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Laboratory Resource Availability and Utilization in the Teaching and Learning of Integrated Science in Public Junior Schools in Kajiado West Sub-County, Kenya

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Abstract

This study examined the relationship between the availability and utilization of laboratory resources and the teaching and learning of Integrated Science in public junior schools in Kajiado West Sub-County, Kajiado County, Kenya. The study adopted a convergent mixed-methods design. The target population comprised 83 public junior schools, 83 head teachers, 216 Integrated Science teachers, and 2,992 Grade 9 learners. A sample of 8 schools, 8 head teachers, 16 Integrated Science teachers, and 299 Grade 9 learners was selected. Of the 299 learners sampled, 259 participated in the study, representing an 86.6% response rate. Schools and learners were selected through stratified and simple random sampling, respectively; teachers were selected through census sampling, while head teachers were purposively selected. Data were collected using teacher and learner questionnaires, head-teacher interview schedules, and an observation schedule. Quantitative data were analysed using descriptive statistics and Pearson product-moment correlation, while qualitative data were analysed thematically. The findings indicated that laboratory resources were associated with positive teaching and learning experiences in Integrated Science. Teachers and learners reported that laboratory resources enhanced active engagement, motivation, application of scientific knowledge to real-life situations, retention of knowledge and skills, collaboration, creativity, and perceived performance. Pearson correlation analysis showed a statistically significant positive relationship between laboratory resource availability and teaching and learning, $r = .224$, $p < .001$, *and between laboratory resource utilization and teaching and learning,* $r = .481$, $p < .001$. *However, laboratory resources were generally inadequate and their utilization was limited. Only 6 (37.5%) teachers reported that their schools had operational science laboratories, while 2 (12.5%) considered the available resources adequate for all learners. Laboratory resource availability and utilization were positively associated with teaching and learning of Integrated Science, although inadequate facilities, limited resources, insufficient financial support, and weak infrastructure for virtual laboratories constrained practical science instruction. Strengthening laboratory infrastructure, providing adequate instructional resources, enhancing teacher professional development, and expanding appropriate virtual laboratory opportunities could support more effective practical learning in public junior schools.*

Keywords: laboratory resources; resource availability; resource utilization; Integrated Science; junior schools; Kenya

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1. Introduction

Science education is central to the development of scientific literacy, problem-solving skills, technological innovation, and the human capital required for socio-economic development. Within science education, practical work provides learners with opportunities to engage directly with scientific phenomena through observation, experimentation, measurement, manipulation of materials, and interpretation of evidence. Such experiences can connect conceptual understanding with practical skills and enable learners to relate scientific knowledge to real-world contexts (Oliveira & Bonito, 2023). A systematic review of practical work in science education found that its major educational value lies in combining hands-on practical skills with conceptual understanding, although the benefits depend substantially on the quality and manner in which practical activities are implemented (Oliveira & Bonito, 2023). Similarly, laboratory-based inquiry can provide opportunities for learners to engage in scientific practices such as investigation, argumentation, evidence-based reasoning, and communication of scientific ideas (Eymur & Çetin, 2024). These findings suggest that the availability of laboratory resources is important, but their educational value ultimately depends on whether teachers and learners can access and effectively utilize them.

Laboratory work is therefore not simply a matter of providing physical facilities and equipment. Effective laboratory-based science learning requires appropriate resources, purposeful practical activities, teacher guidance, and opportunities for learners to actively participate in the learning process. Gericke et al. (2023), in a systematic review of research on laboratory work in secondary school science, demonstrate the diverse pedagogical purposes associated with laboratory activities and the importance of examining how laboratory work is actually implemented in schools. The quality of practical work, rather than its mere presence or frequency, influences the extent to which laboratory activities contribute to meaningful science learning (Oliveira & Bonito, 2023). Consequently, examining both the availability and utilization of laboratory resources is necessary when assessing their contribution to science teaching and learning.

In Kenya, the importance of practical learning has become particularly relevant with the implementation of the Competency-Based Curriculum (CBC) and the introduction of Integrated Science at the junior school level. The Ministry of Education's Guidelines for Implementation of Junior Secondary Education identify inquiry-based learning as an important approach in Integrated Science and provide for schools to have appropriate science facilities and resources, including science laboratories, mobile laboratories, and/or science kits (Ministry of Education [MoE], 2023). The National Education Sector Strategic Plan 2023–2027 further identifies the production and supply of Integrated Science kits to junior schools as a specific intervention, with a five-year target of supplying 6,500 kits (MoE, 2024). These policy provisions demonstrate that practical resources are regarded as necessary for effective implementation of the Integrated Science curriculum.

The assessment of Integrated Science also reinforces the need for meaningful practical learning opportunities. The Kenya Junior School Education Assessment (KJSEA) provides for Integrated Science to be assessed through two papers, with Paper 2 focusing on practical science skills (Kenya National Examinations Council [KNEC], 2026). The assessment framework therefore places practical scientific competencies within the formal evaluation of junior school learners. Where

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schools lack adequate laboratory facilities, apparatus, or other practical resources, teachers may have limited opportunities to provide learners with the experiences required to develop and demonstrate these competencies.

Despite the policy emphasis, disparities in access to laboratory and instructional resources remain evident in Kenyan schools. Recent evidence indicates that shortages of laboratory resources continue to constrain science teaching and learning (Safani et al., 2025). Such constraints may be more pronounced in rural and semi-arid settings, where schools can experience limitations in infrastructure, equipment, financial resources, and access to digital technologies that could provide supplementary alternatives to conventional laboratory work (Safani et al., 2025; Mwaniki & Mutisya, 2025). The availability of resources, however, does not necessarily guarantee their effective use. Teacher preparedness, accessibility of facilities, school-level support, and the availability of complementary infrastructure may determine whether existing resources are translated into meaningful practical learning experiences.

This concern is particularly relevant in Kajiado West Sub-County, a predominantly semi-arid area where pastoralism constitutes an important livelihood activity and schools operate within challenging socio-economic and environmental circumstances (County Government of Kajiado, 2025). Resource limitations in such settings may affect the provision and utilization of laboratory facilities and equipment needed for Integrated Science. Evidence from other Kenyan contexts has reported inadequate instructional resources in junior schools and significant relationships between resource availability and implementation of the Integrated Science curriculum (Wekesa et al., 2026). However, findings from other regions cannot automatically be generalized to Kajiado West because differences in school infrastructure, socio-economic conditions, geographical context, and access to educational resources may shape the implementation of practical science differently.

The existing literature also leaves an important contextual and empirical gap. Studies conducted in Pakistan, Nigeria, the Philippines, Kosovo, and other settings have generally reported positive associations between laboratory resources, practical work, learner engagement, motivation, scientific skills, creativity, and academic outcomes (Shahzadi et al., 2023; Etop et al., 2023; Nimreskosu et al., 2024; Lazaro & Paglinawan, 2025; Ramadani et al., 2026). In Kenya, Wekesa et al. (2026) examined instructional resources and Integrated Science curriculum implementation in public junior secondary schools in the Western Region and reported inadequate resources and a statistically significant relationship between resource availability and curriculum implementation. Nevertheless, limited empirical evidence specifically addresses how laboratory resource availability and utilization relate to the teaching and learning of Integrated Science in public junior schools in Kajiado West Sub-County.

The gap is significant because the successful implementation of Integrated Science under the competency-based curriculum requires more than the formal provision of laboratory resources. It requires learners to interact with available materials and equipment through practical, inquiry-oriented activities. Evidence from Kajiado West is therefore needed to establish the extent to which laboratory resources are available and utilized and how these conditions relate to teaching and learning experiences in Integrated Science. This study consequently examined the relationship between laboratory resource availability and utilization and the teaching and learning of Integrated

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Science in public junior schools in Kajiado West Sub-County, Kajiado County, Kenya. The study was guided by the following research question:

What is the relationship between laboratory resource availability and utilization and the teaching and learning of Integrated Science in public junior schools in Kajiado West Sub-County, Kajiado County, Kenya?

2. Literature Review

2.1 Laboratory Resources and Practical Learning in Science Education

Laboratory resources provide an important foundation for practical science learning because they enable learners to move beyond abstract descriptions of scientific concepts to direct observation, manipulation, experimentation, measurement, and interpretation of evidence. Practical work can therefore support the development of both procedural scientific skills and conceptual understanding. A systematic review of practical work in science education found that its principal educational value lies in combining hands-on practical experiences with conceptual or "minds-on" learning (Oliveira & Bonito, 2023). The review also cautioned that the educational benefits of practical work depend on the quality of its implementation rather than simply on the frequency with which practical activities are conducted.

Similarly, Gericke et al. (2023), in a systematic review of laboratory work in secondary school science, demonstrated that laboratory activities serve multiple pedagogical purposes, including developing scientific knowledge, practical skills, and understanding of scientific practices. The review also highlights the importance of considering how laboratory activities are designed and implemented rather than assuming that the presence of laboratory facilities automatically results in effective learning. This distinction is particularly relevant to resource-constrained school systems, where a school may possess some laboratory materials but lack sufficient quantities, appropriate facilities, or the conditions required for their regular use.

Recent empirical evidence further supports the relationship between inquiry-oriented laboratory experiences and science learning. Eymur and Çetin (2024), using a mixed-method quasi-experimental design involving Grade 8 learners, examined an argument-driven inquiry approach in science laboratory instruction and found evidence relevant to the development of scientific literacy. Their findings demonstrate that laboratory work can provide learners with opportunities to engage in scientific practices rather than merely observe teacher demonstrations. The implication is that the educational value of laboratory resources depends not only on their availability but also on whether teachers utilize them through learner-centred and inquiry-oriented pedagogies.

2.2 Laboratory Resource Availability and Teaching and Learning

Availability is a necessary condition for laboratory-based instruction because teachers cannot consistently conduct practical activities where essential facilities, apparatus, materials, and equipment are absent or insufficient. However, the availability of resources should be considered in relation to the number of learners, the range of curriculum activities, and the frequency with

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which resources are required. A laboratory containing a small quantity of equipment may technically be classified as equipped but may not provide meaningful opportunities for all learners to participate directly in practical activities.

Evidence from developing-country contexts illustrates this challenge. Shahzadi et al. (2023), examining laboratories and science teaching materials at the secondary level in Pakistan, found that laboratory facilities and teaching resources were important to science instruction and student learning. Etop et al. (2023), studying Biology in Nigeria, similarly found a significant relationship between the availability and utilization of laboratory facilities and learners' academic achievement. These findings suggest that resource provision can create opportunities for practical learning, although the educational outcome depends on whether learners actually gain access to and interact with the available resources.

In the Philippines, Lazaro and Paglinawan (2025) reported that laboratory resource availability was associated with students' engagement in science activities. Their findings indicated that access to adequate laboratory resources encouraged active participation and enthusiasm, while practical activities supported collaboration and learner confidence. Such evidence is consistent with the broader literature showing that laboratory resources can facilitate active rather than predominantly teacher-centred science instruction.

The Kenyan context presents similar concerns. Safani et al. (2025) reported continuing challenges in the availability and utilization of laboratory resources in secondary schools in Webuye West. Mwaniki and Mutisya (2025) also examined specialized subject laboratories and the implementation of science and computer studies in public junior schools in Narok County, highlighting the importance of appropriate facilities and resources in supporting curriculum implementation. These studies demonstrate that resource constraints remain relevant to science education in Kenyan schools, but they do not specifically establish the relationship between laboratory resource availability and teaching and learning of Integrated Science in Kajiado West Sub-County.

2.3 Utilization of Laboratory Resources and Learner Engagement

The existence of laboratory resources does not necessarily mean that learners benefit from them. Utilization refers to the extent to which available facilities, apparatus, materials, and other resources are actually incorporated into teaching and learning activities. This distinction is particularly important in the implementation of competency-based curricula, where learners are expected to demonstrate practical competencies rather than simply recall scientific facts.

Recent evidence from Kenya makes this distinction explicit. Wekesa et al. (2026) examined instructional resource utilization in public junior schools in the Western Region and argued that the presence of resources has limited curriculum value when teachers do not use them. Their findings distinguish resource availability from utilization and demonstrate that resources can remain underused even where schools possess some instructional materials. A related study by Wekesa et al. (2026) on the availability of instructional resources and Integrated Science curriculum implementation reported that inadequate resources and delays in the supply of

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materials constrained implementation, particularly by limiting opportunities for practical instruction.

Evidence from other contexts similarly demonstrates the contribution of utilization to learner engagement. Ramadani et al. (2026) examined the role of practical laboratory work in stimulating students' interest in natural sciences in Kosovo and reported a positive association between participation in laboratory activities, learner motivation, and perceived learning outcomes. Nimreskosu et al. (2024), examining laboratory utilization through scientific literacy activities, also found that laboratory-based activities could support scientific attitudes and creative thinking. Together, these findings suggest that the pedagogical value of laboratory resources emerges most clearly when learners actively interact with them.

Utilization may also support differentiated and collaborative learning. Misperos (2026) examined laboratory resource availability alongside instructional strategies in the Philippines and reported the implementation of active learning, differentiated instruction, scaffolding, and assessment-for-learning practices. Although such findings should not be generalized directly to Kenyan junior schools, they demonstrate how laboratory resources can create opportunities for teachers to vary instructional approaches and respond to differences among learners.

2.4 Laboratory Resources, Retention, Creativity and Scientific Competencies

Laboratory activities can provide learners with concrete experiences through which abstract scientific concepts become observable and manipulable. Such experiences may facilitate retention because learners encounter concepts through multiple modes of engagement rather than through verbal instruction alone. Ahmed et al. (2024), for example, found that teaching and learning materials were associated with learner engagement, understanding of complex concepts, retention, motivation, and academic performance in primary schools in Pakistan.

Creativity and scientific problem-solving are also relevant outcomes of practical science learning. Nimreskosu et al. (2024) found that laboratory utilization through scientific literacy activities supported creative thinking. Etop et al. (2023) reported that laboratory facilities were significantly related to learners' achievement in Biology, while Lazaro and Paglinawan (2025) associated practical laboratory activities with collaboration and confidence. These findings are relevant to Integrated Science because the subject requires learners to develop competencies that extend beyond factual knowledge to include investigation, communication, collaboration, problem-solving, and application of knowledge.

Nevertheless, the literature does not support an assumption that laboratory resources automatically improve learning outcomes. Oliveira and Bonito (2023) emphasize that practical work can have limitations when activities are poorly designed or reduced to routine procedures. Gericke et al. (2023) similarly demonstrate that laboratory work serves different purposes and that its effectiveness depends on how it is incorporated into science teaching. The present study therefore considers both the availability and utilization of laboratory resources rather than treating the presence of a laboratory as sufficient evidence of effective practical learning.

2.5 Resource Constraints and Alternative Approaches to Practical Science Learning

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Resource constraints present a particular challenge to schools that lack fully equipped science laboratories. In such circumstances, teachers may rely on demonstrations, improvised materials, shared facilities, science kits, or digital alternatives. The Kenyan policy framework recognizes this challenge by providing for science laboratories, mobile laboratories, and/or science kits in junior schools (Ministry of Education [MoE], 2023). The National Education Sector Strategic Plan 2023–2027 further provides for the production and supply of Integrated Science kits to junior schools (MoE, 2024).

Virtual laboratories may provide an additional option where physical laboratory facilities are limited. However, their effectiveness depends on access to appropriate digital devices, electricity, connectivity, teacher competence, and relevant digital content. The present study's evidence that only a small proportion of teachers could utilize virtual laboratories therefore points to a broader resource problem rather than simply a lack of awareness. The finding is consistent with Monta and Perdio (2025), who reported insufficient exposure to virtual laboratory experiences in public schools in the Philippines. CEMASTEA (2026) has also undertaken teacher training on virtual laboratories as one response to shortages of science learning resources in Kenyan junior schools.

The literature therefore indicates that alternative practical-learning approaches can complement physical laboratories but cannot be assumed to compensate automatically for inadequate infrastructure. In semi-arid and underserved contexts, the feasibility of such alternatives depends on the broader school resource environment, including digital infrastructure and teacher preparedness.

2.6 Theoretical Framework

The study is informed by three complementary perspectives: constructivism, experiential learning theory, and situated learning theory. Piaget's constructivist perspective views learners as active participants in the construction of knowledge through interaction with their environment. Within science education, laboratory activities provide opportunities for learners to manipulate materials, observe phenomena, test explanations, and construct understanding from direct experience (Bereiter, 1994). Laboratory resources are therefore relevant because they create physical and cognitive opportunities through which learners can engage directly with scientific concepts.

Kolb's (1984) experiential learning theory provides a more direct explanation of the relationship between practical activities and learning. The theory conceptualizes learning as a process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. Laboratory activities provide concrete experiences through which learners can observe scientific phenomena and manipulate materials, reflect on observations, develop explanations, and test those explanations through further experimentation. The theory therefore provides a strong basis for understanding why the utilization of laboratory resources may enhance meaningful learning in Integrated Science.

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Lave and Wenger's (1991) situated learning theory emphasizes learning through participation in authentic social and practical contexts. Laboratory activities provide opportunities for learners to work collaboratively, communicate scientific ideas, perform practical procedures, and participate in activities resembling authentic scientific practice. This perspective is relevant to Integrated Science because learning extends beyond the acquisition of information to participation in social and practical activities through which scientific competencies are developed.

Taken together, these perspectives suggest that laboratory resources have educational value when they enable learners to interact with materials, experience scientific phenomena, reflect on observations, test ideas, and participate collaboratively in authentic learning activities**.** The theoretical framework therefore supports examining both resource availability and actual utilization in relation to teaching and learning.

2.7 Synthesis and Research Gap

The reviewed literature establishes several consistent patterns. First, laboratory and practical work can support active engagement, scientific literacy, conceptual understanding, motivation, retention, creativity, collaboration, and other science-learning outcomes (Etop et al., 2023; Nimreskosu et al., 2024; Ramadani et al., 2026). Second, the benefits of practical work depend on the quality of implementation and not merely on the presence of laboratory facilities (Gericke et al., 2023; Oliveira & Bonito, 2023). Third, resource availability and resource utilization are analytically distinct: schools may possess instructional resources that are insufficient, inaccessible, or underutilized (Wekesa et al., 2026).

Despite this evidence, three gaps remain. Contextually, much of the international evidence originates from education systems whose laboratory infrastructure and resource environments differ from those of Kenyan public junior schools. Geographically, Kenyan studies have examined laboratory and instructional resources in settings such as Western Kenya, Narok, and Webuye West, but there is limited evidence from Kajiado West Sub-County. Conceptually, existing studies frequently examine either resource availability, curriculum implementation, learner achievement, or general practical work, rather than examining the relationship between laboratory resource availability and utilization and the teaching and learning of Integrated Science among Grade 9 learners in public junior schools.

The present study addresses these gaps by examining laboratory resource availability and utilization in public junior schools in Kajiado West Sub-County. It combines evidence from Integrated Science teachers, Grade 9 learners, head teachers, and direct school observations to provide a more comprehensive account of the conditions under which laboratory resources are used for teaching and learning. The study therefore extends existing evidence by examining not only whether resources are present, but also whether they are sufficiently available and actually utilized in the teaching and learning of Integrated Science.

3. Methodology

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The study adopted a convergent mixed-methods design, which involves the researcher merging quantitative and qualitative data to provide a comprehensive analysis of the research problem (Creswell & Creswell, 2023). For the quantitative component, a descriptive cross-sectional survey design was employed. For the qualitative component, a phenomenological design was used to explore the lived experiences and perspectives of head teachers.

Kajiado West Sub-County is located in Kajiado County in the Rift Valley region of Kenya. The sub-county is a semi-arid area with a local community of nomadic pastoralists. Due to harsh climatic conditions, the majority of residents are economically disadvantaged, and many parents face challenges in supporting their children with resources required at school.

The target population comprised 83 public junior schools, 83 head teachers, 216 Integrated Science teachers, and 2,992 Grade 9 learners. A sample of 8 schools (10%), 8 head teachers, 16 Integrated Science teachers (census), and 299 Grade 9 learners (10%) was selected. Stratified random sampling was used for schools and learners, simple random sampling for individual learners, census sampling for teachers, and purposive sampling for head teachers.

Four instruments were used: a semi-structured interview schedule for head teachers, a questionnaire for Integrated Science teachers, a questionnaire for Grade 9 learners, and an observation schedule. The teacher and learner questionnaires used a five-point Likert scale. Validity was established through expert review, and reliability was assessed using Cronbach's alpha coefficient, with all coefficients surpassing the 0.7 threshold.

Quantitative data were analysed using descriptive statistics (frequencies and percentages) and inferential statistics (Pearson product-moment correlation) using SPSS version 23. Qualitative data were analysed thematically following Braun and Clarke's (2006) six-phase framework. Triangulation was employed to cross-verify findings from different sources.

4. Findings and Discussion

4.1 Influence of Laboratory Resources on Teaching and Learning

The third research question sought to establish the influence of laboratory resources on teaching and learning Integrated Science. Teachers and learners responded to statements using a five-point Likert scale.

Table 1: Teachers' Perceptions of the Influence of Laboratory Resources (n = 16)

Statement	Strongly Agree f (%)	Agree f (%)	Neutral f (%)	Disagree f (%)	Strongly Disagree f (%)
Using laboratory resources promotes active engagement	5 (30.0)	6 (37.5)	4 (25.0)	1 (7.5)	--

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Statement	Strongly Agree f (%)	Agree f (%)	Neutral f (%)	Disagree f (%)	Strongly Disagree f (%)
Using laboratory resources provides real-world context	8 (50.0)	5 (31.2)	1 (6.2)	1 (6.2)	1 (6.2)
Using laboratory resources facilitates retention and recall	8 (50.0)	4 (25.0)	2 (12.5)	1 (6.2)	1 (6.2)
Using laboratory resources helps in differentiated learning	8 (50.0)	3 (18.8)	3 (18.8)	1 (6.2)	1 (6.2)
Using laboratory resources increases motivation and interest	6 (37.5)	4 (25.0)	4 (25.0)	1 (6.2)	1 (6.2)
Using laboratory resources fosters collaboration and communication	8 (50.0)	4 (25.0)	1 (6.2)	1 (6.2)	1 (6.2)

Source: Field Data (2026)

Results indicated that most teachers, 6 (37.5%), agreed that utilization of laboratory resources promotes active engagement, while 5 (30.0%) strongly agreed. The majority of teachers, 6 (37.5%), strongly agreed that using laboratory resources increases motivation and interest to learn, while 4 (25.0%) agreed. During the face-to-face interview, HT1 noted:

> When learners are involved in conducting practical activities they are always motivated and interested to learn. During the practical lessons learners are punctual to the science laboratory and eager to learn Integrated Science. (Interview, July 27, 2026).

HT2 noted: *Utilization of laboratory resources is very critical because they create and sustain learners' attention to learn, therefore ensuring effective learning of Integrated Science.* (Interview, July 28, 2026).

These findings are supported by Lazaro and Paglinawan (2025), who examined laboratory resources availability and students' engagement in science in the Philippines. The study established that adequate access to laboratory resources was consistent with active involvement and enthusiasm in science activities. Further, the majority of teachers, 8 (50.0%), strongly agreed that

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utilization of laboratory resources provides a real-world context, while 5 (31.2%) agreed. HT3 responded: *Laboratory resources aid the learners to apply what they have learnt to real-life experiences and therefore equip them with skills to solve everyday issues.* (Interview, July 29, 2026).

These findings are supported by Igiri and Effiong (2015), who conducted an inquiry on the impact of instructional materials in teaching and learning Biology in senior schools in Nigeria. The study established that utilization of teaching aids makes learning real and permanent. Additionally, most teachers, 6 (37.5%), agreed that utilization of laboratory resources supports the application of different teaching and learning approaches, while 5 (27.5%) strongly agreed. The majority of teachers, 8 (50.0%), strongly agreed that utilization of laboratory resources helps in catering for learners with different learning abilities, while 3 (18.8%) agreed. HT1 indicated: *Proper utilization of laboratory resources enables the teacher to apply learner-centered approaches such as experimentation and therefore ensures learning is more effective.* (Interview, July 27, 2026). These findings align with Misperos (2026), who evaluated laboratory resource availability and instructional strategies in relation to students' academic performance in the Philippines. The study established a high level of implementation of differentiated instruction, active learning strategies, scaffolding and support, and assessment for learning.

Findings also indicated that most teachers, 8 (50.0%), strongly agreed that utilization of laboratory resources enables retention and recalling of knowledge and skills, while 4 (25.0%) agreed. HT2 noted: *Laboratory resources facilitate the retention and recalling of the knowledge and skills learnt by the learners. They make learning more meaningful* (Interview, July 28, 2026).

These findings are supported by Igiri and Effiong (2015), who established that the use of instructional materials promotes retention. Also, most teachers, 8 (50.0%), strongly agreed that utilization of laboratory resources fosters collaboration and communication skills, while 4 (25.0%) agreed. These findings resonate with Lazaro and Paglinawan (2025), who found that practical activities promote collaboration and confidence among students.

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Table 2: Learners' Perceptions of the Influence of Laboratory Resources (n = 259)

Statement	Strongly Agree f (%)	Agree f (%)	Neutral f (%)	Disagree f (%)	Strongly Disagree f (%)
Using laboratory resources enables me to be actively engaged in learning	78 (30.1)	73 (28.2)	66 (25.5)	22 (8.5)	20 (7.7)
Using laboratory resources enables me to connect what I have learnt with real-life situations	67 (25.9)	78 (30.1)	60 (23.2)	27 (10.5)	27 (10.4)
Using laboratory resources enables me to retain and recall knowledge and skills	77 (29.7)	88 (34.0)	57 (22.0)	17 (6.6)	20 (7.7)
Using laboratory resources enables me to be motivated and interested to learn	79 (30.5)	78 (30.1)	52 (20.1)	36 (13.9)	14 (5.4)
Using laboratory resources enables me to develop collaboration and communication skills	74 (28.6)	86 (33.2)	44 (17.0)	36 (13.9)	19 (7.3)
Using laboratory resources enables me to be creative and imaginative	85 (32.8)	53 (20.5)	62 (23.9)	43 (16.6)	16 (6.2)
Using laboratory resources enables me to improve my performance in Integrated Science	85 (32.8)	57 (22.0)	58 (22.4)	37 (14.3)	22 (8.5)

Source: Field Data (2026)

Results from Table 2 indicated that the majority of learners, 78 (30.1%), strongly agreed that utilization of laboratory resources enables them to be actively engaged in learning, while 73 (28.2%) agreed. Most learners, 79 (30.5%), strongly agreed that utilization of laboratory resources motivates and creates interest to learn, while 78 (30.1%) agreed. HT3 noted:

I have witnessed my learners actively engaged in practical activities. They are punctual in the science laboratory and they participate fully in the learning process. (Interview, July 27, 2026).

These findings are supported by Ramadani et al. (2026), who examined the contribution of practical work to fostering student interest in the natural sciences in Kosovo. The results indicated

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that engagement in laboratory activities is positively correlated with enhanced student motivation and perceived learning outcomes.

Further, most learners, 78 (30.1%), agreed that utilization of laboratory resources enables them to relate what they have learnt with real-life situations, while 67 (25.9%) strongly agreed. HT1 noted: *Utilization of laboratory resources assists the learners to apply the skills they have learnt in real-life situations. Thereby enabling the teachers equip the learners with essential skills and competencies.* (Interview, July 29, 2026).

These findings align with Hein and Khine (2020), who investigated the use of science laboratories in teaching science subjects at the high school level in Myanmar. The study established that scientific and problem-solving skills can be applied in real-life situations.

Additionally, most learners, 88 (34.0%), agreed that utilization of laboratory resources enables them to retain and recall the knowledge and skills learnt, while 77 (29.7%) strongly agreed. These findings resonate with Ahmed, Baloch, and Karim (2024), who investigated the impact of teaching and learning materials on students' academic performance in primary schools in Pakistan. The study revealed that resources significantly influence students' academic performance and play a crucial role in increasing engagement, understanding complex concepts, improving retention, and boosting motivation.

Also, the majority of learners, 85 (32.8%), strongly agreed that utilization of laboratory resources enables them to improve their performance in Integrated Science, while 57 (22.0%) agreed. HT3 stated:

Carrying out practical activities aid the learners in retention of the knowledge and skills they have learnt. The continuous utilization of these resources assists in improvement of the performance of Integrated Science. (Interview, July 27, 2026).

These findings are supported by Etop, Ekon, and Okon (2023), who evaluated the utilization of resources and their influence on learners' achievement in Biology in Nigeria. The study revealed that obtainable laboratory facilities significantly influenced achievement in Biology.

Results also indicated that the majority of learners, 86 (33.2%), agreed that utilization of laboratory resources enables them to develop collaboration and communication skills, while 74 (28.6%) strongly agreed. These findings resonate with Lazaro and Paglinawan (2025), who found that practical activities promote collaboration and confidence among students. HT2 responded:

When the learners are conducting practical activities in groups they develop essential skills such as collaboration and communication skills (Interview, July 28, 2026).

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Most learners, 85 (32.8%), strongly agreed that utilization of laboratory resources enables them to improve their creativity and imagination skills, while 53 (20.5%) agreed. However, 62 (23.9%) were neutral, which could be attributed to their limited exposure to practical activities. HT1 noted:

Manipulation of laboratory resources improves the creativity of the learners and enhance their imagination skills. (Interview, July 27, 2026).

These findings align with Nimreskosu, Leiwakabessy, and Wael (2024), who evaluated the utilization of laboratories through scientific literacy activities to improve scientific attitudes and creative thinking. The study revealed that the use of laboratories through science literacy activities influenced creative thinking.

4.2 Hypothesis Testing

Pearson product-moment correlation analysis was conducted to test the relationship between availability of laboratory resources and teaching and learning of Integrated Science. The analysis established a positive and statistically significant relationship, $r = 0.224$, $p < .001$. The correlation coefficient indicates a weak positive relationship, implying that higher availability of laboratory resources was associated with better teaching and learning of Integrated Science. Since the p-value was less than the 0.05 significance level, the null hypothesis was rejected.

Similarly, the relationship between utilization of laboratory resources and teaching and learning of Integrated Science was tested. Pearson product-moment correlation analysis established a statistically significant positive relationship, $r = 0.481$, $p < .001$. The positive correlation indicated that increased utilization of laboratory resources was associated with more positive teaching and learning experiences. The correlation was stronger than that observed between availability of laboratory resources and teaching and learning. Since the p-value was less than the 0.05 significance level, the null hypothesis was rejected.

These findings are supported by Wekesa, Wasike, and Nyende (2026), who examined the influence of the availability of instructional resources on the implementation of the Integrated Science curriculum in public junior secondary schools in the Western Region of Kenya. The study found that the availability of instructional resources exerted a statistically significant influence on curriculum implementation.

4.3 Challenges and Mitigating Factors

While laboratory resources positively influence teaching and learning, the study established that laboratory resources were generally inadequate in the sampled public junior schools. Table 18 presents the challenges facing laboratory resources utilization.

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Table 18: Challenges Facing Laboratory Resources Utilization (n = 16)

Indicator	Yes n (%)	No n (%)
School has an operational science laboratory	6 (37.5)	10 (62.5)
Laboratory resources are adequate for all learners	2 (12.5)	14 (87.5)
Teacher is able to utilize virtual laboratory	3 (18.8)	13 (81.3)
School community provides financial assistance	4 (25.0)	12 (75.0)

Source: Field Data (2026)

The majority of teachers, 10 (62.5%), reported that their schools did not have an operational science laboratory. This corresponds with the observation schedule findings, which showed that only three schools had their own operational laboratories, while two shared laboratory facilities and three did not have operational laboratories. HT1 stated: *One of the main challenges that we have is that we do not have an operational laboratory, where our teachers and learners can conduct experiments. We prepare and carry out experiments inside the classrooms.*

These findings are supported by Otieno et al. (2020), who investigated factors affecting poor performance in Chemistry in secondary schools in Kajiado and Narok counties. The study established that out of ten sampled schools in Kajiado County, three senior schools did not have laboratory facilities. Only 2 (12.5%) teachers indicated that resources were adequate for all learners, while 14 (87.5%) indicated that resources were not adequate. HT2 responded:

> Inadequate laboratory resources is a major challenge. Sometimes our teachers are only able to demonstrate to the learners the experiments, but learners do not get opportunities to carry out these experiments individually because of limited laboratory resources.

These findings are supported by Thinguri (2017), who conducted a critical analysis on the impact of instructional resources utilization on pedagogy in senior schools in Kenya. The study established that instructional resources were inadequate, which prevented teachers from meeting the individual pedagogical needs of learners.

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Virtual laboratories were also not widely utilized. Only 3 (18.8%) teachers reported being able to use virtual laboratories, while 13 (81.3%) could not. HT5 said: *We do not have infrastructure to support virtual laboratory as a substitute for physical laboratory. We don't have internet and digital devices to support the program.*

These findings are supported by Monta and Perdio (2025), who examined laboratory-based science instruction in public schools in the Philippines. The study established that there was insufficient virtual laboratory exposure, which affected effective learning. In response to these challenges, CEMASTEA has trained junior school county trainers on the use of virtual laboratories to address the shortage of science learning resources in Kenyan junior schools, particularly in remote and underserved areas (CEMASTEA, 2026).

Most teachers, 12 (75.0%), acknowledged that the school community did not support the schools with financial assistance to equip them with essential laboratory resources. These findings resonate with Tazan and Dahiru (2023), who investigated the perceived level of community participation in the provision of school facilities in secondary schools in Nigeria. The findings revealed a low level of community participation in the provision of laboratory facilities.

Conclusion

This study has demonstrated that laboratory resources positively influence the teaching and learning of Integrated Science in public junior schools in Kajiado West Sub-County. The influence is manifested through active engagement, motivation, real-world connection, retention and recall, differentiated learning, collaboration and communication, and creativity and imagination, which collectively contribute to improved learner performance. However, the study has also revealed that laboratory resources are generally inadequate and underutilised, suggesting that the full potential of these resources is not being realised. The findings have important implications for practice and policy, highlighting the need for increased investment in laboratory resources, strengthened teacher professional development, investment in digital infrastructure, and enhanced community engagement. By addressing these challenges, education stakeholders can unlock the full potential of laboratory resources to transform teaching and learning of Integrated Science in Kenyan junior schools.

Recommendations

Based on the findings, the study makes the following recommendations:

1. **Ministry of Education** should provide adequate funding for the construction, equipping, and maintenance of science laboratories in public junior schools.
2. **CEMASTEA** should provide regular in-service training for Integrated Science teachers, particularly on practical work and utilization of laboratory resources.

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3. **Schools** should explore the use of virtual laboratories as a supplementary strategy where physical laboratory resources are inadequate. Schools should invest in appropriate digital devices and internet connectivity.
4. **Integrated Science teachers** should make maximum use of available laboratory resources and improvise locally available materials where appropriate.
5. **Head teachers** should encourage teachers to plan practical activities in advance and establish links with neighboring schools to access resources that are unavailable.
6. **School communities** should be engaged in fundraising efforts to equip science laboratories with resources.

References

Ahmed, S., Baloch, M. A., & Karim, H. (2024). Investigating the impact of teaching-learning materials on students' academic performance in government primary schools in the Naseerabad Division, Balochistan, Pakistan. *Journal of Development and Social Sciences, 5*(1), 538–545.

Bereiter, C. (1994). Constructivism, socio-culturalism, and Popper's World 3. *Educational Researcher, 23*(7), 21–23.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

CEMASTEA. (2026). *CEMASTEA trains teachers on virtual labs for STEM learning enhancement*. Kenya News Agency.

County Government of Kajiado. (2025). *County development planning*. Kajiado County.

Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.

Etop, J. M., Ekon, E. E., & Okon, S. (2023). Availability and utilization of laboratory facilities on secondary school students' academic achievement in Biology in Calabar Education Zone, Cross River State. *Inter-Disciplinary Journal of Science Education, 5*(1), 144–152.

Eymur, G., & Çetin, P. S. (2024). Inquiry-based laboratory experiences and scientific literacy. *International Journal of Science Education, 46*(2), 145–163.

Gericke, N., Högström, P., & Wallin, L. (2023). Laboratory work in secondary school science: A systematic review. *Studies in Science Education, 59*(1), 1–38.

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Hein, M., & Khine, K. (2020). A case study of using science laboratory in teaching science subjects at the high school level. *Journal of the Myanmar Academy of Arts and Science, 18*(9C).

Igiri, C. E., & Effiong, O. E. (2015). Impact of instructional materials in teaching and learning of Biology in senior secondary schools in Yakurr LGA. *International Letters of Social and Humanistic Sciences, 62*, 27–33.

Kenya National Examinations Council [KNEC]. (2026). *KJSEA regulations for Integrated Science assessment*. KNEC.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lazaro, J. M. V., & Paglinawan, J. L. (2025). Laboratory resource availability and students' engagement in science. *International Journal of Research and Innovation in Applied Science, 9*(12), 146–153.

Ministry of Education [MoE]. (2023). *Guidelines for implementation of Junior School Education*. Ministry of Education, State Department for Basic Education.

Ministry of Education [MoE]. (2024). *National Education Sector Strategic Plan 2023–2027*. Ministry of Education.

Misperos, R. (2026). Laboratory resource availability and instructional strategies in relation to students' academic performance. *International Journal of Research and Innovation in Social Science, 10*(2).

Monta, E., & Perdio, A. (2025). Laboratory-based science instruction in public schools: Insights from teachers' experiences and implications for contextualized interventions in Bataan, Philippines. *International Journal of Research and Development, 10*(6).

Mwaniki, K., & Mutisya, S. M. (2025). Specialized subject laboratories and implementation of science and computer studies curriculum in public junior schools in Narok County, Kenya. *Journal of the Kenya National Commission for UNESCO, 5*(1).

Nimreskosu, A. C., Leiwakabessy, F., & Wael, S. (2024). Utilization of laboratories through scientific literacy activities to improve scientific attitudes and creative thinking. *Bioedupat: Pattimura Journal of Biology and Learning, 4*(2), 200–206.

Citation: Njoroge, M. K., Kimamo, G., & Omundi, E. (2026). Laboratory resource availability and utilization in the teaching and learning of integrated science in public junior schools in Kajiado West Sub-County, Kenya. *Journal of Africana Articles, 4*(53), 1-19, 25th September 2026. DOI: https://doi.org/10.5281/zenodo.22954938

Oliveira, A. W., & Bonito, J. (2023). Practical work in science education: A systematic review of 53 international studies. *Science Education, 107*(4), 789–820.

Otieno, G., et al. (2020). Evaluation of Chemistry performance in secondary schools in nomadic pastoralist communities of Kajiado and Narok counties in Kenya. *Journal of the Kenya Chemical Society, 13*(1), 28–35.

Ramadani, F., Çibukçu, B., Ismajli, B., & Pejchinovska-Stojkovikj, M. (2026). The role of practical laboratory work in stimulating students' interest in natural sciences. *Frontiers in Education, 11*, 1726102.

Safani, O. M., Mutsotso, S. N., & Kati, R. (2025). Utilization of laboratory resources and learners' achievement in Biology in secondary schools in Webuye West, Kenya. *International Journal of Research and Scientific Innovation, 12*(7).

Shahzadi, I., Hassan, K. H. U., & Zahid, F. (2023). Role of laboratories and science teaching material in science teaching and students learning at secondary level in public schools. *Journal of Development and Social Sciences, 4*(2), 259–264.

Tazan, M. Y., & Dahiru, A. S. (2023). Perceived level of community participation in the provision of school facilities in Nigeria. *Asian Journal on Perspectives in Education, 4*(1), 1–16.

Thinguri, R. (2017). A critical analysis on the impact of utilization of the instructional resources on pedagogy in public secondary schools in Kenya. *European Journal of Education Studies, 3*(1).

Wekesa, D. N., Wasike, D. W., & Nyende, K. O. (2026). Influence of the availability of instructional resources on the implementation of the Integrated Science curriculum in public junior secondary schools in Western Region, Kenya. *Iconic Research and Engineering Journals, 10*(1).