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Teachers' and Students' Perceptions of Improvised Instructional Materials and the Challenges of Improvisation in Physics Education

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Abstract

This study examines the perceptions of teachers and students regarding the use of improvised instructional materials in physics education, alongside the challenges teachers face in their creation. Specifically, it investigates the impact of improvised materials on students' academic performance and explores the obstacles teachers encounter during the improvisation process. A mixed-method sequential exploratory design was employed, involving 136 physics students and 6 physics teachers from Government Secondary School, Afaha Atai, Eket. Data were gathered through questionnaires, achievement tests, and focus group discussions. Quantitative

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data were analysed using descriptive statistics and paired sample t-tests, while qualitative data were analysed thematically. The findings indicate that both teachers and students view improvised instructional materials as valuable tools that enhance comprehension, student engagement, and academic achievement in physics. However, teachers identified significant challenges in improvisation, including financial constraints, limited skills, lack of administrative support, and low motivation. The study concludes that while improvised instructional materials play a crucial role in improving learning outcomes, their effective utilisation is constrained by contextual and institutional barriers. Recommendations include the need for professional development for teachers, increased funding, and the establishment of school-level policies that foster innovation and support improvisation in resource-limited physics classrooms.

Keywords: Improvised instructional materials; Physics education; Teachers' perceptions; Students' perceptions; Academic performance; Instructional challenges

1.1 Introduction

Physics remains a core science subject in Nigerian secondary schools and serves as a gateway to several science-related disciplines such as medicine, agriculture, and biotechnology (Ahmed, 2021). Despite its importance, persistent poor performance in physics has continued to characterise many Nigerian secondary schools (Emana, 2020). The National Policy on Education (GES, 2007) emphasises activity-based, exploratory, and practical approaches to science teaching, highlighting the need for instructional materials that support hands-on learning. Instructional materials, whether concrete, visual, or audio-visual, enhance students' comprehension and engagement, and their absence often results in superficial learning and low academic achievement (Ekanem, 2019; Opoku-Asare, 2014).

However, adequate and standard instructional resources remain scarce in many schools across Nigeria, including laboratory equipment, models, charts, and modern

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teaching technologies (Azure, 2018). Studies such as Ibitoye and Fabian (2021) and Udofia (2014) have attributed students' weak performance in physics to shortages of learning resources, poor laboratory facilities, overcrowded classrooms, and the absence of student-centred teaching practices. As a consequence, teachers often rely on verbal exposition, which limits students' development of scientific inquiry skills, critical reasoning, and conceptual understanding.

Given these constraints, improvised instructional materials have emerged as practical alternatives, allowing teachers to utilise locally available resources to enhance the teaching-learning process. Existing research affirms that well-designed improvised materials can significantly improve students' academic performance, deepen comprehension of abstract concepts, and promote active learning experiences, especially in resource-constrained environments. Nevertheless, teachers frequently encounter several challenges in the improvisation process, including financial limitations, lack of skills, limited administrative support, and insufficient motivation.

These gaps show the need to understand two critical issues: how teachers and students perceive the influence of improvised instructional materials on academic performance in physics and what challenges physics teachers face when attempting to improvise these materials. This study therefore investigates these two concerns within Government Secondary School, Afaha Atai, Eket, to contribute evidence-based insights towards strengthening the use of improvised instructional materials in physics education.

1.2 Statement of the Problem

Physics remains a foundational science subject in secondary schools, yet persistent poor academic performance among students continues to raise concern. Despite the curriculum's emphasis on hands-on, activity-oriented learning, many schools lack adequate instructional materials, forcing teachers to rely heavily on verbal explanations. Improvised instructional materials have been identified as a viable alternative to standard resources, especially in resource-constrained schools. However, their effective use depends largely on teachers' perceptions, creativity, and willingness to adopt innovative instructional strategies. At the same time, students' perceptions influence how they engage with improvised materials and how these materials affect their understanding and achievement in physics.

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Although existing studies have shown that improvised instructional materials can improve learning outcomes, there is limited research that simultaneously investigates how both teachers and students perceive their effectiveness, and the specific challenges teachers face in improvisation. Without such understanding, efforts to promote classroom innovation may be hindered. Therefore, this study seeks to fill this gap by examining teachers' and students' perceptions of improvised instructional materials and assessing the challenges teachers encounter in the improvisation process.

1.3 Purpose of the Study

The study is set to attain the following purposes:

- i. Explore the views of Physics teachers and students on the extent to which improvised instructional materials influence students' academic performance.
- ii. Examine the challenges that Physics teachers face in improvising instructional materials.

1.4 Research Questions

The following research questions guide the study:

- i. What are the perceptions of Physics teachers and students regarding the extent to which improvised instructional materials affect students' academic performance?
- ii. What challenges do Physics teachers face in improvising instructional materials for teaching Physics?

1.5 Significance of the Study

This study is significant in several ways. To physics teachers, the findings will provide insight into how their improvisation efforts influence students' learning outcomes, while highlighting specific constraints that require attention for improved instructional practice. To students, the study will promote the understanding of improvised materials as effective tools that enhance active participation, comprehension, and retention in physics. To school administrators and policymakers, the results will offer evidence-based guidance for improving support systems, funding, and professional development opportunities aimed at strengthening improvisation practices in science classrooms. To curriculum planners, the study contributes to the ongoing discourse on practical, activity-based learning and reinforces the need for adequate resource provision.

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Finally, researchers will benefit from the study as it fills an existing gap and provides a foundation for further inquiry into innovative instructional strategies in resource-limited educational settings.

1.6 Scope of the Study

This study focuses on the perceptions of physics teachers and senior secondary school students regarding the effectiveness of improvised instructional materials in enhancing academic performance. The study also focuses on examining the challenges teachers encounter during the improvisation process. Geographically, the study covers Government Secondary School, Afaha Atai, Eket, in the Eket Local Government Area of Akwa Ibom State. The study does not cover standard laboratory equipment or the effectiveness of ICT-based instructional resources, as the emphasis is specifically on improvised, locally sourced materials.

Literature Review

2.1 Conceptual Review

The use of instructional resources in physics education is fundamental to effective teaching and learning. When appropriately utilized, instructional materials make learning more concrete, realistic, engaging, and permanent (Ekop, 2019). Physics, being an activity-oriented science subject, requires consistent interaction between students and learning resources to build essential scientific skills, foster self-reliance, and improve academic performance. However, evidence consistently shows that many schools lack adequate physics teaching resources (Ekop, 2019; Bassey, 2018; Pascal, 2018), placing a burden on physics teachers to improvise materials that are unavailable or insufficient.

In this context, the physics teacher becomes central to the teaching-learning process. Teachers' knowledge, creativity, and motivation affect how well they can use the resources they already have and come up with new ones when they need them. Because standard physics materials are hard to find in most Nigerian schools, improvisation is not only necessary but also an important professional skill. Thus, understanding teachers' and students' perceptions of improvised instructional materials is crucial for determining their impact on academic performance and for identifying the factors that either support or hinder effective improvisation.

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2.1.1 Teaching and Learning Physics

Physics education offers learners a methodical way of investigating and understanding the natural world. It develops scientific literacy, critical thinking, and inquiry skills that are essential for national development in areas such as agriculture, environment, industry, and health. According to CRDD (2010), physics education has two major purposes, which are to promote scientific literacy that enables citizens to make informed decisions and to prepare students for higher education and science-related careers through the development of essential scientific skills.

Practical activities are therefore essential for meaningful physics learning. To implement these practical activities effectively, relevant resources, whether standard or improvised, must be available and accessible. Aina (2018) notes that while provision of equipment is necessary, the effectiveness of physics teaching also depends on teacher training, technical suitability of materials, availability of consumables, and teacher competence.

Instructional resources motivate learners, sustain their attention, and help them understand abstract scientific ideas. Empirical evidence from Denyer (2018) and Flora (2019) shows that instructional materials help students remain engaged and improve their comprehension. In Nigeria and other developing countries, however, the lack of funds, inadequate support from stakeholders, and scarcity of standard resources (Eshiet, 2018; Ekanem, 2019) make it difficult for teachers to implement effective practical lessons. As a result, many teachers lose motivation and rely heavily on verbal instruction, which contributes to students' poor performance and declining interest in physics.

Consequently, improvised instructional materials serve as necessary alternatives. They help bridge resource gaps, making physics more relatable and accessible to learners. The literature shows that effective improvisation can arouse student interest, stimulate self-activity, enhance retention, and make learning more meaningful (Uzoegwu, 2017; Agwagah, 2019). These benefits highlight why teachers' and students' perceptions of improvised instructional materials are essential indicators of their influence on academic performance.

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2.1.2 Concept of Improvised Instructional Materials

Nigeria's educational goals emphasize the development of mental, physical, and social competencies that equip learners for societal contribution (FGN, 2004). However, the persistent lack of instructional resources in schools has hindered the realization of these goals. Hence, improvised instructional materials are used as alternatives when ready-made materials are unavailable.

According to Bassey in Emanah (2021), improvisation involves creating or using imitation equipment in place of standard teaching aids. Kamoru and Umeono (2020) add that improvisation makes use of locally available materials selected by teachers to enhance instruction. Improvised materials are simple, affordable, functional, and contextually relevant, allowing teachers to present scientific concepts in an accessible manner.

Improvisation is not merely a replacement strategy; it is also a creative process that engages teachers in resource construction, problem-solving, and adaptation. Judy (2014) emphasizes that improvised materials support learners' physical, cognitive, emotional, and social development by enabling exploration, interaction, and hands-on engagement. For physics students who often struggle with abstract concepts (Ekanem, 2019), improvised resources make learning more meaningful and relatable.

Given the ongoing scarcity of standard materials in Nigerian schools, teachers' willingness and ability to improvise becomes a determining factor in the quality of physics instruction. Thus, understanding both perceptions of improvisation and the challenges teachers face offers important guidance for enhancing physics learning outcomes.

Theoretical Framework

This research is grounded in two educational theories: Instructional Material Theory, as proposed by Gagné et al. (2019), and the Sociocultural Theory of Teaching, Learning, and Development, based on the work of Vygotsky (1978). These theories provide a foundational understanding of the role of improvised instructional materials in enhancing students' learning outcomes and the challenges faced by teachers in their use.

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Instructional Material Theory

Instructional Material Theory posits a direct connection between the instructional materials used by teachers and the academic performance of students. This theory posits that appropriate materials can augment students' capacity to participate in learning activities, formulate effective learning strategies, and foster affirmative attitudes towards learning. Specifically, Gagné et al. (2015) argue that instructional materials not only facilitate student learning through direct guidance but also provoke critical thinking and self-directed learning, leading to improved academic outcomes.

In the context of physics education, improvised instructional materials are essential tools that can make complex biological concepts more tangible and relatable for students. Gagné et al.'s theory emphasizes the importance of materials that not only provide instructional content but also encourage performance feedback and offer pathways for guided discovery learning. This aligns with the study's aim to explore how the use of improvised materials influences student performance in physics and the challenges teachers face in their effective use.

However, a limitation of the theory is that it does not delve deeply into how students independently develop critical thinking through the use of instructional materials. Vygotsky's (2018) sociocultural theory extends this by suggesting that tools like instructional materials help scaffold students' cognitive development, promoting higher-order thinking required for problem-solving. This study seeks to explore the gap in the literature regarding how improvised materials trigger cognitive development in physics students.

Sociocultural Theory of Teaching, Learning, and Development

The sociocultural theory, deeply influenced by Lev Vygotsky, emphasizes that human cognition is shaped through social interaction and the use of cultural tools. According to Vygotsky (2018), learning is not just an individual cognitive process but occurs within a social context where learners interact with peers, teachers, and the materials at hand. In the classroom, these "cultural tools" could be instructional materials, such as models, diagrams, and improvised materials, which mediate the learning process by facilitating deeper cognitive development.

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In physics education, the role of improvised materials is not just about presenting factual information; it's about engaging students in meaningful interactions that enhance their cognitive abilities. Vygotsky's theory implies that when students use improvised materials, they don't merely memorize facts but interact with the material, internalizing new concepts and developing problem-solving skills. This aligns with the study's objective to examine the challenges teachers face in using improvised materials effectively and understanding how such tools, when used interactively, influence the development of cognitive skills in physics students.

The connection between the Theory and the Study

The theories of instructional materials and sociocultural learning offer complementary insights into the use of improvised instructional materials in physics education. Instructional Material Theory emphasizes the importance of materials in facilitating learning outcomes, while Sociocultural Theory underscores the mediating role of these materials in cognitive development. This theoretical framework provides the foundation for exploring how improvised materials can influence students' academic performance in physics, as well as the practical challenges teachers face in their improvisation.

The study will explore how these theories apply in real classroom settings, focusing on how the use of improvised materials affects students' understanding of physics and the extent to which teachers' improvisation efforts face limitations. By examining these factors, the research aims to contribute to the development of more effective strategies for using improvised instructional materials in physics education.

Empirical Review

2.3.1 The Extent to Which Improvised Instructional Materials Affect Student Performance

In their study, Adeogun (2020) explored the link between instructional resources and student academic performance, finding a strong positive correlation. Schools equipped with better instructional resources tended to perform better academically. This finding supports Babayomi's (2019) research, which showed that private schools did better than public schools because they had enough teaching materials. Adeogun (2020) specifically noted that public schools often suffer from a lack of essential resources,

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which significantly hampers effective teaching and learning. Fuller and Clark (2014) further argued that the quality of instructional materials directly influences the quality of the learning experience, leading to improved academic outcomes.

This body of research supports the notion that having adequate teaching resources—whether traditional or improvised—can directly impact student performance. However, this study goes further by focusing on how *improvised instructional materials* can contribute to or challenge physics students' learning, particularly in schools where access to standard resources is limited. Eshiet (2019) discovered that the presence of sufficient instructional materials and equipment markedly improved student performance. However, the study primarily focused on physical facilities and left out the role of improvised materials, which this research seeks to address by investigating their potential impact on physics education.

In line with these studies, Maundu (2017) agrees that schools equipped with adequate instructional materials, including improvised ones, tend to perform better. This study extends these findings by exploring how physics teachers and students perceive the role of improvised materials and how their use influences learning outcomes in the physics classroom.

2.3.2 Challenges Teachers Face in Accessing Improvised Instructional Materials

Teachers in rural and deprived senior high schools face numerous challenges in accessing instructional materials, especially when it comes to improvising in the absence of standard resources. One of the main problems that teachers say they have is that there isn't enough money to buy teaching materials. According to Taiwo (2018), government capitation grants intended to provide schools with necessary resources are often insufficient. This issue is exacerbated by increasing student enrollments, while the capitation grants have not been adjusted to keep pace with inflation or the growing need for educational resources (Godswill, Amefiok, & Atta, 2019).

Moreover, many teachers lack the expertise and experience needed to effectively improvise instructional materials. For instance, rural schools, particularly in pastoral areas, often do not have access to Information and Communication Technology (ICT), which could alleviate some of the scarcity of resources (Udofia, 2018). In schools where ICT infrastructure exists, issues such as poor maintenance, installation challenges, and lack of trained personnel to support the technology hinder effective use. This lack of

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technological resources and support creates additional barriers for teachers seeking to improvise instructional materials for physics education.

Furthermore, the absence of clear governmental policies and monitoring mechanisms for ensuring that rural schools are adequately funded and equipped with necessary resources further compounds the challenges faced by physics teachers. Opoku (2018) highlighted that the government's policy on resource provision for rural schools is often poorly planned and inadequately executed, leaving these schools disadvantaged in terms of instructional materials.

This research builds on these findings by focusing on the specific challenges physics teachers face when trying to improvise instructional materials, particularly in underfunded schools, and how these challenges affect the quality of physics education.

2.3.3 Strategies to Minimize the Challenges of Accessing Improvised Instructional Materials

Improvisation of instructional materials is frequently cited as a viable strategy to mitigate the challenges of inadequate resources in the classroom. Eshiet (2016) characterized improvisation as the act of sourcing, selecting, and utilizing pertinent materials in the absence or inadequacy of conventional resources. Studies by Abodelraheem and Al-Rabane (2015), Ibe-Bassey (2012), and Udosen (2011) suggest that improvisation using low-tech, resource-centered materials can enhance learning outcomes, even in the absence of sophisticated tools. The use of improvised materials can also facilitate the integration of technology into teaching, which is particularly important for subjects like physics that benefit from visual aids and practical demonstrations.

According to UNESCO (2014), ICT has the potential to improve the quality and efficiency of physics education by providing teachers and students with easier access to information. The use of ICT tools, such as educational websites, online simulations, and digital models, can help mitigate the shortage of physical instructional materials. By providing teachers with online resources and access to instructional content from leading educators worldwide, ICT can enhance both the teaching and learning experience.

Tinio (2012) emphasized that ICTs offer developing countries unprecedented opportunities to improve the quality of education. This study expands on this concept by

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examining how the utilization of improvised materials, both traditional and technological, can assist physics educators in surmounting obstacles to accessing standard resources and enhance the overall educational experience for students.

Research Methodology

This study utilized a mixed-method sequential exploratory design to examine the influence of improvised instructional materials on physics students' academic performance at Government Secondary School, Afaha Atai, in Eket Local Government Area. The design followed a two-phase approach: initially, quantitative data was collected and analyzed, followed by qualitative data collection to deepen the understanding of the challenges and perceptions of teachers and students regarding the use of improvised materials. This design allowed the study to integrate numerical findings with personal insights, offering a comprehensive view of the impact of improvised materials on physics education.

The study focused on Government Secondary School, Afaha Atai, located in Eket, Akwa Ibom State. Eket, being a diverse town with a heterogeneous population due to an influx of non-indigenes, was selected for its varied educational settings. The school, established in 2020, has a student population of 1,061. The target population for this study included physics teachers and students from senior secondary classes (SS1 to SS3), with an accessible sample of 486 individuals. From this, 136 students and 6 physics teachers were purposively selected based on their knowledge and experience with improvisation in physics instruction.

Data was collected using tests, questionnaires, and interviews. Pre- and post-intervention tests were administered to assess the effect of improvised materials on student performance. A questionnaire was used to gather teachers' and students' perceptions of the impact of improvised materials on academic performance and the challenges teachers face in accessing standard resources. Focused group discussions (FGDs) were conducted to gain deeper qualitative insights. The instruments were validated by experts and pilot-tested to ensure reliability, with a Cronbach's alpha coefficient of 0.92 indicating high reliability. Data analysis was conducted using SPSS for the quantitative phase, while the qualitative data from interviews was analyzed thematically, allowing for a more nuanced assessment of the research problem.

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4.1 Results and Analysis

Research Question One

What are the views of teachers and students about the extent to which improvised instructional materials affect students' performance in Physics?

This question was intended to determine the reasons why the teachers used instructional materials in teaching. The findings are summarized in Tables 1 and 2 for teachers and students, respectively. On whether the instructional materials used by teachers help students in the teaching and learning process, the majority of the respondents, 63% of the teachers (Table 1) and 79% (Table 2) of the students, pointed out that the materials help them to improve knowledge and skills, and the minority, 21% of student respondents (Table 1) and 37% (Table 2) of the teachers, pointed out that the materials help them to pass examinations. These responses are in line with the literature, where scholars (Osei-Himah et al., 2018; Opoku et al., 2019) asserted that there is a very strong positive significant relationship between instructional resources and academic performance. As Osei-Himah et al. (2018) suggested, schools endowed with more resources performed better than schools that are less endowed. The respondents in this study are in agreement with the literature. This belief is corroborated by the study by Nyarko and Amevi (2019) that private schools performed better than public schools because of the availability and adequacy of teaching and learning resources.

Table 1: Teachers' Views about the Effects of Instructional Materials on Students' Performance

Effect of instructional materials	Frequency	Percentage %
To Pass Examinations	2	33.33
To Improve Knowledge and Skills	4	67
Total	6	100

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Table 2: Students' Views about the Effects of Instructional Materials on their Performance

Effect of instructional materials	Frequency	Percentage
To Pass Examinations	28	21
To Improve Knowledge and Skills	108	79
Total	136	100

Research Question Two:

What challenges do Physics teachers face in improvising instructional materials?

The goal of this research question was to determine challenges physics teachers face in improvising instructional materials. The researcher investigated the challenges that teachers face in improvising instructional materials. This illustrates challenges faced by physics teachers in the four schools under study. Figure 1 shows that 88% of the teachers are faced with financial problems in accessing improvised instructional materials, 6% are faced with the challenge that school administrators are unwilling to readily release money for the purpose of improvising instructional materials even though the money is available, and 6% are not motivated to improvise instructional materials from locally available materials.

Figure 2 shows that 38% of the teachers do not want to improvise local materials for teaching, while 62% of the teachers affirmed that the access to locally made materials is hindered by their lack of improvisation skills. The results concur with the findings by Opoku (2018). Opoku found that the lack of using improvised instructional materials in senior secondary schools was very much related to insufficient skills and creativity among the teachers. These, Opoku opined, may hinder teachers from improvising their instructional materials.

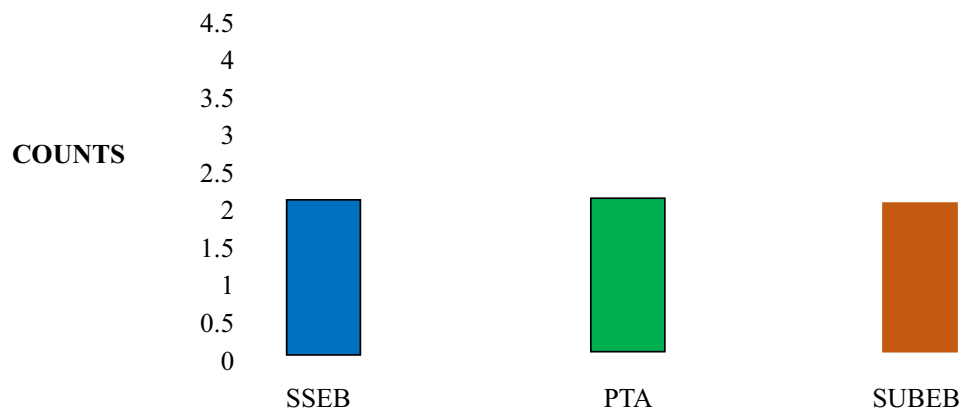
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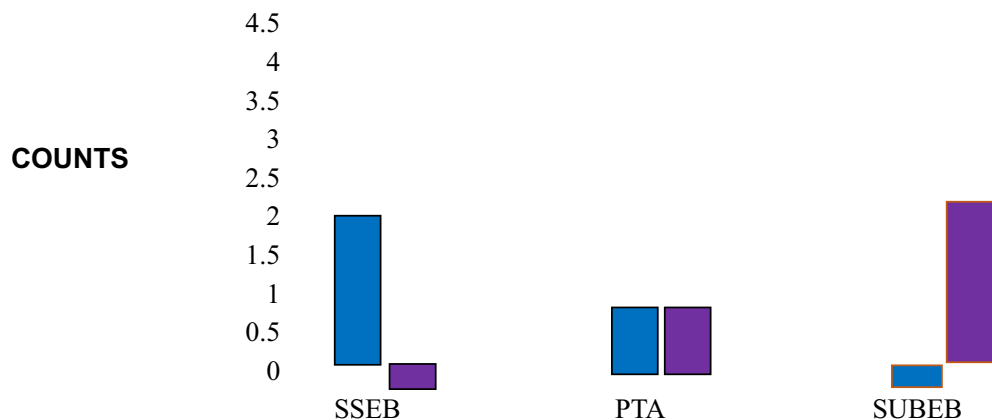
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Financial limitation	2	0	0
Administrative problem	0	2	0
Lack of motivation	0	0	2
SCHOOL			

Figure 1: Challenges of Improvising Instructional Materials



Lack of improvisation skill	2	1	0
Lack of motivation	0	1	2
SCHOOL			

Figure 2: Challenges for Accessing Locally Made Instructional Materials

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Discussion of Findings

The findings of this study support previous research on the positive impact of improvised instructional materials on students' academic performance in physics. Like Olowe and Adedeji (2018), who found that improvised materials significantly enhanced student performance, this study revealed that students who were taught with improvised instructional materials achieved significantly higher post-test scores (mean = 17.49, SD = 4.48) compared to the control group (mean = 10.11, SD = 3.42). The t-test results ($t = -7.39$, $p < 0.05$) confirm that the use of improvised instructional materials has a significant positive effect on students' academic performance. This aligns with the idea that improvised materials can improve students' understanding of physics concepts, particularly in schools where access to standard resources is limited.

In addition to the positive impact on student performance, the study also identified several challenges faced by teachers in improvising instructional materials. Key issues included insufficient funding, lack of improvisation skills, and limited administrative support. Teachers indicated that these barriers made it difficult to fully integrate improvised materials into their teaching practices. Despite these challenges, teachers and students both acknowledged the value of improvised instructional materials in enhancing learning outcomes, particularly when standard materials are not available. The findings suggest that overcoming these challenges could lead to more widespread use of improvised materials in physics education, ultimately improving student learning outcomes.

Conclusion

This study examined the impact of improvised instructional materials on students' academic performance in physics and explored the challenges faced by teachers in improvising these materials. The findings reveal that the use of improvised instructional materials significantly enhances students' performance in physics, particularly in schools where standard resources are limited. The positive impact on student achievement, as evidenced by the higher post-test scores in the experimental group, underscores the effectiveness of improvisation as a viable teaching strategy. Moreover, the study highlights the importance of improvised materials in fostering a better understanding of complex biological concepts when conventional materials are unavailable.

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However, the study also identified significant challenges faced by teachers in utilizing improvised instructional materials, including inadequate funding, lack of improvisation skills, and limited administrative support. These barriers hinder the effective implementation of improvised materials, suggesting the need for targeted interventions to equip teachers with the necessary skills and resources. Despite these challenges, the findings emphasize that improvised materials remain a crucial tool for enhancing physics education. Teachers are encouraged to integrate these materials into their teaching practices to improve student learning outcomes and bridge the gap created by limited access to standard resources.

Recommendation

Based on the findings of this study, the following recommendations are made:

- i. **Incorporate Improvised Instructional Materials in Physics Teaching:** Given the significant positive impact of improvised instructional materials on student performance, it is recommended that teachers be encouraged to regularly integrate improvised materials into their teaching practices. This can help enhance students' understanding of complex physics concepts, particularly in schools with limited access to standard instructional resources.
- ii. **Teacher Training on Improvisation Skills:** To address the challenges teachers face in improvising instructional materials, it is recommended that schools provide professional development opportunities focused on enhancing teachers' improvisation skills. Workshops and training programs should be organized to equip teachers with the necessary knowledge and techniques for creating and using improvised materials effectively in the classroom.
- iii. **Increase Funding for Instructional Resources:** Schools, particularly those in resource-constrained areas, should receive increased funding for instructional materials, including improvisation materials. This will help alleviate the financial constraints that hinder teachers' ability to implement effective teaching strategies.
- iv. **Administrative Support and Policy Development:** School administrators and policymakers should develop and implement clear strategies to support teachers in improvising instructional materials. This includes providing guidance on

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sourcing materials, ensuring adequate funding, and offering technical support for teachers, especially in rural or underserved areas.

- v. **Collaboration with Communities:** Schools should collaborate with local communities to mobilize resources for improvisation. Community engagement can provide additional support, both financially and in terms of materials, helping to bridge the gap in resources available to teachers.

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