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Enhancing the teaching of science practicals in Tanzanian public secondary schools: A mixed-methods assessment of challenges

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Abstract

Laboratory work is essential for increasing students' knowledge of science and improving their hand skills. However, in many secondary schools in Tanzania, especially in the Nyamagana District, teachers find it challenging to apply the curriculum's emphasis on conducting experiments in class. This study aimed to determine the challenges that prevent the effective use of science practicals in secondary education. In this study, questionnaires were administered to 64 science teachers, interviews were conducted with eight school heads, and lessons and laboratory areas were directly observed. Data analysis was done using descriptive statistics and thematic analysis. The difficulty in teaching science appears to have increased due to limited equipment, a shortage of materials, large student groups, high workloads, inadequate professional development, and a lack of laboratory technicians. To date, most institutions have not utilized virtual labs or other digital tools. For this reason, many educators teach students mainly through theory, making lessons diverge from the curriculum's goals. According to the study, three key factors are necessary for meaningful progress: upgrading infrastructure, providing staff with better training, and updating the curriculum to reflect reality and utilize technology more effectively. This research offers valuable insights applicable to Tanzania and other resource-constrained areas in the region.

Keywords: *Practical science education; laboratory instruction; teacher professional development; curriculum implementation; STEM education*

INTRODUCTION

Developments in science and technology in a nation largely depend on the quality of science education taught at the basic levels. In Tanzania and other similar countries, secondary school science education is viewed as crucial for preparing individuals to pursue careers in industry, technology, and science. Participation in laboratory activities is critical to science education because it provides students with the opportunity to practice and learn essential skills and concepts (Shivolo et al., 2024). When students participate in practical activities, they know how theories are applied and how science works in the real world (Boateng & Maroloma, 2024).

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Although the Tanzanian government has made efforts to improve science education by updating the curriculum, establishing laboratories, and assigning more science teachers to public secondary schools, the delivery of hands-on practical lessons in these schools remains insufficient (Nguru, 2021). Teachers struggle because they lack helpful tools and proper preparation, and students often have limited opportunities to interact with science beyond school texts. Practical work in science involves activities where students observe, test, or modify materials, most often in a laboratory setting (Lin et al., 2025). There is universal agreement that it plays a vital role in teaching science. As students engage in practical work, they gain knowledge and sharpen their skills in investigating and resolving problems (AbiDoye et al., 2022). A good science class helps students develop an interest in science, teaches them how to think scientifically, and prepares them for learning science (Gericke et al., 2023).

Tanzanian secondary schools are expected to incorporate practical work into science courses, including physics, chemistry, and biology. Practicals administered by the National Examinations Council of Tanzania (NECTA) are factored into the final score of students. This demonstrates the government's intention to adhere to real science teaching. However, multiple studies and on-the-ground realities show a significant gap between plans and reality (Mkimbili & Kayima, 2022). Therefore, students learn many scientific principles from books but often less about actually conducting experiments. This issue extends beyond technology to include systems. Collectively, poor laboratory tools and instruments, insufficient teaching supplies, crowded curricula, teachers who are not adequately trained, and insufficient help from administrators make it challenging to conduct practicals successfully. Rural schools often suffer from underfunding, teacher shortages, and poor maintenance. Consequently, students in these areas are likely to experience poorer learning and academic outcomes, perpetuating educational disparities and limiting access to careers in science (Spaan et al., 2023). This study examined the challenges teachers encounter in implementing practical science work in public secondary schools in Nyamagana District, Tanzania. This study aims to fill a noticeable gap in the field by identifying problems that hinder science teachers from carrying out their teaching duties effectively.

Literature review

Learning science worldwide is increasingly encouraged to be collaborative and student-driven, and practical work is recognized as a crucial element of STEM education (Lestari et al., 2023). Other countries, such as the United Kingdom and Singapore, with the aid of adequate laboratories, revised curricula, and sustained professional learning, ensure that practical science experiences are part of daily instruction (Osborne & Dillon, 2023). In India, new low-cost science kits and mobile laboratory vans have been developed to bring science education to under-resourced schools and address infrastructure issues (Patel et al., 2022). Similarly, in Brazil and the rest of Latin America, governments have formed alliances with the private sector to enhance science laboratories and provide ongoing teacher training (Silva & Campos 2021). Despite such achievements in most countries, long-standing issues persist in developing nations. In Ethiopia, as noted by Chala and Walabu (2019), a lack of material resources and adequately trained teachers prevents laboratory work from being carried out despite the curriculum providing otherwise. Similarly, AbiDoye et al. (2022) pointed out that, in Nigeria, the absence of equipment and unfavourable conditions in laboratories do not allow students to conduct experiments successfully. These international comparisons highlight that although practical science education requires integrated investment in facilities, human resources, and favourable policies, constraints still hinder its

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realization in resource-limited environments such as Tanzania and others in sub-Saharan Africa.

This issue is also being raised in Tanzania. Tibyehabwa et al. (2017) stated that only some schools had laboratories and the ability to meet the practical requirements of science subjects. The researchers also discovered that many students first used a laboratory during their national examinations, which hurt their learning. In addition, Mokoro (2020) stated that the lack of appropriate laboratory facilities in the Arumeru District made it challenging to implement the competence-based curriculum in practice. Many texts emphasize the importance of teachers' actions in ensuring the success of practical work. Mudaly and Premdutt (2017) noted that experienced and knowledgeable teachers are crucial for supporting students in science subjects. However, many African contexts often offer teachers little opportunity to learn laboratory teaching practices. Furthermore, there are limited in-service training options, and most do not align well with what teachers encounter in the classroom (Mutende et al., 2019).

According to Likuru and Mwila (2022), studies reveal that Tanzanian teachers face a substantial workload, a lack of support, and uncertain guidelines for practical teaching. Practical knowledge is usually not the primary concern for teachers, as theory is often easier to teach in classrooms lacking resources and aligns with the types of questions on exams. This highlights the need for support at the system level, such as through professional training, changes in management, and more straightforward rules. Although studies have been conducted on the problems involved in practical science work in Tanzania, most have been confined to a single aspect, such as resources, curriculum, or teachers' capacity. Few studies have utilized a combination of data from teachers, students, and school leaders, along with laboratory observations and reviews of relevant documents. In this study, data from various sources were combined to thoroughly examine this problem, address the challenges, and relate empirical evidence to theoretical assumptions that explain why scientific work is sometimes hindered. The study recommends targeted educational interventions tailored to the specific situation in Tanzania, which can be adapted for use in other low-resource educational settings in sub-Saharan Africa.

If students cannot engage in hands-on science in school, it affects many areas beyond the classroom (El Masri et al., 2023). This makes it difficult for students to gain admission to advanced science programs, lowers their interest in scientific careers, and ultimately delays the nation's efforts in science and technology (Ioannidou et al., 2022). For the local community, schools are meant to train graduates who can perform their jobs well, utilize innovation, and stand out to employers. Currently, the system does not equip students with the practical skills required by industry, healthcare services, and scientific organizations. Members of the community, such as parents and education officials, are concerned about students' achievements in science and the underutilization of school laboratories. Improving science education is important not only for its subjects but also to meet society's requirements for excellent education, career openings, and country growth (Nurlaela, 2023). This study addresses the challenges faced by science teachers in conducting practical work in public secondary schools.

Many schools in Tanzania prioritize classroom instruction over practical science work (Tibyehabwa et al., 2017). Although these policies are well-intentioned, numerous systemic challenges persist that hinder their effective implementation. This study closes a significant gap in the literature by examining obstacles and enablers from multiple perspectives. Drawing on evidence, theory, and societal needs, it presents ideas relevant to reforming science education policies.

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This study is rooted in the Experiential Learning Theory, developed by Kolb (1984), who states that effective learning is possible when a person has firsthand experience and applies reflection. This theoretical perspective aligns with international and national conclusions presented in the literature review, indicating that practical laboratory work is essential for students to acquire scientific competencies and bridge the theory-practice gap. In the UK, Singapore, India, and Latin America, investments in laboratory facilities and teacher preparation have strengthened the value of experiential learning in achieving quality science education. In contrast, the researchers' findings in Tanzania, Nigeria, and Ethiopia suggest that, in cases where resources are limited and teachers lack support, experiential learning opportunities are reduced. Therefore, teaching becomes superficial, and theory based.

Additionally, the concept of Social Constructivism, developed by Vygotsky, serves as the theoretical basis of the current study, as it helps conceptualize practical work in laboratories as a form of social learning, where collaboration with peers and guidance from the teacher can advance the process of knowledge building and problem-solving (Makamu & Ramnarain, 2022). This theoretical view aligns with the literature on the importance of having well-prepared teachers and conducive environments to facilitate meaningful interaction during practical work. Collectively, the theories provide a consistent framework through which experiences and social learning both of which are expected to be supported by practical science teaching are directly hindered by systemic barriers reported in the literature, including inadequate infrastructure, insufficient professional development, and policy-practice gaps. This conceptual congruence guided the analysis of the study's findings and recommendations on how to enhance practical science teaching in Tanzanian secondary schools.

METHOD

Research design

This study employed a parallel mixed-methods approach, allowing for the concurrent collection and integration of quantitative and qualitative data. This design enabled a robust triangulation of the findings, combining numerical trends with contextual insights from the participants.

Participants and sampling technique

The participants included science teachers and school heads from public secondary schools in Nyamagana District, Tanzania. A stratified sampling approach was employed, in which schools were selected based on their location and size to ensure a representative sample. Within the selected schools, purposive sampling was used to identify science teachers, followed by random selection to minimize bias. Heads of schools were selected using purposive sampling. The final sample consisted of 72 participants, comprising 64 secondary science teachers and eight school heads (SHs). The sample size was determined using Yamane's formula for known populations.

Data collection instruments and procedures

Three main instruments were used to gather data: (1) questionnaires, (2) semi-structured interviews, and (3) laboratory observations. Data collection was carried out between April and May 2025. The classroom observations took place during regular science classes, and each observation lasted 45 -60 minutes. Interviews took the form of semi-structured interviews, lasting 30 to 35 minutes per school head, and were conducted in silent offices on school premises.

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Science teachers were asked to complete questionnaires that included both closed and open-ended questions to share their opinions on resources, teaching methodologies, and the alignment of the curriculum. Expert reviewers assessed the questionnaires for content validity and clarity, and the questions were tested in two pilot schools to verify their reliability. Interviews were conducted with the school heads, and all the interviews were recorded. The recordings were then transcribed in full for the study. Observations were made during regular science instruction to check how practical activities were being conducted. A checklist was created to record the presence of laboratory equipment, student participation, teaching style, and time management during the session.

Data analysis

Quantitative data were analyzed using SPSS Version 25.0. Frequencies, percentages, and means were used to summarise the survey results from teachers. Qualitative data from the interviews and observations were analyzed thematically using NVivo, following Braun and Clarke's (2006) six-stage procedure: familiarisation, coding, developing themes, reviewing them, defining themes, and reporting. It helped to recognize similar and different approaches to supporting practical work in various situations.

Ethical considerations

Ethical approval for this study was obtained from the UNICAF University Research Ethics Committee and the Tanzania Commission for Science and Technology (COSTECH). The aim of the study was explained to all participants, and each participant provided consent by signing a consent form. All personal details were kept confidential and fully anonymized throughout the study. All data were adequately protected and used only for educational purposes. They adhere to the standards of ethical behavior in educational research (Hamblin, 2024).

RESULTS AND DISCUSSION

Results

The key findings of this study were based on a triangulation process that utilized questionnaires, interviews, and laboratory observations. The results explain how the findings relate to the main goals of science education in public secondary schools in Tanzania. The key findings identified the challenges that hinder the effective implementation of practical science work are presented as follows:

Resource-related challenges

The analysis revealed that poor laboratory facilities were a primary obstacle to effective practical work in the sciences. It was found that a large number of teachers and students were unable to use properly equipped laboratories with basic science equipment. These findings were also confirmed in the laboratory, where it was observed that students were sometimes taught theory instead of being engaged in practical activities because the necessary resources were unavailable. Table 1 shows the teachers' responses to the challenges they encountered in accessing laboratory resources.

Table 1. Teachers' ratings of resource-related challenges (n = 64)

	1(N)	2(N)	3(N)	4(N)	5 (N)	Mean
Inadequate laboratory equipment	5	10	18	18	13	3.42
Shortage of consumable materials	7	7	21	16	13	3.34
Lack of safety equipment	4	12	13	16	19	3.57
Overall mean						3.44

Key: *1 = No challenge, 2 = Slightly challenge, 3 = Moderate challenge, 4 = Highly challenge, 5 = Very high challenge*

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Table 1 (adapted from Sanjito, 2025) presents the findings of science teachers' views on resource-related problems in conducting practical work. Among the indicators examined, the lack of safety equipment was considered the most significant problem, with a mean score of 3.57, indicating its importance to many teachers. Inadequate laboratory apparatus (mean = 3.42) and insufficient supplies (mean = 3.34) were identified as moderate to high-level challenges. The average score of 3.44 suggests that there is typically an insufficient amount of the required resources when schools deliver practical science lessons and

School heads, when interviewed, said that inconsistent funding and a lack of a budget for maintenance where the main reasons why laboratories were poorly maintained. One of the school heads pointed that,

> *"Our laboratory it was never fully equipped. We are overly dependent on theoretical teaching, which narrows the practical knowledge of students".*

This underscores permanent underfunding of laboratory resources provisioning. According to the results, the hypothesis that practical science work relies on infrastructure resources is correct, as noted by previous research (Makamu & Ramnarain, 2022, Akuma & Gaigher, 2021) about the hardships that underdeveloped countries face in this area.

Teacher workload, class size, and lack of technical support

The way practical science is handled in the classroom is often influenced by the environment in which teachers work. Those teaching science in Tanzanian public secondary schools typically face crowded classrooms, especially in biology subjects, and require thorough preparation for teaching. They work with limited equipment and manage various non-teaching tasks. Owing to these challenges, teachers struggle to plan, lead, and oversee practical lessons.

Researchers observed that in schools where practical biology lab classes are held, teachers manage classes with a large number of students, which does not allow each student to learn and stay safe during the lab. The heads of schools reported that both the teacher-student ratio and the number of science teachers were higher in rural areas than in urban areas. Because there are not enough teachers, those who are employed must spend most of their time teaching, leaving little time for practical lessons. *One head of a school pointed out,*

> *"Our science teachers are overburdened they teach large classes, and they are supposed to do the laboratory work by themselves, which is dangerous, particularly when dealing with chemicals."*

This understanding highlights how the lack of sufficient staffing and extreme teacher workload combine to affect safe, practical work adversely. The lack of technical support adds to the difficulty of the problem. In most schools, there were not enough trained laboratory technicians, so teachers were responsible for preparing, running, and managing the science laboratories. This leads to an increased workload, which poses safety risks, particularly during experiments involving chemicals and glassware.

Curriculum overload and time constraints

Survey results revealed that many teachers believe the curriculum provides too much material, which prevents sufficient time for hands-on learning. Teachers reported that they placed more emphasis on theory studies to ensure both exam practices and syllabus completion. During the observations, it was apparent that on many occasions, the scheduled practical lessons were planned as lectures.

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Teachers revealed that adhering to national examination rules pressured them to teach mainly content-based subjects. Therefore, despite access to laboratory equipment, the format and speed of the classes prevented practical use. The research reveals a significant disparity between the curriculum's written content and its practical implementation. Despite the requirements of hands-on activities, the curriculum gets diluted due to limited time and heavy evaluation requirements. Figure 1 shows how teachers felt about having sufficient time for practical lessons in their timetable.

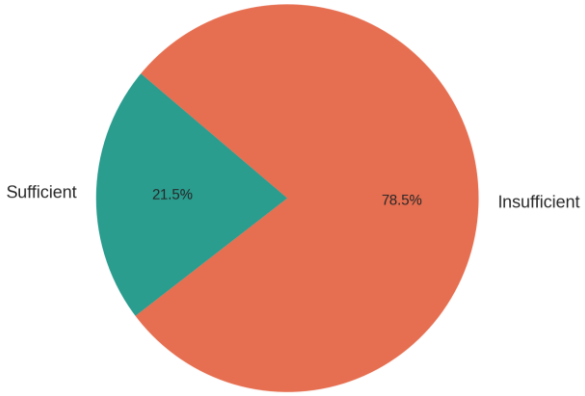

Figure 1. The proportion of schools reporting adequate time allocation for practical sessions (n = 64)

Figure 1 shows that only 21.5% of secondary schools allocate sufficient time in their timetables for practical science sessions to be conducted. Alternatively, 78.5% of schools mentioned that they have insufficient time, meaning that teachers sometimes have to cut back or skip practical lessons to fit them into the allocated hours. Due to time constraints, students are unable to explore topics through hands-on methods, and teachers struggle to conduct experiments in detail (Nemadziva et al., 2023). Therefore, practical science lessons are likely to be less effective for most students.

Limited professional development

According to the survey results and observations, many teachers did not feel prepared or confident teaching practical science topics. Many teachers did not receive in-service training on laboratory work, running experiments, or safety measures during the past two years. The data for teachers trained in managing practical work are presented in Figure 2.

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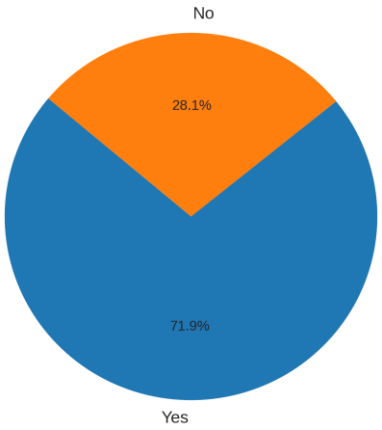

Figure 2. Teachers trained in managing practical work (n = 64)

According to the information, 71.9% of the science teachers received practical work training, whereas 28.1% did not. This gap necessitates that schools provide ongoing professional development to all teachers, ensuring that they are equipped to use science equipment safely in educational settings. Filling this gap is crucial for improving science education. Although teachers were knowledgeable, they stated that handling exercises in class was a challenge due to the class size, the absence of assistants, and the need to employ updated teaching methods to facilitate learning. This suggests that teachers' skill level is a significant factor in the success of practical tasks. Figure 3 represents the frequency of training for science teachers.

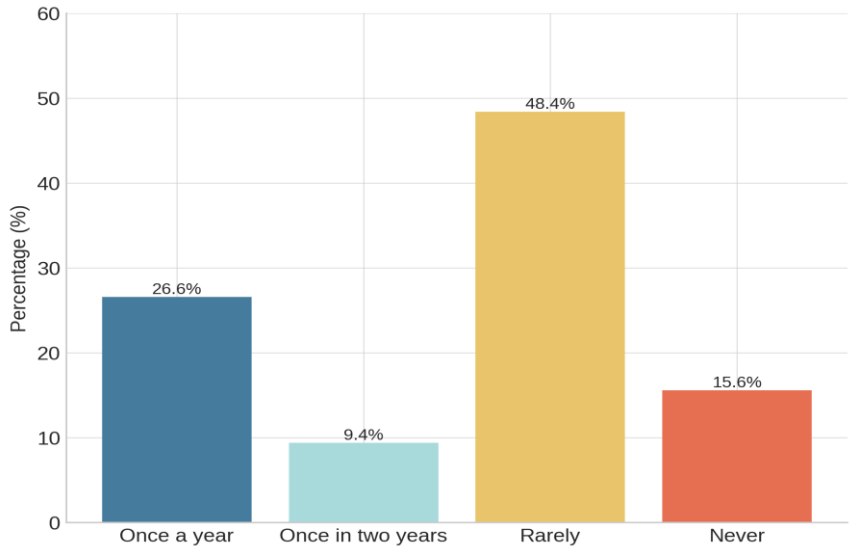

Figure 3. Frequency of teachers' training (n = 64)

It appears that while 26.6% of teachers receive training once a year, fewer than 10% receive training once every two years. Almost half (48.4%) of the teachers reported receiving training only occasionally, and 15.6% of the teachers had never received any training. This suggests that, although a few teachers receive regular training, most teachers do not receive sufficient learning support and may face challenges in conducting safe and effective science classes. Teachers need to receive regular training to develop their skills and continue

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learning the newest teaching approaches. The findings support the Human Capital Theory by demonstrating that immediate investments in teacher training have a direct impact on teacher performance. Additionally, the triangulated method demonstrates that capacity building should be valued equally with providing learning materials during science education reform.

Minimal use of ICT in practical science instruction

ICT is known to improve scientific instruction in limited-resource areas; however, our study found that the use of these technologies was limited. Research has revealed that most teachers do not engage in digital simulation activities or utilize online laboratories. According to the interviews, a shortage of access to computers and the Internet, as well as low training levels, hindered the integration of Information and Communication Technology (ICT).

Laboratory observations showed no situations where ICT was added to or replaced practical work. This highlights the potential for schools to close resource gaps by utilizing digital tools. Although it is recognized elsewhere that ICT could improve science learning, this study notes that it was not used in the sampled cases in Tanzania, leading to new challenges for future work.

Discussion

The results of this study in table 1 provides a clear picture of the various challenges that limit the success of practical science work in Tanzanian public secondary schools. They agreed with studies that have identified a lack of resources, untrained teachers, excessive curriculum to cover, and a lack of support for teachers as significant problems in teaching science (Tibyehabwa et al., 2017). These results align with those of previous studies in Nigeria (AbiDoye et al., 2022) and Ethiopia (Chala & Walabu, 2019), indicating that a lack of proper science laboratories and shortages of supplies pose significant hurdles to hands-on science lessons.

These findings align with Kolb's (1984) experiential learning theory, which posits that direct experiences are essential for effective learning. Due to a lack of essential materials, it is challenging for students to engage in practical science activities, which directly hinders the advancement of science education. The findings support Vygotsky's views by revealing that students have limited opportunities to discuss science and solve problems. The workload of teachers and the high number of students in each classroom were problems in rural areas. This finding is consistent with that of Mwakalinga (2021), which indicates that science educators face significant challenges. Furthermore, due to the shortage of laboratory technicians identified in our interviews, teachers must take on additional responsibilities, which may compromise safety in laboratory classes. This follows Mudaly and Premdutt's (2017) argument that practical laboratory work relies on having good support from staff and institutions.

A further key finding from interview and observations is that, ICT is only being used to a limited extent in practical science classes. While past work has concluded that digital simulations and virtual labs can be used alongside traditional approaches (Osborne & Dillon, 2023), the current study found no evidence of this in Tanzanian public schools. It demonstrates that we are missing an opportunity to connect physical resources with digital solutions, making it clear that digital literacy classes and increased investment in infrastructure are urgently needed.

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From the observation and interview results, It was found that curriculum goals and what occurs in classrooms are very different. While schools do practical work daily, they also feel pressure to follow strict guidelines for teaching the material from the textbooks that support national exams. This means that teachers must place more emphasis on teaching for exams rather than practical activities, as Mokoro (2020) also observed. It reveals that policies should be revised to ensure that classroom lessons align with the goals stated in the curriculum.

Although many science teachers undergo some professional training, few find it useful, as it often occurs infrequently. Only a quarter of teachers receive training each year, and almost half do not receive any training at all. This weakens Human Capital Theory, proposed by Becker (1964), which purports that supporting teachers' growth in knowledge and skills directly affects how well students perform in class.

Policy and practice implications

This study offers important insights for policymakers, school administrators, teacher educators, and science advocates in resource-constrained areas. The findings show that addressing issues with practical science work in public secondary schools involves coordinating multiple efforts rather than employing separate strategies. Main priorities must include better laboratory technology, a steady supply of necessary items, and the hiring of trained technicians to assist science teachers with various laboratory duties. It is necessary to adjust the current curriculum so that students experience more practical classes and apply what they learn through activities and observations. The study emphasizes the importance of regular, high-quality professional development specifically designed to enhance laboratory methods, safety procedures, and innovative teaching strategies. Additionally, the use of virtual laboratories and online simulations in schools, currently lacking in sampled schools, can help rural and economically disadvantaged schools address resource shortages.

Applications of the findings from Tanzania extend to other Sub-Saharan African countries and similar schools that face similar obstacles in science education. Problems like these are experienced in developing countries worldwide, not just in Tanzania. In this way, the research provides valuable knowledge for the country as well as global movements working towards the SDG 4 goals in science education. This study recommends changes supported by research and educational experience, which facilitate informed decision-making and guide future adjustments.

Limitations of the analysis

This study employed a triangulated method, including surveys, interviews, and classroom observations, to enhance the credibility of the results. The limitations of this study are; First, because the research was conducted in the Nyamagana District, the validity of the study across other districts and the Tanzanian education system, in general, might be questionable because regional differences in funding and management practices of schools can significantly influence the reality of practical science work (Mkimbili & Kayima, 2022). Second, the use of self-reported data may have exposed the research to social desirability bias, where respondents underreported or exaggerated difficulties in meeting what they thought was expected of them (Braun & Clarke, 2006). Third, the cross-sectional data do not allow tracking the changes in the resource allocation, practices of the teachers, or outcomes of the students over time, which is also mentioned by Osborne and Dillon (2023), who state the importance of longitudinal research designs in studying the long-term effects of interventions in science education.

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The research also failed to examine the scores of students in examinations and laboratory tests, which would have strengthened the empirical connection between practical science instruction and academic performance, as Chala and Walabu (2019) advise in related situations. Lastly, there were few classroom observations and the potential presence of observer effects, which indicates that not all observed practices might reflect the dynamics that take place in a typical classroom, a point also noted by Mudaly and Premdutt (2017). These gaps must be addressed in future research through the use of larger, more diverse samples, longitudinal designs, triangulation of self-report measures with objective measures of student performance, and unobtrusive observation methods that can provide a more accurate picture of genuine teaching practices. Such improvements will enhance the understanding of how practical science education can be sustained in Tanzania and similar contexts.

Minimizing the limitations

Future research can be enhanced by implementing several key measures. If the study were expanded to cover many areas in Tanzania, it would lead to a more complete national assessment of the science practical work that is done. Studying interventions, training programs, or policies using a long-term approach could lead to valuable insights about their effects on teaching and student learning. Taking into account standardized test scores and practical exam grades would enable the assessment of how students perform practical work and their learning effectiveness. Bringing in independent observers for classroom observations could reduce the likelihood of bias and increase the reliability of the results. Such improvements would strengthen the proof that can guide decisions about science education by policymakers, teachers, and others interested in this topic.

CONCLUSION

The study was conducted to identify the challenges associated with practical science work in Tanzanian public secondary schools, with a focus on the Nyamagana district. According to the findings, while the teaching of practical science is mandated nationally and valued by official policies, the system still faces significant barriers to its proper implementation. Some of the main challenges include inadequate laboratory resources, a lack of necessary equipment and safety gear, insufficient training for in-service teachers, a shortage of laboratory technicians, and limited use of ICT to support classes. Moreover, students face these problems when they have an overly extensive curriculum, are not provided with enough practice time, and the school emphasizes theoretical learning without offering hands-on experience. Notably, there are significant differences in the quality of science teaching and materials between schools, which can hinder the achievements of STEM education and equal opportunities in the country.

It is recognized that improvement can only come through multiple initiatives, such as steady support of infrastructure, updating curricula, implementing set policies, and development of teachers' skills. Utilizing digital tools can bridge significant practical gaps, particularly in areas where resources are scarce. Addressing these challenges will enable science students to achieve more and contribute to the country's development through science and innovative ideas. As a result, the Ministry of Education, school leaders, teacher training institutions, and development agencies need to join forces. To address the challenges surrounding practical science instruction, we must collaborate to ensure that lessons incorporate evidence and hands-on discovery.

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AUTHOR CONTRIBUTION

The first author prepared the research instruments, reviewed the literature, collected and analyzed the qualitative data, and drafted the discussion of the study's findings. The second author, in the role of research supervisor, provided helpful advice throughout the study, including proofreading and manuscript organization. Both authors reviewed the manuscript for accuracy.

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