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Implications of integrating local materials on pupils' participation in primary science instruction in Namutumba District, Uganda

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Abstract

Science education and training are challenges in many regions with inadequate tools and materials, even when recommendations to use locally available materials have been encouraged. This study examined how the use of instructional materials available in the local environment affects learners' participation and comprehension of science subjects in rural primary schools in Namutumba District, eastern Uganda, a region characterized by an acute lack of traditional science resources. The theoretical framework employed for the research was Experiential Learning Theory, while the design adopted was an explanatory sequential mixed-methods approach. Data were collected from 37 respondents (science teachers and school administrators) and 269 pupils chosen through random sampling. Locally made instructional materials such as plants, soil, water, household items, and recycled materials facilitate learner engagement, improve comprehension of abstract science theories, and motivate learners by creating a link between learning and everyday experiences. Nevertheless, teachers face several challenges, including a lack of skills for improvising, large class sizes, insufficient time for lesson preparation, and minimal institutional support. It can be concluded that despite the availability of locally produced instructional materials offering a realistic and sustainable alternative to traditional materials, their effectiveness largely depends on pedagogical skills and adequate institutional support.

Keywords: Conceptual understanding, Local instructional materials, Pupil participation, Science education.

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Contents

Contribution of this paper to the literature
This study was based on empirical findings in the context of a rural setting in Uganda, where a similar study had not been carried out using a mixed methods approach. The study further includes pupils' experiences regarding the use of locally available materials to undertake the science lessons.

1. Introduction

The employment of locally available instructional materials to enhance learning through teaching is not a new idea in education; the concept has been found to promote meaningful learning in several ways. According to experiential and learner-centered theories (Dewey, 1938), the development of scientific understanding among learners can be greatly enhanced through engagement in learning with materials within the immediate vicinity of the learner, shifting the focus of instruction away from textbooks and into the learners' world of experience.

The promotion of utilizing teaching materials increased following educational reforms implemented after independence in Africa, Asia, and Latin America, where abstract Eurocentric curricula were replaced with contextual and indigenous knowledge-based teaching (Sifuna, 2021a). Modern approaches such as Competency-Based Learning (CBL) and Inquiry-Based Science Education (IBSE) continue this trend through contextualization and hands-on learning techniques (Muriithi & Kathambi, 2022; UNESCO, 2021). Several examples from countries like Ghana, Kenya, South Africa, India, and Brazil demonstrate the use of local materials to increase learners' engagement, reduce expenses, and improve comprehension of scientific concepts. The adoption of these practices in Uganda is scarcely studied.

The Ugandan education system, particularly science education, experienced similar processes to those of other developing nations. During the colonial era (1894–1962), teaching focused on developing administrative skills and theoretical knowledge without practical application (Ssekamwa, 1997). Despite several reforms since independence, science teaching, especially in rural areas, remained poor and theory-based (Kajubi, 1992). The reform that introduced universal primary education in 1997 increased enrollment but worsened the shortage of teaching aids, particularly in Namutumba District.

Consequently, education policies since the early 2000s have advocated the adoption of learner-centered teaching methods and the utilization of locally available instructional resources to bridge the gap. Also, the thematic curriculum and NCDC reforms recommended that teachers develop learning activities from their immediate environment and community (National Curriculum Development Centre, 2019). These initiatives align with international frameworks such as Education for Sustainable Development (ESD) and SDG 4, which focus on inclusive quality education (UNESCO, 2019). Nonetheless, implementation varies significantly, especially in rural schools struggling with structural and pedagogical issues (Altinyelken, 2010; Hardman, Abd-Kadir, & Smith, 2021).

Namutumba District, located in eastern Uganda, provides insight into various issues that hamper primary science education, such as a lack of equipment, poor infrastructure, and high pupil-to-teacher ratios. The aforementioned constraints cause teachers to adopt methods like lectures and memorization (UNESCO, 2021; World Bank, 2020). While there is a promotion of local instructional materials among teachers, they continue to exhibit limited expertise and skills needed to implement them effectively and efficiently, leading to low levels of pupils' involvement and poor acquisition of concepts (Makakole & Teane, 2024; Nakabugo, Byamugisha, & Ssenabulya, 2020). Despite these issues, new approaches to teaching science, such as creating school gardens, conducting experiments with available resources, and involving local knowledge holders, should help demonstrate the effective use of local materials (UNICEF, 2021; World Bank, 2022). Therefore, there is a need for empirical studies to evaluate the low adoption of local materials in teaching science. Consequently, the study analyzes the implications of adopting local instructional materials for pupils' participation in primary science lessons in Namutumba District.

2. Reviewed Literature

2.1. Theoretical Review

The research was informed by Experiential Learning Theory (ELT) (Kolb, 1984), which describes how local instructional materials enhance students' involvement in science through a cyclic learning process. Major phases include reflective observation, where learners examine their experiences for deeper insight; abstract conceptualization, connecting experiences to science knowledge; and active experimentation, where learners apply knowledge to other experiences, promoting problem solving, hypothesis testing, and innovation (Kasozi, 2022; Nakabugo et al., 2020; UNESCO, 2019, 2021).

One of the strengths of ELT theory is that the use of local instructional material enables practical experiences to be turned into structured knowledge in order to overcome the shortcomings of theories of learning without practical knowledge. The theory also stresses the need for good teachers who will have adequate skills to help learners benefit from the local instructional materials. ELT also aligns with the learner-centered approach advocated in Uganda through the work of NCDC to adopt local materials for educational purposes. There is empirical evidence indicating that experiential learning enhances learner engagement and comprehension, especially in abstract subject matters (Hardman et al., 2021). In rural Uganda, the utilization of local materials should be used to bridge theory and practice by linking science to everyday experiences (Kasozi, 2022). However, their effectiveness depends heavily on teachers' pedagogical competence, creativity, and institutional support. The use of teaching aids developed from locally available materials to enhance learners' experiences is still unknown.

2.2. Empirical Literature

Using locally available objects to explain science makes it easier for learners to understand scientific topics such as photosynthesis and energy transfer within the environment, among others. Practical activities such as water filtration using sand and charcoal develop critical thinking and problem-solving skills in pupils (Govender & Mudzamiri, 2022; Muriithi & Kathambi, 2022). Elsewhere, the use of local materials has led to improved levels of understanding and academic achievement (Adalikwu & Iorkpilgh, 2020; Owoeye & Yara, 2015). Moreover, in resource-poor environments, locally available materials provide better access to science education, minimize dependency on expensive equipment, and promote creativity. They also incorporate traditional knowledge, make the curriculum more culturally relevant, and relate lessons to real-life applications like farming, environmental conservation, and sustainable development (Makakole & Teane, 2024; Sulaiman, 2020; UNESCO, 2019). The benefits of such strategies in teaching are known; however, their application by science teachers in Uganda has not been studied to provide evidence of their benefits in teaching.

Though useful, the successful integration of locally sourced instructional materials faces some barriers. These include inadequate training for teachers in improvisational skills and experiential learning, making it difficult for them to incorporate local materials within the syllabus (Kasozi, 2022; Nakabugo et al., 2020). The other challenge is time pressure and heavy syllabus workload, which makes it difficult for teachers to engage in practical activities (Makakole & Teane, 2024; UNESCO, 2021). Infrastructure deficiencies such as laboratory equipment, storage facilities, and organizational systems also affect the adoption of local resources (National Curriculum Development Centre, 2020; Ssekamatte, Lubega, & Kintu, 2021). Negative perceptions regarding the quality of these materials are another obstacle which demotivates teachers and learners from using them (Barrett & Long, 2012; Govender & Mudzamiri, 2022). While local materials encourage engagement, they must be used with caution to ensure learning occurs. In essence, it is imperative to address issues such as teachers' knowledge levels, workloads, and administrative support for the effective use of contextualized local materials.

Despite the continuous reform, recommendations and existence of the lived examples the curricula in Uganda towards learner-centered and practical methods, the science teaching in primary schools in rural areas like Namutumba District in Uganda still follows a more traditional pattern based on textbooks with no or less adoption of use of local materials. Consequently, hands-on learning activities are minimal, leading to low pupil engagement in science lessons and poor understanding of scientific concepts. This situation may be due to inadequate training on utilizing locally available instructional materials, large class sizes, limited preparation time, and insufficient institutional support. Therefore, this study seeks to determine the influence of using local instructional materials on pupils' participation by exploring the challenges faced by teachers in utilizing these materials in primary schools in Namutumba District.

2.3. Purpose

The purpose of this study was to examine the implications of integrating local materials on pupils' participation in primary science instruction in Namutumba district, Eastern Uganda.

2.4. Objectives

1. To determine the influence of using local materials on pupils' participation during science teaching.
2. To explore the challenges faced by teachers in using local materials for science instruction.

3. Materials and Methods

3.1. Research Approach and Design

The mixed-methods approach was used to obtain both breadth and depth of data. In the quantitative part of the research, using the questionnaire, it was possible to reveal patterns and correlations between the use of local material and pupils' involvement in learning science. In the qualitative research, using interviews, it was possible to obtain the context of teachers' actions related to using local material during science lessons (Creswell & Creswell, 2018; Kothari, 2004).

This study employed an explanatory sequential research design; data were collected from pupils, and later interviews were conducted with teachers and school administrators. This approach helped in deriving better meaning from the data collected from pupils regarding their participation in creating teaching materials from local resources (Creswell & Creswell, 2018).

3.2. Study Population

The study population consisted of 900 pupils in Primary Five and Six, 18 science teachers, and nine school administrators from nine government-aided primary schools in Namutumba Sub-County.

3.3. Sample Size Determination

In order to identify the number of students required for this study, the Krejcie and Morgan (1970) table was used, with the sample size being 296 at the 95% confidence interval of 5% margin of error. This approach ensured that the sample size was not overly or inadequately sampled, thereby enhancing its reliability and validity (Krejcie & Morgan, 1970). The respondents for this study consisted of 37 individuals, including 18 science teachers and nine school administrators, who were purposely chosen since they had the knowledge and experience to contribute to the research. Data saturation was achieved after 10 science teachers and 6 school administrators were interviewed, as they started repeating information on the relevant questions.

3.4. Sampling Techniques

For the selection of students, a stratified simple random sampling technique was applied to ensure an equal number of male and female pupils, along with classes, were considered. Simple random sampling was used to sample respondents from each stratum (Cochran, 1977; Creswell, 2014).

Table 1 presents the sampling framework.

Table 1. Sampling framework.

Category	Population	Sample size	Sampling technique
Teachers	18	18	Purposive sampling
Pupils (P5 & P6)	900	269	Stratified simple random sampling
Administrators	9	9	Purposive sampling

3.5. Data Collection Methods and Instruments

Data was gathered using closed-ended questionnaires for pupils and open-ended questionnaires for science teachers, as well as interviews for administrators. The teachers' questionnaire included questions on the use of locally made materials and problems encountered, while the pupils' questionnaire focused on their participation. Interviews with administrators centered on their involvement in supporting science teachers in using local materials in teaching.

3.6. Validity and Reliability

The validity of the instruments was determined through both content and construct validation methods. Content validation was established by ensuring compatibility between the research instruments and the overall objectives of the research and its theoretical framework, as well as expert evaluation of their relevance, clarity, and comprehensiveness. Conducting a pilot study of the questionnaire among teachers and pupils from another locality contributed to the refinement of research instruments and the elimination of any possible ambiguities. On the other hand, construct validity was assured by ensuring the correspondence between each item and the theoretical concepts that comprised Experiential Learning Theory. The reliability of the instruments was tested with Cronbach's Alpha, and it was observed that the pupils' questionnaire had an alpha coefficient of 0.731. It proves the reliability of the instruments for measuring variables such as participation, understanding, and utilization of local resources. Transferability and credibility of qualitative data were secured in terms of ensuring the trustworthiness of results.

3.7. Data Management and Analysis

The quantitative data were analyzed using SPSS version 23, employing descriptive and correlation statistics to explore the relationships between local material utilization and students' involvement in science instruction and learning. The qualitative data were analyzed through thematic analysis, where participants' responses were categorized into various themes, with the analysis based on their views as presented in verbatim form (Creswell & Creswell, 2018).

3.8. Ethical Considerations

The participants were made aware that their participation was voluntary and they could opt out of the study at any stage without facing any repercussions whatsoever. The educators, school management, and guardians of the children were provided with full details on the objectives, process, advantages, and disadvantages of the research process. However, there were no anticipated risks involved in the research project. Informed consent was acquired from both the educators and management, while assent was obtained from the children via their guardians before embarking on the research process (Creswell & Creswell, 2018).

4. Results and Discussions

This section presents and analyzes the results of the study concerning the impact of using local materials on science education among primary school students in Namutumba District. Pupils' responses, teacher comments, and administrators' opinions were used to analyze various issues related to classroom practice and pupil participation. This analysis draws on experiential learning theory and other scholarly findings to establish practical implications.

Table 2 exhibits teachers' socio-demographic characteristics.

Table 2. Teacher's socio-demographic characteristics.

Variables	Frequency (n=18)	Percentage (%)
Gender		
Male	12	66.6
Female	06	33.3
Academic qualification		
Grade III	03	16.6
Diploma	10	55.5
Degree	05	27.7
Teaching experience		
0-5	03	16.6
6-10	04	22.2
11-15	03	16.6
16 and above	08	44.4
Subject combination		
Mathematics and agriculture	08	44.4
Mathematics and physical education	06	33.3
Mathematics and integrated science	04	22.2

4.1. Socio-Demographic Characteristics

Regarding socio-demographic information concerning teachers found in Table 2, a relatively even distribution exists concerning gender, with male teachers making up 66.6% and female teachers being 33.3%. This indicates that both male and female teachers participate in teaching science. A higher percentage of teachers, 55.5%, possess Diploma qualifications, showing a relatively good professional background among these teachers. In terms of teaching experience, a large number of teachers (44.4%) have been teaching for 16 years or more, and therefore, more than 60% of these teachers have extensive teaching experience.

Table 3. Pupils' socio-demographic characteristics.

Variables	Frequency (n= 269)	Percentage (%)
Gender		
Male	132	49
Female	137	51
Class		
Primary Five	135	50
Primary Six	134	50
Age (Years)		
6-10	2	1
11-15	254	94
16 and above	13	5

It can be noted from Table 3 that the socio-demographic features of the pupils under consideration are adequate for conducting research into the usage of local materials in teaching science to the pupils in Namutumba Sub-county. Firstly, there is almost an equal gender distribution in the sample; there are 49% male and 51% female respondents. Moreover, an almost equal number of pupils are represented among different classes. Namely, 50.% are from Primary Five, whereas 50% belong to Primary Six. As far as the age criterion is concerned, 94.4% of respondents belong to the 11–15-year age bracket.

4.2. Use of Local Materials on Pupils' Participation in Science Lessons and Activities

To identify the impact that the use of locally available materials can have on the participation of learners in science lessons, this research sought to explore how involved learners were when working with such materials, how often local materials were used in science lessons, and the role they played in learners' understanding of science concepts.

Table 4. Use of local materials in science lessons.

Statements	SA	A	N	D	SD	Mean	Std. Dev.
My teacher uses local materials for science lessons.	221 (82.2)	34 (12.6)	10 (3.7)	3 (1.1)	1 (0.4)	4.75	0.612
I see different types of local materials being used during science lessons.	236 (87.7)	8 (3.0)	3 (1.1)	3 (1.1)	19 (7.1)	4.63	1.083
Lessons are more interesting when local materials are used.	238 (88.5)	9 (3.3)	5 (1.9)	2 (0.7)	15 (5.6)	4.68	0.985
I enjoy touching or observing the materials used in science lessons.	230 (85.5)	9 (3.3)	7 (2.6)	5 (1.9)	18 (6.7)	4.59	1.101
The use of local materials helps me to connect science with real life.	142 (52.8)	76 (28.3)	8 (3.0)	7 (2.6)	36 (13.4)	4.04	1.368
Overall						4.54	1.029

Note: SA – Strongly Agree, A – Agree, N – Not Sure, D – Disagree, SD – Strongly Disagree; () denotes percentages.

It is clear from the findings presented in Table 4 that the application of locally available materials positively influences students' engagement and comprehension of science lessons. Indeed, 82.2% of students strongly agreed, while 12.6% agreed, that their teachers use locally available materials such as leaves, soil, and stones in science instruction; thus, a high mean score of 4.75 was attained. This finding suggests that many students encounter actual materials in science lessons; therefore, they are likely to be engaged because of the connection they make between what they learn in the classroom and the real world around them.

In addition, 87.7% of students agreed that they observed the use of various local materials during class, while 88.5% strongly agreed that lessons became interesting. This demonstrates the importance of locally available materials as motivation for making science lessons more appealing to learners.

4.3. Participation in Lessons

The results in Table 5 indicate that the use of local materials significantly enhances pupil participation during science lessons.

Table 5. Participation in lessons.

Statements	SA	A	N	D	SD	Mean	Std. Dev.
I participate more in lessons when local materials are used.	86 (32.0)	63 (23.4)	100 (37.2)	6 (2.2)	14 (5.2)	3.75	1.02
I enjoy group work when we use local materials.	232 (86.2)	6 (2.2)	6 (2.2)	6 (2.2)	19 (7.1)	4.58	1.26
I feel confident asking or answering questions when local materials are used.	117 (43.5)	131 (48.7)	7 (2.6)	6 (2.2)	8 (3.0)	4.28	0.86
Local materials make science lessons more fun and engaging.	128 (47.6)	108 (40.1)	23 (8.6)	4 (1.5)	6 (2.2)	4.29	0.859

Note: SA – Strongly Agree, A – Agree, N – Not Sure, D – Disagree, SD – Strongly Disagree; () denotes percentages.

It emerged from the findings that the use of local materials positively enhanced the participation, engagement, and confidence of pupils in science lessons. The majority (55.4%) felt that active participation in learning science had increased through the use of local instructional materials, with an average mean of 3.75, owing to increased practicality and relevance. This can be supported by Experiential Learning Theory (ELT) by Kolb (1984), where learning is attained through direct manipulation of concrete objects, as indicated by the key informant.

A very high percentage of pupils (86.2%) preferred learning collaboratively whenever local instructional materials were used, with an average mean score of 4.58. These materials promote interaction among peers and problem-solving. Key informants indicated that participation and retention improved, and learners became more enthusiastic after using such materials.

Also, 92.2% of the respondents reported having become more confident in their class participation because of familiarization with the instructional materials, which facilitated effective learning in science. Other findings revealed that 87.7% of the respondents enjoyed learning science and found the subject interesting when local materials were used. Table 6 shows the relationship between the use of local materials and pupils' participation in science.

Table 6. Relationship between the use of local materials and pupils' participation in science.

		Participation in lessons	Understanding of science concepts
Use of local materials in science lessons	Pearson Correlation	0.408**	0.161**
	Sig. (2-tailed)	0.000	0.008
	N	269	269

Note: ** The correlation is significant.

From the above findings, there exists a weak yet significant positive correlation between the use of local materials and comprehension of science concepts among students ($r = 0.161$, $p = 0.008$). Although local materials facilitate comprehension, the correlation is weak, implying that other variables might affect comprehension, such as teaching strategies, teachers' effectiveness, and access to learning resources. Improvement in comprehension may be attributable to the fact that the use of local materials makes it possible to understand complex and abstract scientific concepts and remember them. The hypothesis can be tested by giving a pretest to pupils in classes five and six regarding "Properties of states of matter and their changes" and conducting an experimental lesson using local materials like water, charcoal stove, chilled water, metal spoon, clay pot, and thermometer to explain phenomena like melting, evaporation, condensation, and freezing. Afterward, a posttest will be given with similar questions, and a paired sample t-test will be conducted.

Table 7 exhibits the paired samples t-test results summary.

Table 7. Paired samples t-test results summary.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre -test marks	49.780	269	11.926	0.727
	Post- test marks	63.571	269	13.893	0.847

Table 8. Paired samples t-tests results.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-test marks – Post-test marks	-13.79	6.60	0.402	-14.58	-13.00	-34.27	268	p < 0.001

Table 8 exhibits the paired samples t-test results.

A mean difference of -13.79 indicates that students performed 13.8 percentage points better in the post-test after training with instructional material made from local resources. The negative value shows improved performance in the post-test compared to the pre-test. High consistency ($SD = 6.60$) and a narrow 95% confidence interval (−14.58 to −13.00) characterized the results, which were statistically significant ($t = -34.27$, $df = 268$, $p < 0.001$).

Such results strongly refute the null hypothesis while providing enough evidence for the alternative hypothesis, indicating that training students through local instructional material leads to increased involvement and improved comprehension of scientific concepts. The average improvement of nearly 14 percentage points clearly demonstrates the significance of practical, real-life learning in relating scientific concepts to students' lives.

4.4. Challenges faced by Teachers in Using Local Materials for Science Instruction

To identify the challenges teachers face when using local materials for science instruction, the results in Table 9 reveal key challenges that hinder teachers from effectively integrating local materials into science instruction in Namutumba sub-county.

Table 9. Challenges faced in using local materials.

Statements	SA	A	N	D	SD	Mean	Std. Dev.
It is hard to find appropriate local materials for every science topic.	6 (33.3)	7 (38.9)	3 (16.7)	2 (11.1)	0 (0.00)	3.64	1.305
I lack enough time to prepare or collect local materials for science lessons.	7 (38.9)	6 (33.3)	3 (16.7)	2 (11.1)	0 (0.00)	3.71	1.281
I have not received adequate training on how to use local materials effectively.	3 (16.7)	9 (50.0)	2 (11.1)	2 (11.1)	2 (11.1)	3.66	1.340
Some local materials are not durable or safe for classroom use.	9 (50.0)	7 (38.9)	0 (0.00)	2 (11.1)	0 (0.00)	3.95	1.175
The school does not support or allocate resources for sourcing local materials.	10 (55.6)	7 (38.9)	1 (5.0)	0 (0.00)	0 (0.00)	3.73	1.373
Using local materials sometimes disrupts the lesson or takes too much time.	4 (22.2)	10 (55.6)	1 (5.0)	2 (11.1)	1 (0.5)	3.92	1.273
Some science concepts are too abstract to teach using local materials.	12 (66.7)	6 (33.3)	0 (0.00)	0 (0.00)	0 (0.00)	3.59	1.361

Statements	SA	A	N	D	SD	Mean	Std. Dev.
I face difficulty in storing or keeping local materials for future use.	6 (33.3)	11 (61.1)	1 (5.0)	0 (0.00)	0 (0.00)	3.71	1.348
Pupils sometimes mishandle or misuse local materials during the lesson.	7 (38.9)	9 (50.0)	1 (5.0)	1 (5.0)	0 (0.00)	3.78	1.154
Community members are not always willing to support the collection of local materials.	5 (27.8)	12 (66.7)	0 (0.00)	1 (5.0)	0 (0.00)	3.93	1.105
Teachers prioritize content coverage over practical engagement	7 (38.9)	9 (50.0)	1 (5.0)	1 (5.0)	0 (0.00)	4.03	0.995
Rigidity of the curriculum limits teachers' creativity	3 (16.7)	3 (16.7)	2 (11.1)	4 (22.2)	6 (33.3)	4.08	1.064
Concerns of safety and classroom control limit teachers' use of local materials	6 (33.3)	7 (38.9)	2 (11.1)	1 (0.05)	2 (11.1)	4.32	0.831

Note: SA – Strongly Agree, A – Agree, N – Not Sure, D – Disagree, SD – Strongly Disagree; () denotes percentages.

A major challenge identified was the difficulty teachers face in sourcing appropriate local materials for different science topics, with 72.2% agreeing or strongly agreeing (mean = 3.64). Teachers and key informants noted that some materials are not readily available and that preparation can be time-consuming and disruptive to lessons.

Another key issue is limited teacher knowledge and creativity in integrating local resources, with calls for improved training in improvisation and instructional design. Time constraints were also significant (73.8%, mean = 3.71), as teachers reported heavy workloads and difficulty preparing materials for every lesson. Inadequate professional training further compounded the problem, with 69.9% emphasizing the need for capacity building.

Institutional support was also lacking, with 70.9% reporting insufficient school resources for sourcing materials, and 83.5% noting that the use of local materials can disrupt lesson flow. Safety and durability concerns were strongly highlighted (90.3%, mean = 4.32), alongside challenges related to large class sizes, curriculum rigidity (92%, constrained by fixed syllabus, mean = 4.08), and pressure to complete content coverage, limiting hands-on learning.

Furthermore, socio-cultural aspects, such as incorrect material handling and resistance by the community (83.5%), were reported, as well as attitudes that could contradict science topics. In general, the results show several challenges related to structure, methodology, and context, which inhibit the efficient use of local materials for science instruction.

5. Discussion

The research was conducted to assess the impact of utilizing locally sourced instructional materials on pupils' engagement in science lessons and to investigate the constraints teachers encounter when applying such resources.

According to the results, employing locally sourced instructional materials has a notable effect on enhancing the engagement and comprehension levels of pupils. Learning through context and practical means boosts engagement, motivation, curiosity, and participation, in line with the concept of Experiential Learning Theory (Kolb, 1984) and supported by various pieces of literature, including Nakabugo et al. (2020) and Ssekamatte, Nsubuga, and Tumusiime (2021). Local material usage during classroom activities fostered cooperation, communication, teamwork, and problem-solving abilities, as learners interacted with objects such as seeds, banana stems, and charcoal (Govender & Mudzamiri, 2022; Muriithi & Kathambi, 2022).

The paired-samples t-test showed sufficient statistical proof that using local materials had a significant positive effect on pupils' participation and performance. It corroborates literature, which states that each day and local materials increase students' engagement, conceptual comprehension, and memory retention (Nakabugo et al., 2020; Rautanen et al., 2025). It is also consistent with the UNESCO (2021) statement that locally sourced resources facilitate scientific learning by making it relevant and understandable, thus allowing learners to relate science concepts to practical applications in agriculture, healthcare, and environmental preservation. Nevertheless, the research indicated the necessity for better supporting structures.

The lack of appropriate training, the availability of necessary materials, and adequate institutional support impede successful application (Adesina, 2019; Sulaiman, 2020). Consequently, developing teachers' professional skills and fostering partnerships between schools and communities are critical steps toward effectively incorporating locally sourced materials into science lessons aligned with current curricula (Nemadziva, Cole, & Sexton, 2025).

5.1. Discussion of Challenges in Using Local Materials for Science Instruction

Some of the constraints faced by teachers in utilizing local materials for science learning at Namutumba Sub-County include the following. First, the scarcity of appropriate materials to teach various scientific concepts was mentioned as one of the limitations (mean = 3.64). The teachers pointed out that although some concepts in science can easily be taught using local materials (such as leaves and soil), others cannot be taught using those materials. Some concepts may require specific equipment that cannot be available in rural areas, such as molecular bonding and electricity, which call for computer simulations of concepts. This observation agrees with Sanderson (2021) and Barrett and Long (2012).

Another constraint affecting the use of local resources in science lessons involves time limitations. Teachers felt that the amount of content to be covered within the school calendar limits their ability to utilize local materials, as it leaves very little time for preparing these materials and integrating them into lessons.

Insufficient teacher training also affects effective implementation. The lack of professional training in improvisation, adaptation, and safety management skills needed for hands-on science teaching also hinders the utilization of available local resources. It is consistent with the results obtained by Nakabugo et al. (2020) and UNESCO (2022).

Logistical issues also affect the implementation of using local materials. There are limited facilities in schools to store, manage, and reuse materials safely. This leads to safety issues, waste, and infrequent utilization of local materials (National Curriculum Development Centre, 2020; Ssekamatte et al., 2021).

Lack of institutional and community support also affects implementation. Schools do not budget for the procurement of local materials, and the role of communities is limited, making teachers rely on their resources. It is supported by the study of Sifuna (2021b) that shows the importance of community involvement in resource-based teaching methods.

Overall, the findings show that although local instructional materials have strong potential to improve science education, their effective use depends on comprehensive reforms, including improved teacher training, adequate infrastructure, stronger institutional and community support, and curriculum flexibility that prioritizes experiential learning.

6. Conclusions

The implications of the study indicate that the usage of locally sourced materials has a considerable impact on the active participation of learners in science classes. The outcomes of the study illustrate that the incorporation of concrete and real materials can assist in making abstract theories more comprehensible to students, stimulate active learning processes, improve retention, build self-confidence, and promote experiential and inquiry-based educational approaches regardless of any constraints. The main obstacles to the effective implementation of locally sourced materials comprise a lack of time for planning lessons, poor training of educators, and insufficient institutional assistance. Such factors significantly limit the possibilities of introducing creative and resource-based educational techniques. Overcoming such obstacles involves targeted policymaking, development of professional development initiatives, and collaboration between teachers, educational institutions, and communities.

7. Recommendations

Educational institutions should be encouraged to adopt an experiential learning model that emphasizes practical exercises with locally available items. School leaders should help teachers design science classes in such a way that learners get involved and comprehend what they are taught. Engaging students in searching for and using local materials can also boost their level of engagement.

Education stakeholders must ensure that schools are given sufficient time to plan and incorporate local materials into their science instruction. This can be achieved by collaborating with district education officers and head teachers, who play a crucial role in ensuring that schools have easy access to these materials.

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