (Antipolo, 2019). In response, chemistry educators have developed strategies and materials to encourage students to understand the topic and change their perspectives on it. Chemistry is difficult for students since they have to deal with several representations at once, such as experiments, formulas and calculations, graphs, and conceptual explanations (Hamdani, 2022).

Letychevskyi (2020) discovered that students' lack of experience in scenario analysis and problem-solving is causing teachers to struggle while teaching chemistry. Nowadays, there are a lot of ICT apps available that motivate students to actively engage. One of these is computer simulation, which is especially crucial for chemistry education (Sausan, 2020). Because computer simulations offer advantages over traditional schooling, they are dynamic, computer-generated models that theoretically depict elements, phenomena, and other aspects of the real world (Woithe, 2020).

According to research on the general efficacy of computer simulations in teaching chemistry in Turkey, computer simulations affect students' academic accomplishment (Assi, 2019). Hamdani (2022) found that secondary school students who received computer-assisted learning had a higher achievement rate than the control group, which received traditional methods of instruction. Comparable research conducted in Europe shows that computer simulations are a useful tool for raising students' level of learning the chemistry subject (Saidin, 2024).

There are a few studies conducted in Africa on the use of computer simulations to educate and study non-metallic subjects (Simunza, 2019). However, the limited published study findings generally support the conclusions of scholars throughout the world. Nonetheless, the outcomes of the few published studies typically corroborate the findings of researchers worldwide. Musafir-Chazot (2019), for instance, discovered that students who were exposed to computer-assisted learning outperformed those who used traditional methods in scientific courses (Ocloo, 2021).

Early efforts to integrate and enhance technology in Tanzanian education date back to the 1980s (Mwakapemba, 2024). Following this, the Ministry of Science, Technology, and Higher Education (MSTHE) and the Tanzania Commission for Science and Technology (COSTECH) were established. One of the focuses of a national ICT plan that was created in 2003 was education (Beichumila, 2022).

The use of technology in the teaching and learning process enhances students' comprehension, particularly in an intangible subject like non-metals found in the chemistry course, in Tanzania, where there is a shortage of educational resources (Kibriya, 2021). In Tanzania's coastal area, the Bagamoyo district is distinguished by its traditional legacy and increasing focus on the advancement of education. However, scientific concepts from science courses like chemistry are difficult for traditional teachers to convey. As demonstrated by Mfaume (2019), who discovered that the learning environment caused many secondary school students to fail to grasp science topics.

According to studies, using computer simulations to improve students' comprehension of challenging ideas from science courses like chemistry through interactive experiences and visual representations is one of the key methods (Khan & Wanyama, 2020). With the use of these resources, students may more effectively investigate atomic structures, visualise chemical processes, and understand the characteristics of non-metals. As a result, this study evaluates the motivation and engagement of both teachers and students with computer simulation in the teaching and learning of non-metal topics in the Chemistry course.

1.1 Statement of the Problem

Chemistry is one of the science subjects taken in secondary school. Numerous science-related courses, such as those in medicine, pharmacy, and other fields, need it. Nevertheless, nationwide student achievement in chemistry is poor (Mwantimwa, 2021). According to CSEE statistics from the previous three to five years, chemistry student performance has been low nationwide (Mwantimwa, 2021). For the past three years, the chemistry pass rate has been below 50%; in 2021, it was 42%, in 2020, it was 45%, and four years before, in 2019, it was 48% (Mwantimwa, 2021).

According to Mwantimwa (2021) and Mbiti (2021), a number of issues, such as students' attitudes towards Chemistry, the availability and utilisation of resources, the unfavourable learning environment, and inadequate teaching approaches, are responsible for this poor performance. Investigating cutting-edge tactics that might raise student involvement and advance their comprehension of chemical subjects is crucial to addressing some of these issues. The current study findings link a number of factors, including the students' motivation towards learning Chemistry, the availability and utilisation of resources, the unfavourable learning environment, and the inefficient teaching approach, to the students' poor achievement (Mbiti, 2021).

Despite the importance of computer simulations in teaching in secondary schools and the strategies developed by the government and other stakeholders, as formulated in the secondary education ICT policy of 2007, studies revealed that several schools are not efficiently implementing computer simulations in teaching and learning particular science subjects (Mwantimwa, 2021). Pima (2019) emphasizes the importance of promoting the integration of visual aids, such as computer simulation, to enhance teaching effectiveness and student learning experiences. In Bagamoyo Secondary Schools, students face challenges in understanding and retaining the concepts

related to non-metals in their chemistry curriculum (Pima, 2019).

This difficulty in learning Chemistry is reflected in the students' motivation to learn Chemistry and engagement during lessons on this topic. Computer simulations are known to enhance the learning experience by providing interactive and visual representations of complex scientific concepts. They allow students to explore and manipulate variables, observe outcomes, and develop a deeper understanding of the subject matter. Despite contributions made by previous studies on the effect of computer simulations on the teaching and learning outcomes related to non-metal topic, there is still a gap in understanding how students are motivated towards learning Chemistry. Thus, prompting the question: what are Students' Perceptions on the use of computer simulation in teaching and learning of non-metals topic in Bagamoyo District Secondary schools?

2.2 Theoretical Framework

Multimedia Learning Theory (MLT) is used in this work. Dr. Richard Mayer presented the Multimedia Learning Theory (MLT) in 2005. It developed in response to the need to look at how multimedia technologies impact learning and the expanding trend of technology acceptance in the classroom. The fundamental tenet of MLT is that words alone do not promote deeper learning as much as words paired with pertinent images. The idea is extremely applicable to modern educational methods that include technology in the learning process because it emphasises the necessity for information representation to be in harmony with human cognitive architecture. Three fundamental assumptions form the basis of MLT: the active processing assumption, the restricted capacity assumption, and the dual-channel assumption. According to the dual channel assumption, people process visual and aural information through different channels.

Overload can impede learning since these channels have a limited processing capacity, as indicated by the limited capacity assumption. Finally, the active processing assumption postulates that learners actively choose, arrange, and incorporate information to achieve meaningful learning. Research such as that conducted by Mayer and Moreno (2003) shows that effective multimedia teaching resources enhance students' comprehension of challenging subjects. In a similar vein, Tarmizi and Bayat (2012) showed how effective multimedia tools are at improving understanding of abstract scientific topics.

These findings above support the notion that, when used carefully, multimedia resources greatly improve learning results, especially in disciplines like chemistry. MLT offers a strong framework for assessing and maximising the use of multimedia resources to improve chemistry education's learning outcomes. This prompts the study's question: How do teachers' and students' engagement and motivation with computer simulations influence the teaching and learning of non-metal topics in Chemistry?

2. Literature Review

This section provides details about the use of technology, computer simulations in particular, empirical evidence, theoretical underpinnings, and the research gap.

2.1 Empirical Evidence

2.1.1 Students' Engagement and Motivation in Learning

Oladejo and Adesoji (2020) looked at the opinions of secondary school students in Nigeria about the use of computer simulations in chemistry classes. Using a quasi-experimental study methodology, the researchers worked with 150 students, tracking their performance levels and participation in class before introducing simulations. According to 85% of respondents, students gave simulations a good evaluation since they helped simplify difficult concepts like electron configurations and periodic patterns. When learning through simulations, the students demonstrated increased desire and active classroom involvement. According to research findings, 30% of students encountered technical issues with simulation tools due to both software bugs and power outages. The full potential of simulations in Nigerian education can only be realised with well-maintained facilities and trained teacher support.

Nkurunziza's (2024) study revealed the opinions of lower secondary students on the use of computer simulations in chemistry classes. This study looked at how students' chemistry learning experiences are impacted by interactive computer simulations. Through surveys of 160 people chosen based on their aim, the researchers collected both quantitative and qualitative data using a convergent design as part of their mixed-method approach. According to research findings, the study participants reported that their learning experience with ICS became less difficult while also improving. Students gave ICS's teaching and learning process usability a 79% high ease level and showed 77% strong positive attitudes towards its use, with 76% of them expressing a positive willingness to use ICS for chemistry education. However, 39% of students gave ICS a negative evaluation because they lacked basic computer competency.

Mwangi and Kariuki (2020) examined how secondary school students in Kenya responded to teaching chemistry about non-metals via computer simulations. 180 students in all took part in the study, which used a quantitative methodology using questionnaires. According to research findings, students who used simulations were able to understand abstract non-metal concepts concerning their characteristics and reaction patterns with an 80% success rate. According to the statistics provided, most students preferred simulation-based training since they regarded these simulations to be both entertaining and useful. Two primary problems hindered student engagement: half of the students showed inadequate technical ability, and 35% of students were reported to lack computer access. The findings of the study highlighted the necessity of better training-related technology access, as these elements increase student engagement and academic performance.

Because of the profound change they achieved by putting it into practice, Maro (2020) discovered that integrating ICT with conventional instructional delivery methods was applied to students' learning and was highly helpful. The study's findings suggested creating training curricula that incorporate subject matter and pedagogical principles with more than simply call-by-call instruction and ICT proficiency. Better instruction and more student involvement may follow from this (So SBC, 2019). The study's conclusions are closely related to the use of computer simulations in education because training teachers in ICT guarantees that they have the resources needed to implement such technology in the classroom, encouraging students to adopt ICT and enhancing learning in science courses that may be thought of as more challenging because it provides students with the means to observe abstract concepts (Cocitus, 2013).

2.1.2 Teachers and students' perceptions of learning a non-metal topic

A study by Zhang et al. (2021) in China looked at how students felt about learning the periodic patterns and chemical characteristics of non-metallic elements using computer simulations. 210 secondary school students in all took part in the study and engaged with a virtual chemistry lab to explore the properties of oxygen groups and halogen elements. The results demonstrated that students found the simulations enjoyable, especially when it came to visualizing complex atomic interactions and reactions that might be challenging to demonstrate in real lab settings. Compared to textbook explanations, several students stated that animations helped them retain electron configurations, electronegativity, and reactivity patterns. Additionally, because they could change variables, repeat experiments, and have their work assessed right away, students loved the simulations' hands-on component. Additionally, the study found that students who had previously struggled with chemistry now had a more favourable opinion of the subject. However, some students had expressed dissatisfaction about their inability to use digital gadgets and their inability to receive instructor instructions during simulation sessions.

Adebayo and Omotayo (2020) investigated how secondary school students in Nigeria perceived the use of computer simulations to acquire non-metal chemical concepts, such as the structure of nitrogen, sulphur, and chlorine. Using ChemCollective simulations in the classroom, 180 students from three urban schools participated in the study, which was conducted using a quasi-experimental methodology. When learning about unseen phenomena, students overwhelmingly hailed the simulations as eye-opening. Students in groups would remark that the simulations helped them comprehend a variety of topics, including the oxidation state and ion production.

According to the study, students were able to comprehend abstract ideas like valence electrons and non-metal bonding through the use of three-dimensional representations in the digital world. Additionally, because the simulations' gamified framework motivated and enabled greater participation, the students were more involved. According to the poll, over 85% of participants responded that they preferred learning through simulations over traditional classroom instruction. Students who were allowed to perform experiments in a risk-free setting also appreciated it, and virtual laboratories played a key role in this, as they eliminated the anxiety associated with handling hazardous substances. The study concluded that when teaching complicated chemistry topics in impoverished, resource-constrained institutions, students believe computer simulations have the potential to be a useful supplement to the conventional teaching approach. However, other students highlighted issues with internet access and inadequate computer knowledge, and they suggested a more structured approach to integrating digital literacy into the curriculum. Overall, students considered computer simulations to be engaging and beneficial for learning abstract chemistry ideas, primarily because they helped them move past rote learning and towards conceptual comprehension.

3. Methodology

3.1 Study Area

Bagamoyo District in the Coast Region of Tanzania serves as an ideal research site for this study because of its distinct educational environment and the difficulties in bringing scientific courses to underprivileged communities

(Mfaume, 2019). The district is a sample site to investigate the efficacy of computer simulations in teaching non-metals since it includes a mix of urban and rural secondary schools with differing degrees of access to resources and technology (Mfaume, 2019). The significance of this research site is further supported by the existence of several secondary schools actively working to enhance science instruction using creative methods. Additionally, Bagamoyo's proximity to educational institutions and technology centres makes it more feasible to integrate and access cutting-edge teaching resources, guaranteeing the study's interventions are put into practice (Mfaume, 2019).

3.2 Research Approach

A quantitative approach through the use of a questionnaire was used in this investigation. According to Park et al. (2020), a quantitative approach facilitates the gathering of quantitative (numerical) data. Understanding, characterizing, and forecasting the nature of a phenomenon was the aim of collecting this quantitative data.

3.3 Study Participants and Sampling Procedures

Yamane's (1967) method, which is intended to establish an optimal sample size for large populations while retaining a set accuracy level, was used to select the sample size for this investigation. Considering a precision level of 0.05 and a total population of 630 Form Three chemistry students from the chosen public secondary schools. As a result, 245 students in all were chosen for the study using basic random selection. By guaranteeing that each qualified student has an equal opportunity to participate, this approach reduces selection bias and improves the validity and dependability of the results.

3.4 Data Collection Tool and Procedures

Questionnaires were used in this study to gather data. In this regard, a questionnaire was used in this study to explore the students' impression of and activities in learning non-metals using computer simulations. Then, after, lesson plans for this study were crafted from the Tanzania secondary school Chemistry syllabus. The content was on a non-metal topic, and it consisted of their physical properties, uses, and characteristics. Every lesson comprised of lesson objectives, an introduction to the lesson content, computer simulation activities, and comprehension checks. Each lesson started with an introductory segment presenting lesson content and educational targets. Students participated in computer simulations that showed key concepts. Testing of student comprehension was integrated throughout the lesson to

confirm active student engagement and measure understanding levels. This teaching framework builds student knowledge by connecting ordered goals with dynamic session tools, along with systematic feedback systems. Lastly, a questionnaire was administered to find out their views on the use of computer simulation in their learning.

3.5 Validity and Reliability

The reliability of the scales used in this study, as assessed by Cronbach's Alpha, demonstrates acceptable to excellent internal consistency. For the "engagement and motivation" scale, comprising seven items, the Cronbach's Alpha of 0.7 indicates good internal consistency, suggesting that the items within this scale are closely related.

The measurement of what the research instruments are supposed to measure is guaranteed by validity. Expert evaluation, in which seasoned education academics and policymakers evaluated the questionnaire and interview guide for appropriateness and relevance, guaranteed content validity (Yin, 2018).

3.6 Data Analysis

In this study, descriptive statistics summarized findings related to students' engagement and perceptions, offering a broad view of their reactions to these teaching computer simulations. This provided comprehensive insights into the effectiveness of computer simulations in enhancing students' comprehension of non-metals.

3.7 Ethical Considerations

The ethical considerations of harm reduction, anonymity, and consent were judged suitable in this investigation. The study obtained a research approval letter from St John's University of Tanzania, and later this was sent to the Bagamoyo district office for the permit to collect data in Bagamoyo government schools, to conduct research in schools.

4. Results and Discussion

This section gives an account of demographic characteristics of respondents and their values, and later findings on motivation and engagement using computer simulations during learning.

4.1 Demographic Information

4.1.1 Gender of students

According to the data, 105 (44.1%) of the 238 students polled were female, and 133 (55.7%) were male. This indicates that there were slightly more men than women among the participants, indicating a well-balanced gender distribution. Based on this distribution, the results on students' engagement and motivation in learning the non-metals topic via computer simulations were inclusive and provided information on how male and female students react to the use of digital teaching resources.

Table 1: Gender of students

Sex of students	Frequency	Percent
Male	133	55.9
Female	105	44.1
Total	**238**	**100.0**

Source: Field data (2025)

Gender has been shown to have an impact on the adoption and effectiveness of technology-enhanced learning. To cite one study, Adebayo and Oyekunle (2021) found that when computer-assisted instruction was used in secondary schools in Nigeria, both male and female students performed better academically in Chemistry, but female students showed somewhat higher levels of motivation. In a similar vein, a study on animation-based chemistry lessons in Zanzibar by Mussa and Said (2022) found that both boys and girls found the lesson to be equally enjoyable. They also found that there was a difference in preferred learning styles but no discernible gender difference in content knowledge.

As a result, this study's proportionate gender representation supports a thorough evaluation of the effects of computer simulation on various students based on gender variance in Tanzanian secondary school settings. The study concludes that when computer simulations are used to teach chemistry, gender has no discernible impact on students' academic achievement. Academically, both male and female students gain from the use of technology, exhibiting enhanced comprehension of non-metals.

4.1.2 Age of Students

Table 2 presents the age distribution of the students who participated in the study, highlighting their age range and frequency to understand the demographic characteristics relevant to the research.

Table 2: Age of Students

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	238	15.00	19.00	16.2941	.82014
Valid N (listwise)	238				

Source: Field Data (2025)

With a mean age of around 16.29 years and a standard deviation of 0.82, the students' ages varied from 15 to 19. Students at Tanzania's ordinary-level secondary schools, especially those in Forms Three and Four, fall into this age bracket. They are required to understand more complicated chemistry ideas, such as those involving non-metals. The students' comparatively small age range indicates that they are at a similar stage of cognitive development, which is perfect for evaluating the effects of a teaching strategy like computer simulations.

Similar results were noted by Kitta and Tilya (2010), who highlighted that when the right teaching resources are used, Tanzanian secondary school students in this age range are cognitively ready to interact with abstract scientific ideas.

Furthermore, because they are more receptive to technology-enhanced learning settings, Mtebe and Raisamo (2014) noted that ICT-based interventions, such as simulations, work best when presented to students in this age range.

According to the results, most respondents are in a critical stage of developing their capacity for abstract thought, which can be aided by simulations that provide an interactive and visual depiction of complex chemical processes. This perspective is supported by Nyamubi and Mlowosa (2020), who show that the use of simulations improves the conceptual learning experience and involvement of students in the age group in secondary schools.

Similarly, Ngussa and Mbuti (2023) commented that age-appropriate simulation tools were found to dramatically boost student engagement and recall of Chemistry content in research done in Tanzanian secondary schools. Therefore, the age range in this study provides a strong foundation for evaluating how simulations affect the learning efficacy of Tanzanian secondary school students at the regular level.

4.2 Students' Perceptions of their

Engagement and Motivation using a Computer Simulation

Students' perceptions about their interest and involvement in class while studying the non-metal subject using computer simulations are shown in this section. Students' perceptions of the value of simulations in raising their level of engagement, involvement, and comprehension throughout the chemistry session are compiled in Table 3.

Table 3: Students' perceptions of learning non-metal using computer simulation

Response Category	I perform better in Chemistry after simulations	Willing to use tech-based methods	Simulations make me more curious	Tech integration improves learning	I participate more using simulations	I enjoy Chemistry with simulations
Strongly Disagree	22 (9.2%)	22 (9.2%)	22 (9.2%)	24 (10.1%)	22 (9.2%)	24 (10.1%)
Disagree	23 (9.7%)	72 (30.3%)	46 (19.3%)	72 (30.3%)	48 (20.2%)	23 (9.7%)
Agree	74 (31.1%)	73 (30.7%)	94 (39.5%)	72 (30.3%)	49 (20.6%)	72 (30.3%)
Strongly Agree	119 (50.0%)	71 (29.8%)	76 (31.9%)	70 (29.4%)	119 (50.0%)	119 (50.0%)
Total	238 (100.0%)	238 (100.0%)	238 (100.0%)	238 (100.0%)	238 (100.0%)	238 (100.0%)

Source: Field Data (2025)

4.2.1 Performance in Chemistry after Simulations

Among the 238 students from A and B Secondary Schools who responded, 22 (9.2%) severely disagreed, 23 (9.7%) disagreed, 74 (31.1%) agreed, and 119 (50.0%) highly agreed that utilising computer simulations improves their performance in chemistry. This suggests that 193 of the students, representing over 81%, reported positive academic impacts due to simulation-based learning. The results suggest that by providing interactive and visual information that clarifies abstract ideas, computer simulations greatly improve students' comprehension of the non-metallurgical topic in chemistry.

These findings are consistent with those of Oladejo and Adesoji (2020), who discovered that 85% of Nigerian students agreed that simulations were useful for comprehending difficult chemistry topics like periodicity and electron configurations. The usefulness of such technology was also demonstrated by Mwangi and Kariuki (2020), who discovered that Kenyan students learning non-

metal through simulations had an 80% success rate. Additionally, 77% of Rwandan students had a favourable opinion of the usage of simulations in chemistry classes, according to Nkurunziza (2024), who also noted that simulations increased clarity and decreased academic difficulties. These results provide credence to the idea that using simulations in chemistry classes improves student performance, particularly when teaching difficult subjects like non-metals. Therefore, to reduce the quality gap in scientific education, governments should support simulation-based teaching methods in Tanzanian classrooms.

4.2.2 Willingness to Use Tech-Based Methods

Regarding their readiness to adopt technology-based approaches in Chemistry classes, 22 (9.2%) of the 238 students severely disagreed, 72 (30.3%) disagreed, 73 (30.7%) agreed, and 71 (29.8%) highly agreed. A substantial 94 students (39.5%) opposed the use of tech-based solutions, even though 144 students (60.5%) indicated that they would be eager to adopt them. This

1279

contradictory reaction suggests that although most people are amenable to using technology, obstacles such as a lack of digital skills, problems with access, and insufficient support from teachers may prevent wider adoption. In a similar vein, Mwangi and Kariuki (2020) observed that although students had a strong preference for simulations, their preparedness was impacted by the fact that 50% lacked digital skills and 35% lacked access. According to Nkurunziza (2024), 39% of respondents still had trouble using ICT because they lacked the necessary computer skills, even though 76% of respondents were open to using computer simulations. According to Oladejo and Adesoji (2020), 30% of students had technological difficulties, indicating that well-furnished classrooms and qualified faculty are essential for simulation success. According to Bagamoyo's results, Tanzanian secondary schools must upgrade their ICT infrastructure and skills to integrate tech-based learning resources into scientific instruction more widely and successfully.

4.2.3 Simulations Make Students More Curious

The finding revealed that 22 (9.2%) of respondents highly disagreed, 46 (19.3%) disagreed, 94 (39.5%) agreed, and 76 (31.9%) strongly agreed that simulations increase their curiosity about chemistry among the 238 students from Bagamoyo and Asinali Secondary Schools who participated in the study. The statistics suggest that simulations are essential for fostering students' intellectual curiosity while they study non-metals, with 170 students (71.4%) agreeing or strongly agreeing. Simulations with animated and interactive features probably encourage deeper participation and inquiry, which is important in scientific disciplines.

The researchers came to the conclusion that using simulations increased the motivation and engagement of Nigerian students, which is in line with the theory put forward by Oladejo and Adesoji (2020). Similarly, Nkurunziza (2024) found that the simulations made studying easier and more enjoyable for Rwandan students, which increased their interest in chemistry-related subjects. Following the simulations, Mwangi and Kariuki (2020) discovered that the abstract chemistry ideas became more approachable and thrilled the Kenyan students. These findings imply that using simulations to teach chemistry in Tanzanian classrooms can have a revolutionary impact by encouraging curiosity-driven learning, particularly when it comes to abstract ideas like non-metals, and subsequently improving student engagement and performance.

4.2.4 Participation Increases with Simulations

While just 70 respondents (29.4%) disagreed or strongly disagreed, the majority of respondents (168, or 70.6%)

agreed or strongly agreed that using simulations improves class engagement. The results indicate that simulations successfully convert passive learners into active participants in chemistry classes, with 70.6% of students reporting improved involvement. In Tanzania, where big class numbers sometimes restrict individual student interaction, this is very helpful. Senyagwa (2021) tackled this problem and highlighted how ICT tools, such as simulations, may increase classroom engagement even in congested settings. Similarly, Oladejo and Adesoji (2020) discovered that during simulation-based courses, Nigerian students engaged in more active participation. Additionally, Nkurunziza (2024) noted that simulations made the classroom more participatory, promoting enquiries and group projects. According to the research, computer simulations for non-metal subjects can improve learning in Tanzanian classrooms by encouraging more active and diverse student participation. This emphasises how important it is to integrate simulations widely to reduce the disparities in participation brought on by teacher-centered instruction and infrastructure constraints.

5. Conclusion and Recommendations

5.1 Conclusion

According to this study, when computer simulations were used in chemistry classes on non-metals, students showed a high degree of engagement. Teachers emphasized that, in contrast to the conventional chalk-and-talk approach, the use of simulations made classes livelier and more participatory. The simulations made it possible to visualize chemical processes and atomic structure in real time, which piqued students' interest in reading and learning new material and introduced them to inquiry-based learning. Additionally, the students responded effectively by actively participating in the simulations, working in groups, and playing active roles in class assignments. Their enthusiasm for chemistry as a topic grew as a result of their active engagement, which also changed classroom behaviour.

5.2 Recommendations

Secondary schools should methodically integrate computer simulations into their chemistry curricula to increase students' interest in them. Structured teacher training programs that focus on developing proficiency with simulation software and interactive teaching techniques should facilitate this integration. Teachers will get the practical skills they need to utilise simulations effectively through workshops and ongoing professional development sessions. To guarantee active and significant involvement in classes, students should also be taught to the

fundamental features of simulation tools during orientation sessions.

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