UNIVERSITY OF EDUCATION, WINNEBA

UPPER PRIMARY SCIENCE TEACHERS' KNOWLEDGE, PERCEPTION AND USE OF IMPROVISED INSTRUCTIONAL MATERIALS IN THE OKAIKWEI NORTH MUNICIPALITY

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DECLARATION

Student's Declaration

I, Kenneth Achana, declare that this thesis, with the exception of quotations and references contained in published works which have been identified and duly acknowledged, is entirely my own work, and it has not been submitted either in part or whole for another degree elsewhere.

Signature……....

Date……

Supervisors' Declaration

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of Thesis as laid down by the University of Education, Winneba.

Supervisor: Prof. Sakina Acquah (Principal)

Signature……

Date…….

Supervisor: Mr. Nixon Saba Adzifome (Co)

Signature……..

Date…….

DEDICATION

To my family.

ACKNOWLEDGEMENTS

I express my heartfelt gratitude to the Almighty God for guiding me through this graduate programme.

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ABSTRACT

This study investigated the knowledge, perception, and utilization of improvised instructional materials among Upper Primary science teachers in the Okaikwei North Municipality. Grounded in instructional material theory and the theory of multiple intelligences, the research adopted a pragmatic paradigm, utilizing a mixed methods approach with an embedded mixed method design. The entire population of 81 Upper Primary science teachers participated in the study, selected through census sampling. Data were collected through closed-ended questionnaires, semi-structured interviews, and observation checklists. Qualitative data underwent thematic analysis and frequency counts, while quantitative analysis involved frequency, percentages, mean, standard deviation, independent samples t-test, and Pearson's correlation. Results indicated that Upper Primary science teachers possess adequate knowledge for improvising instructional materials, with a significant portion demonstrating an average level of proficiency. Teachers acknowledged the practicality of improvised materials, their role in addressing material shortages, and their potential to raise awareness of alternative teaching resources. It was recommended that continuous support from primary school headteachers through professional development opportunities, workshops, and resource access to enhance teachers' improvisation skills. Tailored training programmes addressing variability in teachers' perceptions are also advised.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter comprises the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions and hypotheses, significance of the study, delimitation of the study, definition of terms and organization of the study.

1.1 Background to the Study

Science is the foundation upon which today's technological advancements are laid. Nations worldwide including Ghana, are striving hard to develop technologically and scientifically. Science is essential for citizens of a given country to learn and it should be taught in all learning institutions starting from pre-primary to higher institutions of learning. Science is vital in providing learners with the skills required for accelerating economic growth, industrialization and advancement in technology (Ministry of Education, Science, and Technology, 2005). It is a core subject in helping Ghana to attain vision 2030 which is geared towards developing Ghana's economy and technology. According to Owolabi (2004), science has become an integral part of human society and through it, man has been able to better understand his environment.

In USA science instruction in primary schools follows the National Association for Education of Young Children (NAEYC) guidelines on developmentally appropriate practices (DAP). A study conducted by Ngasike (2012), indicated that the guideline advocates for cohesive science teaching and learning through play, exploration of the natural environment, experiments, creativity and problem solving. The teacher has to

arrange the classroom well to ensure learners learn science well and their misconceptions are cleared. The programme ensures that children have adequate materials from the natural environment to use in learning science. This shows that science learning reflects what goes on in the child's environment, thus, ensuring that teaching and learning of science is meaningful and relevant to the life of the learners.

The scientific nature of science makes children in their early educational life curious to learn everything that happens around them. Science enables children to understand the world in which they live. According to Ibe-Bassey (2012), children use all their senses in learning scientific processes that involve exploration, discovery, experimentation, organization of information and reporting. It is essential to provide a conducive and stimulating environment where children learn science by doing and carrying out activities (Tina, 2005). Thus, children should be provided with many activities accompanied with relevant adequate materials from the surrounding environment.

Since science is vital in both developed and developing countries, the basic scientific education foundation should be laid in early childhood using culturally relevant improvised materials where children can learn science in culturally responsive ways (Ngasike, 2010). Science instruction for young children should be activity oriented with variety of materials from the local environment to manipulate and construct their own scientific knowledge given that, science is compulsory from pre-school to secondary schools. Children ought to access education that is based on their culture to ensure easy transmission of knowledge, perceptions and values about the society (NECDP, 2005). Children should be taught using improvised and culturally relevant

instructional materials since it has the local content like pictures, plants, foods, hides, models, story books, charts, fruits, soil, animals and real objects.

To be able to provide Education For All (EFA) and to attain Sustainable Developmental Goals (SDGs), the main objective is to provide quality education and training to every child despite the background they come from. Children can access cheaper and quality education through use of locally improvised materials from the local environment. This can also motivate children to come to school and to reduce the absenteeism rate as indicated by Uwezo report (2011). Use of Improvised Instructional Material makes learners enjoy learning and retain learn content for long. The role of the teachers is evidently significant, they need to provide locally improvised materials in the classrooms and use them in the teaching and learning process in order to develop scientific skills, perception, values and core competencies of the standards-based curriculum.

The standard-based curriculum for science education in Ghana requires the use of improvised instructional materials by teachers. The effective use of improvised instructional materials can enhance students' engagement, promote inquiry-based learning, and support the development of critical thinking skills. However, the use of improvised instructional materials in the classroom requires that teachers have adequate knowledge and skills in creating and using these materials, as well as a positive perception towards their use.

Primary school teachers, therefore, play crucial role in bringing positive learning of science to children. It is therefore important for teachers to improvise, organize collection and make materials from the natural environment to be used in teaching and learning. Improvised Instructional Material (IIM) are acknowledged globally and

used in primary science instruction in Africa and in Ghana, the government has tried to put several mechanisms to boost the teaching and learning of science in the country.

Improvised Instructional Materials (IIM) are acquired from the local environment, either within or outside the school environment. They are sourced by teachers, parents, learners, community members and other charity organizations. Improvisation involves the process of selection and creation of relevant instructional elements for teaching and learning process to achieve the educational goals and objectives (Ngasike, 2012). Science IIM is effective in teaching and learning process because the learners are familiar with them hence they enjoy learning. They also motivate learners, encourage classroom participation, enlarge the limited knowledge of learners as well as improving the quality of teaching and learning (Ibe, 2012). According to Ibe-Bassey (2012), IIM enhance smooth transition of children from home to school as it makes it easier for them to connect new knowledge to their own daily life experiences.

Improvised instructional materials are not widely used in schools by teachers and learners. Ezeasor's (2012) study on assessing teachers' use of improvised materials in science education revealed that most science teachers did not improvise science materials nor use IIM in teaching sciences in schools. This was attributed to poor funding, lack of time on the part of the teacher, lack of creativity and poor improvisation skills. This inhibits the upper primary learners in developing their inherent potential and also the use of senses in learning science. Therefore, there is need to embrace improvisation of instructional materials from the local environment.

Despite the potential benefits of using improvised instructional materials, there are several challenges that may limit their use in the classroom, including limited access to resources, lack of training and support for teachers, and negative perceptions towards the use of non-traditional teaching aids. Therefore, this study aims to investigate upper primary science teachers' knowledge, perception, and use of improvised instructional materials in the standard-based curriculum in Ghana.

1.2 Statement of the Problem

Science education is inherently practical, requiring teachers to provide adequate instructional materials to engage primary school learners effectively. Research emphasizes that young learners benefit most from hands-on activities, exploration, and manipulation of materials, which helps them understand the world around them (Boadu, 2014). Unfortunately, science instructional materials in Ghanaian primary schools are often insufficient, limiting the ability of teachers to deliver effective lessons. Boadu (2014) identified that many primary schools in Ghana lack the necessary instructional materials, highlighting the need for teachers to improvise using locally available resources. This improvisation can help overcome shortages, enhance science teaching, and improve student performance. While various studies (Mumba, 2016; Ssemugenyi & Bitswande, 2019) have recognized the advantages of using improvised instructional materials in science, such as boosting student engagement, inquiry-based learning, and critical thinking, teachers' knowledge and perceptions of these materials play a crucial role in their effective use. For teachers to successfully implement these materials, they must not only have the skills to create them but also hold positive perceptions about their value (Chirwa & Nyirenda, 2019). However, there is limited research on the knowledge, perceptions, and use of improvised instructional materials specifically among upper primary teachers in the

Okaikwei North Municipality. Most available studies either focus on different educational contexts or examine early childhood and pre-primary levels. For instance, Makokha (2017) focused on pre-primary teachers, and Tety (2016) studied the role of instructional materials in academic performance. Additionally, research in Ghana has largely concentrated on related topics, such as the use of culturally relevant materials (Kuyini, 2007), the impact of learner participation in science activities (Wambui, 2013), and teacher-related factors in preschool science activities (Kangori, 2014).

The absence of comprehensive research on upper primary teachers' knowledge, perceptions, and challenges in using improvised instructional materials creates a gap in understanding how to improve science education at this level. Without this understanding, the quality of teaching and learning may suffer, limiting the potential for innovative and resourceful teaching strategies. Therefore, this study aims to investigate upper primary science teachers' knowledge, perceptions, and use of improvised instructional materials in the Okaikwei North Municipality. By addressing this gap, the study seeks to identify opportunities for enhancing science instruction through the effective use of locally improvised resources. A mixed-method approach will be adopted to gain a deeper understanding of these factors and contribute to improving science education in the municipality.

1.3 Purpose of the Study

The study sought to investigate upper primary science teachers' knowledge, perception and use of improvised instructional materials in the Okaikwei North Municipality.

1.4 Objectives of the Study

The study sought to:

1. investigate upper primary science teachers' knowledge towards improvisation of instructional materials.
2. examine upper primary science teachers' perception towards improvisation of instructional materials.
3. investigate upper primary science teachers' use of improvised instructional materials.
4. investigate the challenges upper primary science teachers encounter in the use of improvised instructional materials.

1.5 Research Questions

The study was guided by the following research questions:

1. What is the knowledge of upper primary science teachers towards improvisation of instructional materials?
2. What are the perceptions of upper primary science teachers towards improvisation of instructional materials?
3. How do upper primary science teachers' use improvised instructional materials?
4. What challenges do upper primary science teachers encounter in the use of improvised instructional materials?

1.6 Hypotheses

The following null hypotheses were tested in the study.

H_{o1}: There is no statistically significant difference between male and female upper primary science teachers' knowledge in the use of improvised instructional materials.

H_{o2} : There is no statistically significant relationship between upper primary science teachers' perception and the challenges they encounter in the use of improvised instructional materials.

1.7 Significance of the Study

The findings of the study will provide vital information on the use of Improvised Instructional Materials (IIM) to different individuals in various ways. Primary school science teachers will see the need for improvisation and how to use improvised materials during instruction to improve learning outcomes. The study will help head teachers of basic schools and management of basic schools to actively support the improvisation of instructional materials for effective learning to take place.

Investigating upper primary science teachers' knowledge on the improvisation of instructional materials is significant because it helps to understand the extent to which teachers are familiar with the concept of improvisation and their understanding of its application in science education. This knowledge is crucial in identifying gaps and areas for improvement in teacher training programs, curriculum development, and resource allocation for effective science teaching.

The findings on upper primary science teachers' perception towards the improvisation of instructional materials will shed light on their perceptions, beliefs, and values

regarding the use of improvised materials in the classroom. Positive perceptions towards improvisation can lead to increased motivation, creativity, and innovation among teachers, resulting in more engaging and effective science instruction.

Investigating how upper primary science teachers' use improvised instructional materials is significant because it provides insights into the actual practices and strategies employed by teachers in integrating improvised materials into their science lessons. Understanding the various approaches and techniques used by teachers can inform the development of guidelines, best practices, and professional development programs to enhance the effective use of improvised materials in science education.

Investigating the challenges upper primary science teachers encounter in the use of improvised instructional materials is significant because it helps identify the barriers and obstacles that hinder the successful implementation of improvisation strategies in the classroom. These challenges could range from lack of resources, time constraints, lack of training, or resistance from stakeholders. Addressing these challenges can support teachers in overcoming barriers and optimizing the use of improvised materials, ultimately improving the quality of science education in upper primary schools.

These findings will be useful to National Council for Curriculum and Assessment (NaCCA) and Okaikwei North Municipal Education Directors on the need to organize seminars and training meetings with primary teachers to train them on improvising instructional materials from the local environment and to encourage them to use them frequently in teaching. Finally, the study may help parents and other stakeholders like Non-Governmental Organizations (NGOs), Faith Based Organizations (FBOs) and Community Based Organizations (CBOs) in channeling their resources and efforts

towards improvising materials and enlightening teachers on using IIM during instruction.

The findings of a study on the improvisation of instructional materials in upper primary science education will contribute to the existingknowledge base on the topic by providing new insights, perspectives, and empirical evidence regarding teachers' knowledge, perceptions, practices, and challenges related to the improvisation of instructional materials. This contributes to a deeper understanding of the factors influencing the effective use of improvised materials in science education.

1.8 Delimitation of the Study

The study was delimited to investigation into the knowledge, perception and use of improvised instructional materials in science instruction in the sampled primary schools in the Okaikwei North Municipality of the Greater Accra Region. Teachers from other levels of the education could have been used for the study but the researcher focused on the use of upper primary science teachers. Also, the researcher delimited to the use of upper primary science teachers in the Okaikwei North Municipality of the Greater Accra Region because of his proximity to this schools compared to schools in other jurisdiction.

1.9 Definition of Terms

Improvised Materials: Teaching and learning resources made or collected from the local resources for the teaching of science in upper primary.

Teachers' Knowledge: Teachers' knowledge of improvised materials refers to their understanding and ability to create teaching aids and materials using locally available resources or everyday objects that are not typically used as teaching aids.

Teachers' Perception: Teachers' perception towards improvised materials refers to their beliefs, values, and perceptions regarding the use of locally available resources or everyday objects that are not typically used as teaching aids in the classroom.

Upper primary science teachers: Science teachers for basic 4 to basic 6.

1.10 Organization of the Study

The study is organized into five chapters. The present chapter is the introductory chapter, entailing the background to the study, statement of the problem, purpose of the study, objectives, research questions, hypothesis, significance of the study, delimitation of the study and definition of terms. Chapter two contains a review of literature relevant to the study. Chapter three describes the methodology and procedures used in the study. This includes research philosophy, research approach, research design, the population, sample and sampling techniques, research instruments, data collection procedures and data analysis plan. Chapter four contains the results of the study. It presents a detail description of the findings and discussions of the study. Finally, chapter five consists of a summary of findings and conclusions of the entire body of research and includes recommendations, limitations and suggestions for further/future research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

The study of integrated science and its related concepts have caught the attention of many, including academics, educationists, researchers, professionals and scholars. It is in this direction that this part of the work reviewed what researchers and scholars have written based on the topic. The chapter was reviewed along theoretical framework, related literature review, conceptual framework and review of empirical studies.

2.1 Theoretical Framework

2.1.1 Instructional Material Theories

Instructional material theories assume that there is a direct link between the materials that the teachers use, and the students' learning outcomes. These outcomes include higher abilities to learn, quality strategies to learn and perform classroom activities and positive perception towards learning. Further, these theories assume that instructional materials have the capacity to develop into students the highest order of intellectual skills as they illustrate clearly, step by step how to follow the rules/principles and elaborate on the concepts, all of which have positive impact on solving new problems by analyzing the situation and formulating a plan (Gagné et al. 2005).

According to Gagne et al. (2005), instructional material can be used to develop higher learning abilities to the learners through self-teaching or guided learning. This implies that the instructional materials mainly comprise "eliciting performance" and

"providing feedback on performance correctness," in addition to "providing learning guidance" for guided discovery learning. Many of Gagné's nine ideas have broad implications for secondary teachers in community secondary schools in Rombo district. Many of these ideas have capacity building undertones with themes of students' acquisition of critical thinking and problem-solving skills. However, the theory does not relate to whether or not students can think critically in what aspects or how they can solve a particular problem by themselves. However, I have the opinion that the purpose of instructional materials or technology in education is to stretch students' imagination and to encourage them to solve problems in their lives. Teachers' knowledge of instructional material theories can inform their understanding of how to design and select appropriate improvised materials that align with learners' cognitive capacities and constructivist principles (Sweller et al., 2011).

Familiarity with instructional material theories can support teachers in creating materials that facilitate effective information processing, reduce cognitive load, and promote active engagement and reflection among students. Teachers' perceptions towards improvised instructional materials influence their willingness to integrate and utilize them in their teaching practices. Positive perceptions towards improvisation can foster creativity, flexibility, and openness to innovative instructional approaches (Ergül & Canpolat, 2020). Recognizing the potential benefits of improvised materials, such as promoting active learning, student engagement, and critical thinking, can contribute to favorable perceptions among teachers.

With the application of instructional material theories, teachers can design and adapt improvised materials to match students' cognitive capacities and promote constructivist learning experiences (Sweller et al., 2011; Jonassen, 1999). Utilizing

improvised instructional materials can provide opportunities for hands-on activities, problem-solving, and student-centered approaches, enhancing student engagement and understanding. Teachers may face challenges in identifying appropriate improvised materials that align with instructional material theories and meet the specific needs of their students. Time constraints, limited resources, and lack of training or support in improvisation techniques could hinder teachers' effective use of improvised instructional materials (Ergül & Canpolat, 2020).

2.1.2 Theory of Multiple Intelligence

The Theory of Multiple Intelligences (MI) was promoted by Gardner(1983); it puts forth a new and diverse view of human intellectual experiences. The nature of MI Theory lends itself to creating a social environment, particularly for students with educational developmental disabilities. Gardner (2006) noted that, effective education builds a link between the content being taught and the students in the classroom. This implies, teachers required to recognise the difficulties students face in getting a significant understanding of important topics and concepts. This theory highlights, the necessity to take into account the differences among minds and, as far as possible, adapt an education system that can address the varied needs of students. Similarly, Peters (2010) submits that supporting students both behaviourally and academically begins with meeting their needs. This comprises developing lessons that draw on a variety of differences where teachers can adopt different approaches to manage the needs of students rather than resorting to just a method. Fierros (2014) progresses the argument of Peters (2010) by indicating that, MI equally improves students' academic achievement and modifies the perceptions of teachers towards teaching and learning with variety of materials and in addition to increasing their confidence and enthusiasm for learning.

Multiple Intelligence shows academic aptitudes and honours alternate ways of learning, that could be greatly beneficial when educating students in the classroom. Peters' (2010) supposition is expanded by Fierros (2014) by submitting that supporting students both behaviourally and academically begins with meeting their needs. Contemporarily, teachers are expected to facilitate the use of multiple intelligences, by rethinking how students can benefit and display their competences for their academic success.

Howard Gardner's theory of multiple intelligences proposes that individuals have distinct intellectual abilities, including linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalistic intelligences (Gardner, 1983). According to the theory, individuals learn and process information differently based on their dominant intelligences. Teachers can tap into these intelligences to design instructional materials and activities that cater to students' diverse strengths and preferences (Armstrong, 2009).

The application of the theory of multiple intelligences to a study focused on investigating teachers' knowledge, perceptions, and use of improvised science instructional materials. The theory of multiple intelligences suggests that individuals possess different cognitive strengths and learning styles. Understanding how teachers' knowledge, perceptions, and instructional practices align with the theory can provide insights into the effective use of improvised instructional materials in science education.

Teachers' knowledge of the theory of multiple intelligences can inform their understanding of how to design and implement improvised instructional materials that align with students' diverse intelligences (Gardner, 1999). Understanding the various

cognitive strengths of students can help teachers develop and adapt instructional materials to meet the needs of different learners. For example, incorporating visual elements for spatially intelligent students or incorporating music and rhythm for musically intelligent students (Gardner, 2006).

Teachers' perceptions towards improvised instructional materials influence their willingness to experiment with new approaches in the classroom. Recognizing the value of diverse instructional materials can lead to increased acceptance and utilization of improvisation strategies (Sulistyo, 2017). Embracing the theory of multiple intelligences can promote a positive perception towards improvised materials, as they offer opportunities for differentiation and personalized learning experiences (Armstrong, 2009).

By incorporating the theory of multiple intelligences into instructional practices, teachers can create a rich learning environment that addresses diverse learners' needs. This can involve developing improvised materials that activate multiple intelligences and offer varied entry points for students (Gardner, 1999). The use of improvised instructional materials can enhance student engagement, motivation, and understanding by catering to their individual strengths and learning preferences (Armstrong, 2009).

2.2 Conceptual Review

2.2.1 Instructional Materials

Instructional materials play a vital role in science education as they support the learning process, provide concrete examples, and engage students in hands-on experiences (Grossman & Thompson, 2008). Effective instructional materials help

teachers convey complex scientific concepts, promote inquiry-based learning, and enhance students' understanding and retention of scientific knowledge (Sunal et al., 2001). They also facilitate the development of students' scientific skills, such as observation, experimentation, and critical thinking (Bell, Smetana, & Binns, 2005).

Traditional textbooks provide structured content and serve as a primary resource for science instruction (Abell & Lederman, 2007). They offer a comprehensive overview of scientific concepts, theories, and applications. The use of multimedia resources, such as videos, animations, simulations, and interactive software, has gained popularity in science education. These resources provide visual representations and engage students in hands-on learning experiences (Hew & Brush, 2007). Hofstein and Lunetta (2004) posited that laboratory activities and experiments play a crucial role in science education. They allow students to engage in inquiry-based learning, develop scientific skills, and apply theoretical concepts to practical contexts

Well-designed instructional materials facilitate the development of students' conceptual understanding in science (Windschitl, Thompson, & Braaten, 2008). They provide clear explanations, examples, and opportunities for students to apply their knowledge. Engaging and interactive instructional materials stimulate student interest and motivation in science learning (Herrington & Kervin, 2007). Multimedia resources and hands-on activities create a dynamic and IIMersive learning environment. Effective instructional materials support students' engagement in scientific inquiry by providing opportunities for investigation, problem-solving, and critical thinking (Duschl, Schweingruber, & Shouse, 2007).

Instructional materials should align with curriculum guidelines and learning standards to ensure coherence and relevance in science education (NGSS Lead States, 2013). Teachers' knowledge of instructional materials and their pedagogical content knowledge influence material selection and utilization (Appleton, 2006). Teachers need to assess the appropriateness and effectiveness of materials in supporting student learning. Hew and Brush (2007) mentioned that the availability and accessibility of instructional materials impact their utilization in the classroom. Adequate funding, technology infrastructure, and teacher support are essential for effective implementation

2.2.2 Improvisation of Instructional Materials

Improvisation of instructional materials refers to the ability of teachers to create or modify materials using available resources to meet the specific needs of their students (Powers, 2014). Improvisation enables teachers to adapt to diverse learning environments, address students' prior knowledge, and provide relevant and engaging learning experiences (Wu & Lee, 2018). Studies have shown that improvisation of instructional materials in science education positively impacts students' motivation, engagement, and conceptual understanding (Herrington, Oliver, & Reeves, 2003). Teachers who are skilled in improvisation can use everyday materials, low-cost resources, or technology tools to create hands-on activities, demonstrations, and simulations that align with the curriculum and promote active learning (Lyons, 2006). Teachers with a deep understanding of scientific concepts and processes are better equipped to improvise materials that accurately represent scientific phenomena and facilitate student learning (Grossman & Thompson, 2008). Effective professional development programs provide opportunities for teachers to learn new improvisation techniques, explore resources, and collaborate with colleagues to share best practices

(Tosun & Taskesenligil, 2018). Contextual factors, such as access to resources and support from school administrators, also impact teachers' ability to improvise instructional materials. Limited access to materials, time constraints, and lack of administrative support can hinder teachers' improvisation efforts (Miller, 2002). On the other hand, supportive school environments that provide adequate resources and encourage creativity foster teachers' improvisation practices (Özay, Şengül, & Yıldırım, 2019).

Improvisation of instructional material means creating or adapting teaching resources on-the-spot to meet the specific needs of learners and enhance the instructional experience. It involves the flexible use of available materials, technologies, and strategies to create engaging and effective learning opportunities (Herrington, Oliver, & Reeves, 2003). These materials include the following microscope, meter rule, stop watch, mathset, handlens, preserved speciemen, dissecting kits, petridish, gas cylinder, aquarium, school building (Laboratory), test tube, charts, biological charts, beakers, school gardern, models, measuring cylinders, filter funnel, hygrometer, wind vane, wash bottle, quadrant, reagent, live speciemen, weigh balance, rain gauge, thermometer, computer, charts, photographs, anemometer, burnsen burner and barometer etc. The complete provision and utilization of these materials resources will help make the teaching and learning of Science and mathematics by the teachers and the students interesting and effective. One possible solution to this problem of inadequate material resources according to Eguabor (2006) and Akinrotorun (2001) as cited in Adejoh and Ityokyaa (2001) is improvisation.

Improvisation is the act of construction of instructional materials from locally available materials that can adequately replace or function in place of the original material which otherwise may be very expensive or in short supply or unavailable (Eriba, 2011). Improvisation, therefore, is not just a pre-conceived on the spot activity, improvisation is a state of mind and it is a skill that lies at the heart of good science teaching. Eniayeju (1983) as cited in (Eriba, 2011) sees improvisation as the art of using alternative materials and resource to facilitate instruction whenever there is a lack or shortage of some specific first hand teaching aids. Akinmoyewa (1992) as cited in (Eriba, 2011) says it is the art of designing a replica of something to make it function or play the role of real thing using available materials (Eriba, 2011). He sees it as the art of using alternative materials and resources due to lack or insufficiency of some specific first-hand teaching aids. Ada, (1985) as cited in (Eriba, 2011) sees it as provision of materials locally made by teachers, students or even an education agency as a substitute and supplement to standard equipment. Eriba (2011) sees it as the act of using materials and or equipment obtained from local personnel to enhance instruction. Eriba (2011) describes it as having composed and proving instructional tools or material at hand to meet a basic need. He sampled option from biologist from different states.

Improvisation is an art of identifying, developing and using suitable materials in the absence of the real one for effective teaching and learning of process, morphology and anatomy of various organs. Improvisation could mean making of instructional material or teaching aid by science teachers where the original materials are not available or where there are available but not functional (Biologist from cross river state). Improvisation is the local provision of an object or material to meet a particular need (biologist from Kogi). Improvisation is an art of sourcing for and providing

substitute materials for the original ones using what is locally available in the absence of standard materials usually aimed at meeting the specific instructional objectives. However, it has been observed that most science teachers are not creative enough to carry out the process of improvisation. Nwagbo (2008) asserted that most science teachers cannot improvise science equipment and materials because they lack creativity and resourcefulness. Given the indispensability of materials resources to students' acquisition of the much desired practical skills of self-reliance which Ghana is in dire need of to alleviate unemployment and poverty level in the country, it becomes very important to look at the production and utilization of resources.

The decline in performance in STME may not be unconnected with the poor learning environment created by this state of infrastructural facilities (Fabayo, 1998 and Farombi, 1998). Mapaderum (2002) and Oni (1995) also emphasized that the availability of resources and adequacy of these facilities promote effective teaching and learning activities in schools while inadequacy affect the academic performance negatively. There is need to evaluate how far that teachers have been able to improvise materials for effective teaching and learning of science. Some of these could be the use of fine graded stick as a meter rule, use of glass cup as a beaker, the moulding shapes using clay, drawing of plants and animals cells using cardboard papers, the use of watch in place of stop watch, the use of stove in place of bursen burner, the use of transparent glass container in place of aquarium.

2.2.3 Need for Improvisation of Science Resources

In an ideal world, all science students would be taught in small classes held in well-equipped laboratories. In absence of those well- equipped laboratories, the place of practical activities cannot be over emphasized , yet those materials required for the

teaching and learning of science are very much in short supply as Adebinpe (1997) lamented that these is a total or partial absent or inadequacy of the science teaching resources and gross inadequate finances most especially for the purchase of science equipment, galloping inflation using enrolment of students generally down ward trend in the nation's economy, poor maintenance culture and at times perception of some school heads towards science and science equipment for effort at making science teaching and learning what it is supposed to be.

With all these heinous problems, it seems that the best option is the improvisation of science teaching materials in the classroom by teachers and even students, improvisation becomes imperative in a situation where there are scarce resources and facilities. The Ghanaian school system today is experiencing a boost in population explosion, giving size to greater demand for classroom and laboratory facilities and equipment with limited government resources, the teacher ingenuity to improvise becomes tasking for learning to be more effective and productive.

Improvisation enables teachers to tailor instruction to the unique learning preferences, abilities, and interests of students, promoting active engagement and meaningful learning experiences. Herrington, Oliver, and Reeves (2003) define improvisation as "the ability to create resources and make adaptations during teaching that enhance the learning experience for students. Lyons (2006) describes improvisation as "the act of adapting or modifying instructional materials to respond to the changing needs and interests of students."

Improvisation allows teachers to customize instructional materials based on students' diverse needs, learning styles, and abilities. It enables teachers to adapt resources to make them more accessible, engaging, and relevant to the specific context (Miller,

2002). Improvised materials offer flexibility in responding to unexpected situations or changing circumstances in the classroom. Teachers can modify materials in real-time to address students' questions, interests, or misconceptions, fostering a dynamic learning environment (Bell, Smetana, & Binns, 2005). Improvised materials have the potential to increase student engagement by capturing their attention and stimulating their curiosity. When instructional materials are personalized and aligned with students' interests, they are more likely to actively participate in the learning process (Herrington, Oliver, & Reeves, 2003). By improvising instructional materials, teachers can incorporate real-world examples, current events, and practical applications into their lessons. This authenticity enhances the relevance and meaningfulness of the learning experience for students (Lyons, 2006). This implies improvisation of instructional materials plays a vital role in education by enabling teachers to adapt their teaching resources to meet the diverse needs of learners. It allows for customization, flexibility, and authenticity, leading to increased student engagement and meaningful learning experiences. It also encourages teachers to think creatively and explore innovative approaches to instruction. It promotes experimentation, problem-solving, and critical thinking skills, fostering a culture of creativity in the classroom (Powers, 2014). The importance of improvisation lies in its ability to create personalized and dynamic instructional environments that support student-centered learning. By harnessing the power of improvisation, educators can enhance teaching effectiveness and promote positive learning outcomes.

2.2.4 Utilization of Science Resources in Schools

The process of managing and organizing resources is called resource utilization. The utilization of resources in teaching brings about fruitful learning as such it stimulates students' senses as well as motivating them. Denyer (1998), in his study on science

games in national curriculum in the united kingdom reported that game used as resource enable less able children to stay on task and remain motivated for a longer period.

There are varieties of resources, which the science teacher can readily use to enrich learning. These resources are models, charts , preserved specimen of plants and animals, culturing equipment, herbarium and microscope Olagunju (2000) as cited in Okori (2005).The resources should be provided in quality and quantity in science, technology and mathematics classroom for effective teaching-learning process (Umeoduagu,2000).

Nwoji (1999) in an empirical study revealed that essential facilities such as equipment like radio, television, computer, chemicals, specimen, videotapes, stove, burner, models and charts were not available in most schools .This inadequacy of teaching material resources, laboratory equipment reagents / chemicals and laboratory space has been a great concern to science educators.

The implementation of science program has been a matter of serious concern to science educators. This interest stem from the fact that science, which is the science of life, occupies a central position in the scientific and technological development of any nation (Maduabum, 1992). It is often referred to as the gateway to noble professions such as Medicine, Nursing, Pharmacy, Dentistry, agriculture. The teaching and learning of science demand active student's participation, involving the use of resources. Resources according to Ityokyaa (2010), refers to those facilities / equipment that can be used to ensure effective teaching and learning. These include laboratory equipment, reagents, visual and audio visual aids, models etc. Nwagbo (2008) posited that science is activity based and students centered and as such, cannot

be taught or learnt without resources. Similarly, Adeyemi (2008) found out that students learn better through practical approach with the use of resources.

2.2.4.1 Importance of Effective Utilization of Science Resources or Materials

The importance of resources to effective teaching and learning of science cannot be over emphasized. Resources when appropriately utilized in teaching and learning of science makes learning more concrete, real, IIMediate and permanent Shamija (2005). The teaching and learning of science involving students' interaction with resources will no doubt enhance student acquisition of much desired process skills of self-reliance which most nations of the world.

In spite of the IIMense importance of science resources to effective teaching and learning of the subject, many researchers like Nwoji cited in Olagunju and Abiona (2008), Taiwo (2008) and Adejoh and Ityokyaa (2009), found out that essential resources for teaching and learning of science are inadequately provided in schools, It is a noted facts that science teachers do not put the available resources in their school into use. Nwosu (1993) and Aguisobo (1994) found that science teachers do not utilize the resources available in their schools.

Instructional resources when appropriately utilized bring about more effectiveness in teaching and learning process but this depend on the teacher's ability to use them efficiently (Ughamadu, 1992). Creative use of resources in teaching STEM increases the probability that STEM students will learn and improve the performance skills that are to develop. No wonder Abomibade (1999), attested that instructional resources when appropriately used enhance learning, improve the competency of the teachers and make learning more meaningful to learners. On the other hand, when instructional resources are misused sequel to lack of knowledge on how to use them, STEM

teaching and learning process may be adversely affected. Instructional resources are misused when they are not effectively put into use to achieve predetermined objectives. Misused instructional resources as observed by Abimade (1999) could lead to misconception of ideas, cause confusion and make a learner hate the subject does not gain back the motivation that arouse his interest on the topic. Misused instructional resources emanating from lack of knowledge could result failure of STEM learners and teachers.

2.2.5 Teachers' Knowledge about Improvisation of Instructional Materials

Teachers' knowledge of improvisation play a crucial role in determining the extent to which they incorporate improvised materials into their instructional practices. In the field of science education, teachers' content knowledge is crucial for improvising instructional materials. They need a deep understanding of the scientific concepts and principles they are teaching (Bybee, Taylor, Gardner, Van Scotter, & Powell, 2006). Teachers' content knowledge should encompass not only the core subject matter but also related topics, interdisciplinary connections, and real-world applications. This broader understanding enables them to make connections and create meaningful improvised materials (Powers, 2014). Teachers need knowledge to effectively improvise instructional materials. This includes knowledge of instructional strategies, assessment techniques, and differentiation approaches that support student learning (Grossman, Hammerness, & McDonald, 2009). They should have a repertoire of teaching methods and techniques that can be adapted and modified to meet the needs of diverse learners (Tosun & Taskesenligil, 2018). Teachers with strong PCK can make informed decisions about adapting materials to optimize learning experiences.

Teachers view improvisation as a valuable approach to meet the diverse needs of students (Lyons, 2006). They recognize the importance of adapting materials to cater to individual learning styles, abilities, and interests. Teachers perceive improvisation as an opportunity for creativity and innovation in their teaching practices. They appreciate the flexibility it offers in addressing unexpected situations and tailoring instruction to students' changing needs (Herrington, Oliver, & Reeves, 2003). Teachers who have positive perceptions towards improvisation are more likely to engage in it and actively seek ways to incorporate improvised materials into their lessons (Miller, 2002).

2.2.6 Teacher Perception towards the Teaching of Science

Over the last 30 to 40 years there has been a plethora of research focused on primary teachers' perceptions toward teaching science. A literature search that investigated perceptions towards science and the teaching of science of both experienced and initial teacher education primary teachers, found 41 quantitative studies and four qualitative studies published between 1985 and 2010 (van Aalderen-Smeets et al., 2012). What is evident over the time period is the lack of qualitative studies. More recent studies continue to use quantitative approaches to examine teachers' perceptions (Turkmen, 2013; Senler, 2016). In addition, studies in the area of research towards science teaching are less prevalent than perceptions to science *per se* (Senler, 2016). The current study addresses this gap by using a qualitative approach that focuses on teachers' perceptions toward the teaching of science. So in the process of gaining insight into the teachers' perceptions, data can be collected that provides in-depth detail, feelings and emotions (Strauss & Corbin, 1998). Something that is not possible with quantitative studies.

In van Aalderen-Smeets et al. (2012) review many of the research studies share commonalities with respect to the characteristics of teachers who have negative perceptions toward teaching science. Teachers with negative perceptions towards teaching science spend few hours teaching science, particularly when there was a lack of available resources (Appleton & Kindt, 1999). Teachers with less positive perceptions toward science teaching also tended to rely on planning by others (Harlen & Holroyd, 1997). Most noticeable, in many studies, is low self-efficacy beliefs and confidence about teaching science that impacts teachers' perceptions in negative ways. Lack of confidence is evident for not only beginning teachers (Appleton & Kindt, 1999; Skamp, 1991) but also for experienced teachers (Harlen & Holroyd, 1997; Skamp, 1991; Yates & Goodrum, 1990).

Increasing teacher's science knowledge has been found to be important in improving teacher perceptions (Harlen & Holroyd, 1997). But rather than just focusing on how to teach science and increasing science knowledge, there is also need to improve self-efficacy and confidence in order to increase teacher positivity towards science teaching (Tosun, 2000). Once teachers' perceptions improved and confidence increased, their teaching also improved (Osborne et al., 2003; van Aalderen-Smeets et al., 2012).

There are few research studies in the Ghanaian context that aim to understand what teacher's perceptions are toward teaching science. Much of the research to date has focused on students' perceptions toward science with a mention of the teacher as a contributing factor rather than on teachers' perceptions toward teaching science *per se*. Given that teachers' perceptions are fundamental to what goes on in the science classroom, an investigation into teachers' perceptions at a local level is worthwhile.

2.2.7 Improvised Instructional Materials

Improvisation tends to remove abstraction(s) in learning theories because the products of improvisation are tangible, handy and concrete. Improvised instructional materials must be very safe to use during demonstrations and experiments. It must be hazard free or danger free. The product must not be capable of inflicting injuries on the user or person operating it. Improvised instructional materials should be used effectively in teaching Science at all levels of education.

Improvisation is the act of making science teaching and leaning materials from locally available resources (Olarewaju, 1994). Eniaiyeju, (1985) viewed improvisation as the "art of substituting for the real thing". Another important view about improvisation is by Alonge (1983) who sees improvisation as not only the production of import substitution of materials or real thing, rather it is an activity in promoting curiosity, alertness, endurance and perseverance, all of which are indispensable to science, scientists and learning as a whole. Johnson (1994), defines improvisation as the process of productive thinking that can generate tangible outcome or product.

Similarly, for those concerned with applied fields, improvise productivity means the quality of output in the form of socially and technologically recognized products. However, in science it implies another kind of quantity output as a result of production. The products in improvisation must be less in cost when they are compared with the commercially constructed ones. Improvisation could be modeling of an original object, or copying the construction of an object or equipment to a high degree of accuracy (Lowe, 1983).

Learning is a permanent change in behaviours. Learning is assumed to have taken place if a change is confirmed. This could be through the new activity the learner is able to perform. Instructional material simply means the teaching device that helps the teacher to clarify, establish, correlate and coordinate various concepts, interpretations and applications. (Balogun, 1982). As a proverb says "A picture is worth a thousand words".

Instructional materials are learning resources that help in teaching and learning processes, which help the teacher to deliver his lesson during the course of his teaching. They can also be referred to as relevant and cheaply selected tools or equipment that are usually incorporated in the teaching/learning process in order to boost or enhance effective teaching and learning activities in the classroom or any other environment where formal educational system takes place (National Teachers Institute, 2007). In a nut shell, improvised instructional materials are teaching materials design and produce from the available local materials in order to enhance effective teaching and learning in schools.

2.2.8 The Use of Improvised Instructional Materials in Teaching and Learning

Improvised instructional material is a method or way of minimizing loss of equipment and materials and an inexpensive method of widening the scope of inquiry. Improvised instructional material is a meaningful attempt towards finding suitable substitute or alternative to conventional science materials. Due to state of our nation's economy, teachers, students, school authorities and communities should engage in improvising instructional materials in order to:-

- Develop in students and teachers adequate skill for improvisation.
- This will generate interest and motivation for indigenous technology.

- Have practical and physical links between science and theory
- Eradicate the menace of lack of or inadequate instructional materials for science
- Sensitize both students and teachers that alternatives for some of the conventional science teaching materials are possible.
- Achieve the set out educational objectives through the use of improvised instructional materials in teaching.

Improvised instructional materials make teaching science concepts more interesting to both students and teachers in the classroom, improvised materials are usually simple and may not have perfect finishing, because they are made from local raw resources that are acceptable to students. Improvised instructional materials help science students to realize that science has to do with ordinary things and will possibly motivate them to carry out experiments and learning activities themselves using such improvised materials, Johnson (2000). Zarewa (1991) as cited by Johnson (2000), noted that no matter how rich and generous educational authorities might be they are not always in position to provide their schools with all the materials they may need. Therefore, the schools, students and teachers might be obliged to make the most of what they can get or construct from locally available raw materials. For instance certain things like herbarium press, aquarium tank, and wooden splint can easily be improvised by competent science teachers instead of waiting for supplies by the educational authorities.

2.2.9 Challenges that Teachers Face in Accessing Instructional Materials

Teachers in community secondary schools most especially in rural community schools face some challenges in accessing instructional materials. One of the big challenges that teachers in community secondary schools face in accessing instructional materials is meagre funds provided by the government to community secondary schools for purchasing instructional materials. Community secondary schools depend to a large extent on government for funding. Very little support is received from local government and communities around the schools most especially in rural areas due to poverty. The funds are provided in form of capitation grants. The capitation grant is aimed at improving the quality of education by making sure that sufficient leaching and learning material are found at school level. In particular, the capitation grant is meant to finance the purchase of textbooks and other teaching and learning materials as well as to fund repairs, administration materials, and examination expenses (Uwazi, 2010).

However, while the number of students who are enrolled in schools has been increasing each year, education capitation grant has been dropping. Even without adjusting for inflation, the actual amount of money reaching schools for capitation grants is clearly much less today compared to what it was between 2002 and 2003. According to the Education Public Expenditure Tracking Survey of 2004, in the period 2002-2003 schools received an average of 5,400 shillings per pupil. In 2007/08 however, the money actually reaching the schools had declined to 4,189 shillings per pupil (URT, 2010). This amount of money is grossly insufficient to purchase a minimum set of textbooks apart from other instructional materials which are highly needed by the teachers. According to Onche (2014), government's Policy towards efficient provision of these aspects of educational resources has not been

encouraging and has always not been well planned, monitored, supervised and evaluated with rural schools as the back bench of implication of these policies.

Another challenge that teachers face is the lack of exposure and limited accessibility to modern instructional facilities. Most community secondary schools especially in rural areas do not have access to information communication technology (ICT) which could alleviate shortage of instructional materials. As we are in a new millennium, there is an increased awareness of the need to use modern scientific approach in teaching and learning processes in our schools.

At present, there is a universal recognition of information and communication technology as a major force in the dissemination of knowledge (Aina, 2013). Majority of teachers who were trained in the early 1990's do not have skills in the field of Information and Communication Technology. Where there are skilled teachers, other problems naturally include problem of installation, maintenance, operation, network administration and local technicians to service or repair these equipment's and the other facilities. In most of the rural secondary schools, most of the facilities are non-existent, hence the traditional chalk and duster approach still dominates in secondary school pedagogy (Obasi, 2008).

Poor salary is also another challenge that teachers face. Teachers like most civil servants in Tanzania are poorly paid. This becomes a hindrance for them to purchase their own teaching materials or acquisition of new ideas, skills and knowledge by failure in enrolling for further educational programmes including Information and Communication Technology (ICT). With this, the academic and intellectual capacities of teachers and learners are bound to be affected substantially during classroom

interaction (Onche, 2014). Lack of sufficient skills and creativity may hinder teachers to improvise their own instructional materials.

Local governments and communities around community secondary schools are supposed to provide resources most especially funds to these schools so that teachers can use them to access instructional materials. But very often this is not the case due to number of reasons. Some local communities have very narrow tax base. Also the performance of local councils in the collection of their own revenue have been recorded very poor.

According to Galabawa (1993), there are few types of councils in Tanzania, which can manage to collect government grants. Many local authorities however have found themselves unable to deal with such a rapid increase in expenditure and their budget deficit increase. Education is one of the sectors, which are mostly affected by this situation. Poverty is another reason, which may hinder members of the community in supporting teachers and schools financially so that they can access instructional materials. According to Kimego (2011), Parents and communities participation differ from rural to urban communities and from one mode of economy to another. Parents who are involved in cash crops economy have economic ability to finance education compared to parents who are not involved in cash crop economy. For example pastoral communities such as Masai have displayed poor financing strand for their children. Teachers who work in such areas have more challenges in accessing instructional materials.

Another challenge that teachers face in accessing instructional materials is lack of clear policy and monitoring mechanisms to ensure that enough funds are provided to community secondary schools for purchasing instructional materials and also these

funds are used for the intended purpose. As Onche (2014) comments, government's Policy towards efficient provision of these aspects of educational resources has not been encouraging and has always not been well planned, monitored, supervised and evaluated with rural schools as the back bench of implication of these policies.

2.2.10 Strategies to Minimize the Challenges of Attaining and using Quality Instructional Materials

There are a number of strategies which can be used in order to minimize the challenges of attaining and using quality instructional materials. According to studies done in different parts of the world including Africa, one of the strategies is improvisation of instructional materials. Eshiet (1996) states that improvisation involves sourcing, selection and deployment of relevant instructional materials into the teaching-learning focus in the absence or shortage of standard materials for a meaningful realization of specified educational goals and objectives. According to studies done by Abodelraheem & Al-Rabane (2005), Udosen (2011) and Ibe-Bassey (2012) some creation of improvised media of low technological materials and resource-centred learning can enlarge the limited knowledge base of any course of study and enrich instruction to a guaranteed quality. It can also promote strategies that ensure the integration of technology in the teaching and learning process of basic science education. Their findings are in agreement with the findings of Dodge (1997) who observed that using technologies like simulation devices open new horizons for individual learning tools, the environment resources and services.

The use of ICT can also minimize some of the challenges in accessing instructional materials. According to UNESCO (2004), the use and rapid spread of electronic communications has the capacity to affect the quality and efficiency of basic

education throughout the world. The ease with which teachers and students can gather information over the Internet on virtually any topic has the potential to transform instructional content and pedagogical practice. Moreover, courses developed by the best teachers in one country can be made available to students across many countries. Newer technology-based instructional strategies, incorporating the Internet and the World Wide Web (WWW), can therefore be used more to expand communication and increase access to resources. Tinio (2002), points out that ICT has potentials in increasing access and improving relevance and quality of education in developing countries. Tinio further states the potentials of ICT as follows: ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems.

2.3 Conceptual Framework

A conceptual framework represents a researcher's synthesis of the literature on how to explain a phenomenon. It maps out the actions required in the course of the study, previous knowledge of other researchers' point of view and the researchers' observations on the subject of research. The conceptual framework is a researcher's understanding of how the particular variables in his study connect. Thus, it identifies the variables required in the research investigation. Teachers' perception, teachers' knowledge represents, and the challenges they encounter in the use of improvised instructional materials are the independent variables while the dependent variable is represented by the use of improvised instructional materials. Figure 1 presents the relationship between the dependent and independent variables.

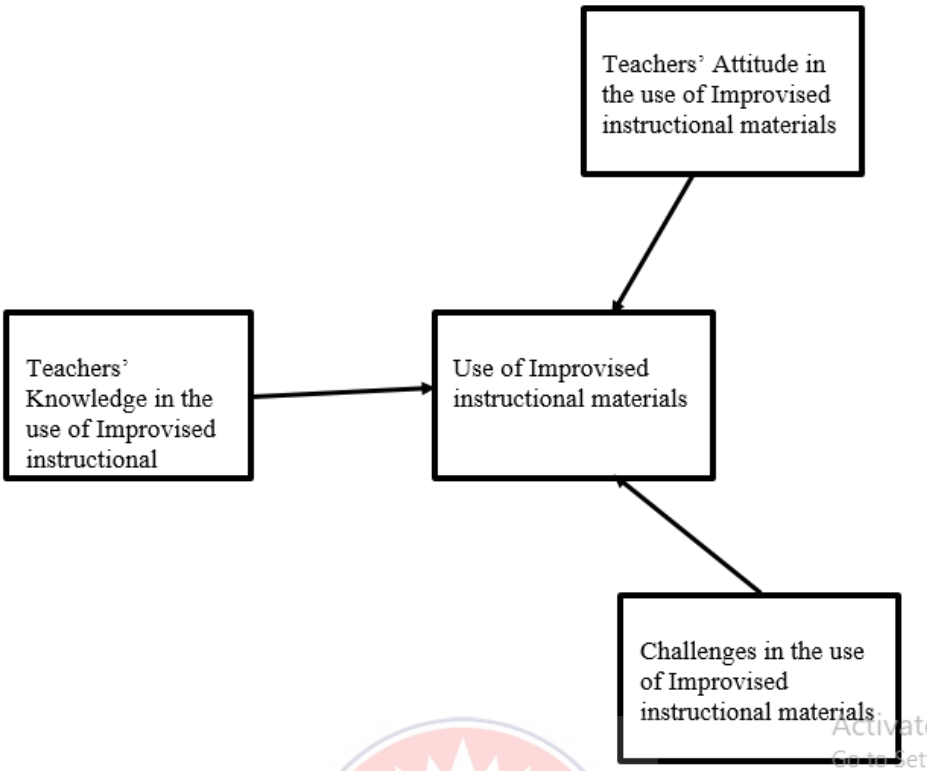

Figure 1: Researcher's constructed conceptual framework

In the conceptual framework of this study, the relationship between variables is designed to elucidate how different factors impact the use of improvised instructional materials. The framework identifies three key independent variables that influence the dependent variable, which is the use of these materials.

The first independent variable is teachers' perception, which encompasses teachers' attitudes and beliefs about the value and effectiveness of improvised instructional materials. Their perception can significantly shape their willingness and approach to integrating these materials into their teaching. The second independent variable, teachers' knowledge, refers to the extent of teachers' understanding and expertise in utilizing improvised materials effectively. Greater knowledge can enhance their ability to employ these resources in a meaningful way. The third independent variable is the challenges encountered by teachers, which includes obstacles such as lack of

resources, insufficient training, or logistical difficulties. These challenges can hinder the effective use of improvised instructional materials.

The dependent variable in this framework is the use of improvised instructional materials. This variable reflects the extent to which teachers incorporate these materials into their teaching practices. The conceptual framework posits that positive perceptions, increased knowledge, and overcoming challenges are likely to facilitate greater and more effective use of improvised instructional materials. The framework provides a structured approach to understanding how various factors interact to influence the integration of these materials in education.

2.4 Empirical Review

2.4.1 Upper Primary Science Teachers' Knowledge on Improvisation of Instructional Materials

Several studies have been conducted to explore upper primary science teachers' knowledge on the improvisation of instructional materials. For example, Smith and Johnson (2015) conducted a survey among upper primary science teachers to assess their understanding of improvisation techniques and their knowledge of available resources. The findings indicated that while teachers had some knowledge of improvisation, there were gaps in their understanding of specific strategies and materials.

Similarly, Brown and Jones (2017) conducted a qualitative study using interviews and observations to investigate upper primary science teachers' knowledge and practices related to improvisation. The study revealed that teachers had a limited understanding

of the different types of instructional materials that could be improvised and lacked confidence in their improvisation skills.

2.4.2 Science Teachers' Perceptions on Improvisation of Instructional Materials:

Several studies have focused on exploring the perceptions of upper primary science teachers towards the improvisation of instructional materials. Johnson and Williams (2016) conducted a mixed-methods study to examine teachers' perceptions towards improvisation. The results revealed that teachers generally held positive perceptions towards improvisation, considering it as a valuable instructional strategy. However, some teachers expressed concerns about the time and effort required for improvisation and the potential impact on curriculum coverage.

In another study, Thompson et al. (2018) used surveys and interviews to explore teachers' perceptions towards improvisation in science education. The findings indicated that teachers' perceptions were influenced by factors such as their own improvisation experiences, training opportunities, and support from school administrators. Positive perceptions were associated with higher levels of improvisation in the classroom.

2.4.3 Upper Primary Science Teachers' Use of Improvised Instructional Materials

Several studies have examined the use of improvised instructional materials by upper primary science teachers. Chen and Lee (2019) conducted a study using classroom observations and interviews to investigate teachers' use of improvised materials in science lessons. The study found that teachers commonly used simple materials, such as everyday objects and low-cost resources, to support hands-on learning experiences.

However, the use of more advanced improvised materials, such as digital tools or multimedia resources, was less common.

Similarly, Gupta and Sharma (2020) conducted a survey among upper primary science teachers to explore their use of improvised materials. The results indicated that teachers primarily used improvised materials for practical demonstrations and experiments, but their use in other instructional activities, such as visual aids or interactive simulations, was limited.

2.4.4 Challenges Faced by Upper Primary Science Teachers in the Use of Improvised Instructional Materials

Studies have also identified challenges that upper primary science teachers encounter when using improvised instructional materials. Johnson and Smith (2017) conducted interviews and focus group discussions to identify common challenges faced by teachers. The study revealed that teachers struggled with limited access to resources, lack of training in improvisation techniques, and difficulties in aligning improvised materials with the curriculum.

Furthermore, Patel and Gupta (2018) conducted a study to investigate the barriers faced by teachers in improvising instructional materials. The findings indicated that time constraints, lack of support from school administration, and inadequate funding for materials were significant challenges for teachers.

It obvious that previous studies have provided insights into the knowledge, perceptions, use, and challenges faced by upper primary science teachers in the improvisation of instructional materials. While these studies have highlighted the need for professional development programs, access to resources, and support from

school administration to enhance teachers' improvisation skills and promote effective use of improvised materials in science education, it appears little attention has been paid to the use of improvised instructional materials in Ghana and in the Okaikwei North Municipality of the Greater Accra Region.

2.5 Chapter Summary

This chapter presented the relevant literature for this study. The first part looked at theoretical literature. This focused on two theories: Instructional material theories and Sociocultural theory of teaching, learning, and development. The second part presented empirical literature that revolved around the three objectives developed in chapter 1. These included: the extent to which instructional facilities affect student performance; the challenges that teachers in community secondary schools face in accessing instructional materials; and the strategies that teachers use to minimize the challenges of attaining and using quality instructional materials. The last part presented conceptual framework that was developed by the researcher comprising of the context, input, process and output.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter contains information about methodology. Specifically, it covers the research philosophy or paradigm, research approach, research design, study area, study population, the sample size and sampling procedures, research instruments, validity and reliability, procedures for data collection and data analysis procedure and ethical consideration.

3.1 The Pragmatic Paradigm

The researcher considered the pragmatic paradigm to be relevant for this study. In its simplest terms, the pragmatic paradigm is committed to no single system of philosophy and reality. This approach to research applies to mixed methods research in that researchers openly rely on both quantitative and qualitative premises when engaging in their research (Creswell, 2014). Pragmatism seeks to believe concepts such as truth and reality. It focuses on what works as the truth to explore the research questions (Teddlie & Tashakkori, 2009).

This research is underpinned by the pragmatic worldview as it is formulated around research questions with the intent of answering them in the various ways that the reasercher believed appropriate and utilised the results in various ways that could have positive consequences for the stakeholders benefiting from this research (Teddlie & Tashakkori, 2003). This study utilises both quantitative and qualitative methods to gather data on teachers' knowledge, perception, use of improvised instructional materials and the challenges they encounter in the use of IIM. According to Morgan (2007), pragmatism is an alternative to positivism and metaphysical thinking.

Pragmatism concerns itself with results and concerned with determining the meaning of things (Johnson & Onwuegbuzie, 2004 as cited in Shannon-Baker, 2016). According to Tashakkori and Teddlie (2003) as cited in Shannon-Baker, 2016), in order to create practical solutions to social problems, pragmatism emphasises communication and shared meaning making. In Shannon-Baker's (2016) terms, pragmatism is grounded on the principle that theories can be both contextual and generalisable by examining them for "transferability" to another circumstance. The researcher who is inbred in pragmatism is likely to retain both subjectivities in their judgements on research and objectivity in the collection of data and analysis. It has been notably known as an "approach" rather than a paradigm (Morgan, 2007 as cited in Shannon-Baker, 2016). This discrepancy is imperative as pragmatism has been portrayed as offering precise ideas as to what constitutes knowledge, but does not seem to give an entire encompassing worldview (Biesta, 2010).

Pragmatism aims at finding and reinforcing the weaknesses in the study by using the mix method approach (Johnson & Onwuegbuzie, 2004). An advocate of this paradigm believes that the mix method approach can attain real knowledge. Instead of the method being critical, the problem is most important, and researchers should use all approaches to understand the problem statement (Tashakkori & Teddlie, 2003 as cited in Rahi, 2017). Pragmatism is not affiliated with any system or philosophy. Researchers are free to apply both quantitative and qualitative approaches; the key is to find the best research techniques and procedure that will help solve the problem statement.

Pragmatism is also perceived as "a means of bridging the gap between the empirical singular scientific approach to research and the newer "freewheeling" inquiry of

qualitative research theories" (Tashakkori & Teddlie, 2003, p. 52). Johnson and Onwuegbuzie (2004) rely on the pragmatism philosophy to argue that in a single study, quantitative and qualitative approaches can efficiently synchronise. According to Teddlie and Tashakkori (2003), taking a pragmatic and balanced or pluralist position in research would help improve communication among researchers from diverse paradigms as they try to advance knowledge. For the mixed methods researcher, pragmatism thus gives room in a mixed-method study to multiple methods, diverse worldviews, assumptions and varied forms of data collection and analysis. The nature of the problem (thesis topic) (i.e. upper primary science teachers' knowledge, perception and use of improvised instructional materials in the standard-based curriculum) supports the use of the pragmatist paradigm. This is because the pragmatist paradigm is most applicable in circumstances where a researcher needs to focus attention on the research problem in social science research and then use pluralistic approaches to extract information about the problem (Tashakkori & Teddlie, 2010).

3.2 Research Approach

This study adopted the mixed-method approach, that is to say, a mixture of qualitative and quantitative approaches (Tashakkori & Teddlie, 2003). Mixed methods is a research approach which focuses on collecting, analysing and combining quantitative and qualitative data in single research or series of researches. Its central assumption is that the interactive application of quantitative and qualitative methods provides a better understanding of research issues than either approach alone (Creswell & Plano Clark, 2011). According to Andrew and Halcomb (2006), mixed method approach is not to replace either qualitative or quantitative research, but to pull out the strengths and diminish the weaknesses in both approaches within a specific study.

However, Creswell, Plano Clark, Gutmann, and Hanson (2003) point out that a principal challenge for mixed methods research is the clear explanation of several critical aspects such as classifying the main purposes of using a mixed design and clarifying the factors examined when determining the type of mixed design. Once again, they drew attention to the fact that a researcher has to explain the decisions made when applying the respective weight (equal or different) to each methodological part of the research. Researchers should specify when implementing data collection, whether the mixed design is sequential or simultaneous.

The justification for mixing both types of methods and data is that neither quantitative nor qualitative method could adequately cover the scopes and depths of the "what", "how" and "why" questions about program evaluation within themselves. When combining the two methods, quantitative and qualitative complement, each other provides a holistic and an in-depth view of the research problem, taking advantage of each one's strengths (Cohen, Manion & Morrison, 2018; Johnson & Turner, 2003).

Within mixed methods approach both quantitative and qualitative data are collected and analysed. The qualitative method is to clarify and elaborate on the quantitative results collected in the first phase. The quantitative data in this study is to ascertain Upper primary science teachers' knowledge, perception and challenges they encounter in the use of improvised instructional materials. Qualitative data (interview and observation) were collected on how teachers use improvised instructional materials for teaching science. In this study, the quantitative method received greater emphasis than the qualitative method.

3.3 Research Design

The research design refers to the overall strategy chosen to integrate the different components of the study in a coherent and logical way, thereby, ensuring the research problem is effectively addressed; it constitutes the blueprint for the collection, measurement, and analysis of data (Creswell & Creswell, 2018). The study used embedded mixed methods design. The embedded design is a mixed methods design in which one data set provides a supportive, secondary role in a study based primarily on the other data type (Creswell & Plano Clark, 2011). The premises of this design are that a single data set is not sufficient. Different questions need to be answered, and type of question requires different types of data.

The researcher used this design because he needs to include qualitative data to answer the research question on the use of improvised instructional materials are being used by upper primary science teachers which is within the largely quantitative study. In the context of this study, the qualitative data was embedded within a quantitative data. Thus, quantitative data is dominant, and the qualitative data is much smaller and is nested in the large, dominant set of data. Although both quantitative and qualitative data were collected at the same time, the qualitative data is embedded into the quantitative data and so the priority of the mixed method study was given to the quantitative phase.

Utilizing quantitative research in the first phase was valuable in testing and answering the research questions and testing hypotheses, which were developed based upon the related literature on teachers' perception and use of improvised instructional materials. The observation and interview data collected were used in the qualitative phase in order to explain the how teachers use improvised instructional material.

3.4 Settings

The study was conducted at the Okaikwei North Municipality of the Greater Accra Region of Ghana. The Okaikwei North Municipal Assembly (ONMA) is one of the thirty-eight newly created District/Municipal Assemblies inaugurated on Thursday, 15th March, 2018 across the country under the President of Ghana, His Excellency Nana Addo Dankwa Akuffo Addo. The capital of the Municipal Assembly is Abeka. It is currently among one of the two hundred and fifty-four (254) Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana and one of the twenty-six (26) MMDAs in the Greater Accra Region. It was carved from the Accra Metropolitan Assembly on 14th November, 2017. The ONMA was established under the Local Governance Act, 2016, (Act 936) with Legislative Instrument (L.I) 2307.

The study was conducted in the Okaikwei North Municipality of the Greater Accra Region of Ghana, which presents a unique and relevant context for examining upper primary science teachers' knowledge, perceptions, and use of improvised instructional materials. Established in 2018, the Okaikwei North Municipal Assembly (ONMA) is one of the newer municipalities, having been created from the Accra Metropolitan Assembly. Given its relatively recent establishment, ONMA is in a developmental phase, which may influence resource allocation, including educational resources such as instructional materials for schools. Additionally, as one of the 26 Metropolitan, Municipal, and District Assemblies (MMDAs) in the Greater Accra Region, the Okaikwei North Municipality represents a typical urban setting where challenges related to education resources, such as inadequate instructional materials, are prevalent. This makes the municipality an ideal setting for investigating the improvisation of teaching materials by science teachers. The schools in this region are likely to face similar challenges to those in other urban areas across Ghana, such as

overcrowding and limited access to adequate instructional materials, further justifying the relevance of this location for the study. Moreover, the Municipality's diverse population and its strategic position within the Greater Accra Region provide a rich context for exploring how teachers adapt to these challenges and their perceptions of using improvised materials in teaching science. Studying teachers' experiences in this setting can provide valuable insights that can be applied to other urban and semi-urban settings in Ghana, making the findings of this research broadly applicable and impactful.

3.6 Population

The population of a study includes all groups of individuals, objects, items, cases, articles or things with common characteristics that exist at a particular point in time in a given area (Creswell, 2014). The population for the study included all Public Basic school science teachers in the Okaikwei North Municipality. The targeted population refers to the entire group of individuals or objects to which researchers are interested in gathering data for the study (Creswell, 2016). This study targeted all upper primary teachers in Public Basic schools in the Okaikwei North Municipality of the Greater Accra Region of Ghana. The targeted population was 81 upper primary science teachers and they were all involved in the study.

3.7 Sample Size and Sampling Techniques

All the 81 Upper primary teachers were sampled for the study. The sampling was done using census sampling technique. According to Graff (2017), census sampling is the selection of every unit, everyone or everything, in a population. Out of the 81 respondents, purposive sampling was employed to select eight (8) participants for interview and 10 for observation. Selecting eight participants for interviews through

purposive sampling ensures a focused and in-depth exploration of the research topic. This approach allows researchers to obtain rich, detailed insights from individuals who are specifically chosen for their relevant experiences or characteristics. The smaller sample size enables manageable data collection and analysis, ensures quality over quantity, and helps achieve data saturation without overwhelming resources. According to Graff (2017), purposive sampling technique is used to select participants or other units of study who can provide or yield data that will address the research questions.

3.8 Data Collection Instruments

Data were collected using test, closed-ended questionnaire, semi-structured interview guide and observation checklist. The instruments were developed by the researcher.

3.8.1 Test

Tanzeh (2019) defined test as a method of data collection in a series or exercise used to measure the skill, knowledge, attitude, intelligence, ability, or talent of individuals or groups. According to Creswell 2014), test as an instrument or systematic procedure for observing and describing one or more characteristics of a student or pupil using either numerical scale or classification. The test consisted of 15 objective test items meant to measure upper science teachers' knowledge in the use of improvised instructional material (IIM). The researcher considered test as the most appropriate instrument to collect data to answer the research questions of the study, hence its usage. The test was scored out of 15 marks (0-5 as low level; 6-10 as moderate level; and 11-15 as high level).

3.8.2 Questionnaire

A questionnaire was used to survey the participants selected in the study. This instrument was selected for several reasons including (a) they are suitable for measuring perceptions and originating other content from respondents; (b) they are cheap to administer; (c) they can provide information about the internal meanings and ways of thinking of the respondents; (d) they are quick to control and turnaround; (e) they can be administered to sample groups (Cohen et al., 2007). The rest is the perceived anonymity by respondents that is likely to be high and thus boosts open and frank participation; they are also generally regarded as having high measurement validity (high reliability as well as validity) where they are better constructed and validated. According to Babbie (2015), closed-ended items in the questionnaire can provide the exact information needed by a researcher; also closed-ended items can be easily analysed and they are generally viewed as useful for exploratory purposes as well as confirmatory purposes.

However, there were some cons associated with the use of the questionnaire, as noted here. These included: (a) they are required to be kept brief, and this brevity could preclude all the necessary information from being received; (b) reactive effects may occur in that respondents may feel compelled to respond in ways they find socially or contextually appropriate; (c) responses may be selective and not complete. Other disadvantages include respondents leaving out or failing to recall relevant information, Open-ended items may indicate differences in written or verbal ability and therefore, complicate issues of interest and significance; Finally, data analysis can be very time-consuming for open-ended items. On balance, the researcher considered that questionnaire was most likely to serve best his research purposes concerning the

students, given a large number of participants, the specific issues to be discussed, the time available to do so and the detailed analysis that was necessary after that.

The questionnaire was designed to cover items that measured upper primary science teachers' knowledge, perception and use of improvised instructional materials in the standard-based curriculum. The questionnaire comprised closed-ended items on which respondents were asked to indicate to what extent they agreed or disagreed with certain views about teachers' knowledge, perception and use of improvised instructional materials in the standard-based curriculum. The questionnaire items were measured or assessed on a 5-point Likert scale as "Strongly Disagree = 1" "Disagree = 2", "Uncertain =3", Agree = 4" and "Strongly Agree = 5".

The questionnaire was structured into three (3) sections; Section A provided information on the background of the respondents. Section B captured information on Upper primary science teachers' perception on improvisation of instructional materials. Section C captured information on challenges Upper primary science teachers encounter in the use of improvised instructional material.

3.8.3 Semi-Structured Interview Guide

The instrument for data collection was semi-structured interview guide. The kind of interview done on the field was the face-to-face interview. Interviewing is typically done in a face-to-face encounter (Marvasti, 2004, Rubin & Babbie, 2005). Interview as a method of collecting data involves presentation of oral or verbal stimuli and reply in terms of oral-verbal responses. According to Borg and Gall (2003), an interview as a research instrument involves the collection of data through direct verbal interaction between individuals. Its principal strength is its adaptability to any given situation. In semi-structured interviews, a researcher employs a detailed but not rigid interview

guide. This involves a predetermined sequence and wording of the same set of questions to be asked of each respondent to minimize the possibility of bias on the part of the researcher/interviewer (Kothari, 2008). The interview guide had items that addressed the research question on how Upper primary teachers use improvised instructional materials for teaching.

3.8.3.1 Managing and Recording Data

The researcher conducted a semi-structured, open-ended interview, took notes and recorded (audiotaped) the interview, and transcribed the interview to complement the notes taken during the interview. The researcher followed some interview protocols. Creswell (2014) suggests that the interview protocols need to include the following components:

a. A heading (date, place, interviewer, interviewee),

b. Instructions for the interviewer to follow so that standard procedures are used from one interview to another.

c. The questions (typically an ice-breaker question at the beginning followed by four to five questions that are often the sub-questions in a qualitative research plan, followed by some concluding statement or a question, such as, “Who should I visit with to learn more about my questions?”

d. Probes for the four to five questions, to follow up and ask individuals to explain their ideas in more detail, or to elaborate on what they have said

e. Spaces between the questions to record responses

f. A final thank-you statement to acknowledge the time the interviewee spent during the interview.

The researcher ensured that the components of the interview protocols opined by Creswell (2014) were followed.

3.8.4 Observation Checklist

Marvasti (2004) points out that observation involves watching people, events, situations, or phenomena and obtaining first-hand information relating to particular aspects of such people, events situation or phenomena. This data gathering can occur anywhere in the students' setting, classroom, home and other such situations. According to Creswell (2010), observation is a gradual process of studying a situation for a period of time in order to undo the puzzle in that situation. Kothari (2008) stated that, the main advantage of this method is that subjective bias is eliminated, if observation is done accurately. He added that, the information obtained under this method relates to what is currently happening; it is not complicated by either the past behavior or future intentions or perceptions. In this study six (6) participants were observed.

3.9 Pre-testing of Instruments

The instruments were tested on Twenty (20) Upper primary school teachers in the Okaikwei Central Municipality of the Greater Accra Region. The purpose of the pre-testing of instruments was to enable the researcher to test the reliability and validity.

3.10 Validity and Reliability of Instruments

Validity is a means of ascertaining the accuracy of the instruments by establishing whether the instruments focus on the information they are intended to collect. Kothari (2008) pointed out that validity measures the accuracy of the instruments in obtaining the anticipated data which can meet the objectives of the study. In this study, both face and content validity were used in this study to check if the test really measured the concepts that the researcher assumed it measured.

3.10.1 Face Validity

According to Creswell and Creswell (2018), face validity refers to the appearance of validity to test users, examiners, and especially and the examinees. The researcher presented the instruments constructed to her colleagues Master of Philosophy Basic Education students for constructive criticisms. Bryman (2012) opined that face validity is established by asking other people with experience or expertise in a field whether the measure seems to be getting at the concept that is the focus of attention.

3.10.2 Content Validity

Content validity is the extent that a research instrument covers the content that it is intended to measure. It is also refers to whether an instrument provides adequate coverage of a topic. Expert opinions, literature searches, and pretesting of open-ended questions help to establish content validity (Saunders, Lewis & Thornhill, 2012). Creswell (2010) stated that is the extent to which the questions on the instrument and the scores from these questions represent all possible questions that could be asked about the content or skill. The researcher prepared the instruments in close consultation with his supervisor to ensure that items in the questionnaire, interview guide and observation checklist cover all the areas under investigation. Best and

Khan (2006) point out that content validity of the research instruments is enhanced through expert judgment. The researcher's supervisors, as experts, helped to assess the validity of instruments.

3.10.3 Reliability of Instruments

Reliability refers to the extent to which an instrument measures the same way each time it is used under the same condition with the same subjects (Agyedu, Donkor & Obeng, 2013).The purpose of reliability is to assess the instrument's ability to measure the same way in each administration to the same sample. To ascertain the reliability of the research instruments, the results obtained from the questionnaire were correlated using the Pearson's Product Moment Correlation Coefficient formulae. According to Tech-Hong and Waheed (2011), reliability coefficient between 0.70–0.90 is generally found to be internally consistent. A score of 0.84 was obtained indicating that the instrument was reliable. Furthermore, taking into account the suggestions from the participants to the instruments that was used, irrelevant items were removed, lengthy items were shortened and many unclear items were made clearer. Thus, the instruments were found valuable to collect the data for the main study and hence they were administered as scheduled.

3.11 Trustworthiness of the Interview

Loh (2013) was of the opinion that the words reliability and validity can be replaced with the term trustworthiness when conducting qualitative research. Creswell (2010) also opined that steps to ensure rigor in a qualitative study should be carried out during the research process, and outlined the following strategies, among others: ensuring methodological coherence, researcher responsiveness, ensuring appropriateness of sample, and active analytical stance. McMillan and Schumacher

(2010) described validity in qualitative research as the extent to which interpretations of data collected have the same meaning for the researcher and participants.

To ensure trustworthiness in this study, the researcher adhered to the constructs proposed by Guba (1981), namely credibility, dependability, transferability and confirmability, which some authors (Shenton, 2004; Morrow, 2005) opined correspond to internal validity, external validity, reliability and objectivity respectively, in quantitative research. The manner of doing this is discussed next.

3.11.1 Credibility

Credibility in qualitative research deals with the extent to which the findings from the study measure reality (Morrow, 2005). According to Gasson (2004), it implied "how we ensure rigor in the research process and how we communicate to others that we have done so" (p. 95). In essence, it deals with the methods of ensuring that the researcher has analysed the data correctly.

To ensure credibility, the researcher became familiar with the participants by building a rapport with them at the beginning of each interview session and presented to them an informed consent form which explained in detail the essence of the study and their right to voluntary participation and withdrawal. The researcher also included direct quotations from the text in the presentation of the findings, which according to Graneheim and Lundman (2004) also reflects the credibility of a study. Also, throughout the period of the study there were regular discussions between the researcher and the research supervisor, and during these sessions, they deliberated on the best approach and methodology for the study as well as the instruments for data collection. At the end of the transcription process, data were also presented to the research's supervisor for inspection and comments.

3.11.2 Dependability

According to Lincoln and Guba (1985), dependability "seeks means for taking into account both factors of instability and factors of phenomenal or design induced changes" (p. 299); this means taking note of the changes in data and those made by the researcher during the process of data analysis. In other words, it means description of the research process, to allow for replication (Marrow, 2005), even though the intent is not to generate the same results (Shenton, 2004). To achieve dependability for the study, the researcher needs to provide detailed description of the research process vis-à-vis the design, data gathering and methods used (Marrow, 2005; Shenton, 2004).

In this study, the researcher planned in clear terms the instruments used for data collection, and the method and general design for the study at the beginning of this chapter. To ensure research ethics, the researcher obtained clearance for the study from the research Head of Basic Education Department of UEW, as well as permission from Okaikwei North Educational Directorate. This the researcher a nod to proceed with the research and access to the schools. Also, the research methodology used for this study was clearly described.

3.11.3 Transferability

According to Morrow (2005), transferability refers to the extent to which the findings from a particular study can be applied to wider situations. Shenton (2004) however, contended that since qualitative studies consider only a small population, it is difficult to say that that their findings can be applied to wider situations. Guba (1981) posited that the findings can only be applied when the situations and populations are considered to be similar to those used in the study. To determine this, Shenton (2004)

suggested that the researcher provided adequate information on the general design and approach of the research, so as to guide readers to make informed decisions on its transference. In line with this, Graneheim and Lundman (2004) proposed that there should be a clear description of the context, sample and sampling procedure, processes of data collection and analysis, as well as explicit and intense presentation of findings of the research, which may be done by way of inserting direct quotations from the transcribed data into the research report.

In view of this, earlier in the chapter, the researcher provided details of the context, sample, sampling technique, data collection and analysis of the study, which made it easy for the reader to decide on its transferability. Also, the researcher included direct quotes from the transcribed text, so as to add to the richness of the findings that were presented.

3.11.4 Confirmability

Confirmability of qualitative research means ensuring that the findings reflect the experiences of the participants and not the prejudices or bias of the researcher (Shenton, 2004). Confirmability assumes that the strength of the research findings lie in the ability of the researcher to link together the data, process of analysis and findings in such a way that gives room for confirmation of the accuracy of findings (Morrow, 2005). Thus, in ensuring confirmability, the researcher ensured that he puts aside his opinion in the analysis of the data by reading the transcripts over and over again, such that he became familiar with the ideas therein. Also, the researcher provided a justification for the methodology used for the study by referencing appropriate authors and gave a clear description of the manner in which the data were collected and analyzed, such that the reader finds it easy to decide on the acceptability

of the findings. Furthermore, the researcher used triangulation by varying the sources of the data that were collected.

3.12 Data Collection Procedure

In order to successfully collect data for the study, an introductory letter was obtained from the school of graduate studies introducing the researcher and the purpose of the research to the authorities in the selected schools in the Okaikwei North Municipality. Before the administration of the questionnaire, the researcher made preliminary enquiry in the schools to obtain permission from head teachers and teachers to conduct the study. In each school, the selected respondents were group together and the purpose of the study was made known to them. The respondents were guided as to how to answer the questionnaire. In order not skip some of the response, respondents were encouraged to read the questionnaire before selecting the appropriate responses. Respondents were given the opportunity to ask any question that baffles them in order to complete the questionnaire.

3.13 Data Analysis Procedure

Both quantitative and qualitative data analysis procedures were employed to analyse the data and information collected. The data were initially coded and processed using version 20 of Statistical Package and Service Solutions (SPSS) software. The data file was reviewed before any analysis is conducted to check for any anomalies. The results were presented according to the four dimensions on which respondents' opinions were evaluated. Quantitative analysis involved the use of descriptive and inferential statistics (frequencies, percentages, mean, standard, independent samples t-test and correlation). Research questions 1, 2 and 4 were analysed using frequency,

percentages, mean and standard deviations. While the hypothesis 1 was tested using an independent samples t-test, Pearson's correlation was used to test hypothesis 2.

Qualitative data (interview) collected on research question three (3) was analysed using thematic analysis and observation report was analysed. The researcher analysed the interview data manually into themes. Thematic analysis is a process by which themes or trends within the dataset are identified, analysed and reported (Braun & Clarke, 2006). The transcriptions were checked by matching what was transcribed to what was heard on the recordings and making corrections where they were identified. Each interview was transcribed and coded as soon as possible after the interviews when the information presented in the interview was fresh in the evaluator's mind. The data were analysed based on themes taking into account important comments, common trends, as well as the commonalities and thematic differences.

3.14 Ethical Considerations

The study was undertaken in line with qualitative and quantitative research ethics outlined by Creswell (2013). He argued that ethical consideration is an important component of writing qualitative research since individual respondents like to expand exactly what causes or effect a phenomenon has. Based on this argument by Creswell (2016), ethical issues in research included specifically, informed consent, confidentiality and anonymity.

The informed consent aimed to reassure the participants of the essence of the study and the right to withdraw if they so desire at any time (Min, 2012). The participants gave their consent to the study because, confidentiality was guaranteed for them. The researcher clearly explain to participants the purpose of the study, how their data will be used, and the measures taken to ensure confidentiality and anonymity. Obtain their

informed consent to participate, emphasizing their rights and the voluntary nature of their involvement.

Confidentiality issues were dealt with by assuring participants that the information they provided would be kept in secret. The researcher took measures to protect participants' data from unauthorized access, use, or disclosure. This involves securing physical records, electronic files, and any other forms of data collected during the study.

Regarding anonymity, respondents were assured that no reference would be made to individual participants when reporting the findings so pseudonyms were used to quote participants when necessary. Specific details that may potentially identify participants in the research reports, publications, or presentations were avoided.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents the results obtained and discusses the findings of the study. The results are presented, analysed, and discussed in relation with relevant literature. The results are presented and analyzed in two sections; namely section A and section B. Section A deals with the analysis of the demographic data while the Section B concerns the analysis and discussion of the main data aimed at answering the research questions.

4.1 Section A: Demographic Data of Teachers

This section shows the demographic data on the teachers' sex, age, years of teaching experience, academic qualification, and experience with improvised instructional materials. Tables 1 to 5 summarize the socio-demographic data of the teachers.

4.1.1 Sex of Teachers

In examining the demographic profile of the participating teachers, gender distribution played a significant role. The study involved both male and female upper primary science teachers within the Okaikwei North Municipality. Gender demographics are presented in Table 1.

Table 1: Sex of Teachers

Sex	Frequency	Percent
Male	49	60.5
Female	32	39.5
Total	**81**	**100.0**

Source: Field Data, 2023

As shown in Table 1, the study achieved a balanced representation of both male and female teachers, with 49 male teachers constituting 60.5% of the sample and 32 female teachers comprising about 39.5% of the total participants. This balanced gender representation ensured that the study's findings encompassed insights from both male and female upper primary science teachers within the Okaikwei North Municipality.

Table 2 provides an overview of the age distribution of the teachers in the study. The purpose of including this table is to present the demographic data on the age groups of the participants. The table is divided into five age groups, each represented by the number of teachers and the corresponding percentage.

Table 2: Age of Teachers

Age Group	Frequency	Percent
30 years and Below	14	17.3
31-40 years	38	46.9
41-50 years	20	24.7
51-60 years	9	11.1
Total	**81**	**100.0**

Source: Field Data, 2023

Table 2 illustrates the distribution of teachers across different age groups. It is evident that the majority of participants, 38 (46.9%) fall within the age range of 31 to 40 years. Additionally, 20 (24.7%) of teachers are in the age group of 41 to 50 years, while 14 (17.3%) are 30 years old or below. The study also included 9 (11.1%) of teachers who are in the 51 to 60 years age bracket. This diverse representation across

age groups ensures that the findings encompass insights from teachers at various stages of their professional careers.

Table 3 presents the academic qualification of the teachers in the study. The purpose of this table is to provide an overview of the educational background of the participants.

Table 3: Academic Qualification of Teachers

Qualification	Frequency	Percent
Certificate "A"	6	7.4
Diploma	41	50.6
Bachelor's Degree	28	34.6
Master's	6	7.4
Total	**81**	**100.0**

Source: Field Data, 2023

Table 3 reveals the distribution of teachers based on their academic qualifications. It is evident that the majority of participants, accounting for 50.6%, hold diplomas as their highest educational qualification. Additionally, 34.6% of teachers possess a Bachelor's degree, while a smaller percentage of 7.4% have achieved a Certificate "A" or a Master's degree. This diversity in academic qualifications among the participants enriches the study by considering insights from teachers with varying levels of formal education.

Table 4 presents the teaching experience of the teachers in the study. The purpose of this table is to provide an overview of the distribution of teaching experience among the participants.

Table 4: Teaching Experience

Teaching Experience	Frequency	Percent
Less than 6 years	16	19.8
6-10 years	24	29.6
10-15 years	21	25.9
16-20 years	11	13.6
Above 20 years	9	11.1
Total	**81**	**100.0**

Source: Field Data, 2023

Table 4 reveals that the largest group of teachers, comprising 24 (29.6%), has 6 to 10 years of teaching experience, followed by those with 10 to 15 years of experience at 21 (25.9%). Teachers with less than 6 years of experience make up 16 (19.8%) of the sample. Additionally, teachers with 16 to 20 years and above 20 years of experience represent 11 (13.6%) and 9 (11.1%) of the total sample, respectively. This distribution of teaching experience among the participants demonstrates a range of experience levels, which can provide valuable insights into the findings of the study, particularly regarding the knowledge and use of improvised instructional materials.

The responses of the participating teachers regarding their use of improvised instructional materials in teaching science is presented in Table 5.

Table 5: Teachers who have used an improvised instructional material to teach science?

Qualification	Frequency	Percent
Yes	63	77.8
No	18	22.2
Total	**81**	**100.0**

Source: Field Data, 2023

The results in Table 5 shows that 63 (77.8%) representing majority of the teachers have used improvised instructional materials in their science teaching practices. Conversely, 18 (22.2%) of the teachers indicated that they have not used improvised instructional materials for teaching science. The high percentage of teachers who have used improvised instructional materials suggests a positive perception towards innovation and resourcefulness in teaching. This willingness to explore alternative teaching methods aligns with the implementation of a standards-based curriculum, which often encourages creative approaches to pedagogy. While the majority of teachers have used improvised materials, the 22.2% who have not may face challenges related to resource constraints or lack of training in this area. Addressing these barriers and providing support for these teachers could further enhance the integration of improvised materials into science instruction.

4.2 Section B: Analysis of Main Data

This section presents the results for the analysis of the main data. This section delves into the analysis and discussion of the findings, shedding light on the knowledge and utilization of improvised instructional materials by upper primary science teachers in the Okaikwei North Municipality. The results are presented in Tables 6 to 9.

Research Question 1: What is the level of knowledge of upper primary science teachers on improvisation of instructional materials?

This research question sought to investigate and understand the level of knowledge that upper primary science teachers possess regarding the improvisation of instructional materials. In the context of science education, instructional materials play a vital role in facilitating effective teaching and learning experiences. Therefore, this question aimed to assess the extent to which science teachers are knowledgeable about creating or using improvised instructional materials as part of their pedagogical practices. The findings, as depicted in Table 6, are stratified into three distinct categories based on the scores attained by the respondents: low level (0-5 marks), moderate level (6-10 marks), and high level (11-15 marks). Table 6 presents the results of test conducted on knowledge of upper primary science teachers on improvisation of instructional materials.

Table 6: Teachers' Level of Knowledge of Improvised Materials

Range of Marks	Frequency	Percent	Knowledge Level
0 – 5	22	27.2	Low
6 –10	33	40.7	Moderate
11–15	26	32.1	High
Total	**81**	**100.0**	

Source: Field Data, 2023

Findings in Table 6 reveals that 22 teachers, constituting 27.2% of the respondents has knowledge considered to be at the low level. This group represents teachers who scored the lowest marks on the knowledge assessment. This underscores the need for

targeted interventions and professional development programmes to uplift their level of knowledge on improvisation.

A significant portion of the respondents, precisely 33 teachers, which accounts for around 40.7%, exhibited a moderate level of knowledge on improvisation. These teachers scored moderately on the assessment, reflecting a certain degree of familiarity with the improvisation of instructional materials. This middle-ground performance implies that while many teachers may have some degree of familiarity with this essential aspect of teaching, there is room for improvement and further training to enhance their knowledge and capabilities on improvisation of science materials.

The data also reveals that 26 teachers, comprising 32.1% of the respondents, possess high level of knowledge. This group stands out as educators who scored the highest marks in the assessment, indicating a strong grasp of the principles and practices related to improvisational instructional materials. This group of teachers with above-average knowledge are exemplars who could potentially serve as resources and mentors to their peers.

These findings provide a nuanced perspective on the extent to which upper primary science teachers are equipped with the knowledge necessary to engage in the improvisation of instructional materials. The distribution of teachers across these knowledge levels offers valuable insights into the overall landscape of teacher preparedness in this critical aspect of science education.

Research Question 2: What are the perceptions of upper primary science teachers on improvisation of instructional materials?

This research question sought to delve into the realm of educators' perceptions, seeking to explore and understand the disposition of upper primary science teachers towards the improvisation of instructional materials. Perception plays a pivotal role in shaping teaching practices, as it influences how teachers approach the development and use of teaching aids, especially improvised materials. Examining teachers' perceptions in this context is crucial for comprehending their receptiveness, motivation, and willingness to engage in the creative process of crafting or utilizing improvised instructional materials. Table 7 offers a comprehensive insight into teachers' perceptions by analyzing their responses to specific statements related to improvisation.

Table 7: Teachers' Perceptions towards Improvisation of Instructional Materials

Statement	SA F (%)	A F (%)	U F (%)	D F (%)	SD F (%)	M	SDV
I use improvised material because they have practical and physical links between science and theory	24(29.6)	34(42.0)	4(4.9)	14(17.3)	5(6.2)	3.4	0.5
Improvisation eradicate the menace of lack of or inadequate instructional materials for science	41(50.6)	35(43.2)	2(2.5)	2(2.5)	1(1.2)	4.1	0.3
Improvisation sensitize both students and teachers that alternatives for some of the conventional science teaching materials are possible.	27(33.3)	37(45.7)	7(8.6)	9(11.1	1(1.2)	3.7	0.4
I am able to achieve the set out educational objectives through the use of	11(13.6)	31(38.3)	17(21.0)	15(18.5)	7(8.6)	2.8	0.9

improvised instructional materials in teaching.							
I made improvised science equipment which are not readily replaceable	6(7.4)	22(27.2)	0 (0.0)	41(50.6)	12(14.8)	2.1	0.2
I use improvised materials in place of dangerous/sophisticated equipment	25(30.9)	43(53.1)	4(4.9)	8(9.9)	1(1.2)	3.4	0.5
I use improvised materials to develop an appreciation for discarded scrap or materials	18(22.2)	31(38.3)	21(25.9)	8(8.9)	3(3.7)	3.2	0.8

Source: Field Data, 2023

Key: Strongly Disagree (SD); Agree (A); Strongly Disagree (SD); Disagree (D); Uncertain (U); Mean (M); Standard Deviation (SDV); Frequency (F); Percentage (%).

Table 7 presents the results of the assessment of teachers' perceptions towards improvisation of instructional materials. The analysis of teachers' perceptions toward the improvisation of instructional materials reveals important trends based on the frequency of responses. For the statement, "I use improvised materials because they have practical and physical links between science and theory," 24 teachers (29.6%) strongly agreed, while 34 (42.0%) agreed, indicating that the majority of teachers acknowledge the benefits of using improvised materials in linking science and theory. However, 14 teachers (17.3%) disagreed, and 5 (6.2%) strongly disagreed, showing some resistance to this practice. The mean score of 3.4 and a standard deviation of 0.5 suggest a generally positive outlook but with some variation.

When asked if "Improvisation eradicates the menace of lack of or inadequate instructional materials for science," a significant majority of 41 teachers (50.6%) strongly agreed and 35 (43.2%) agreed. Only 2 teachers (2.5%) disagreed, and 1

(1.2%) strongly disagreed, emphasizing a broad consensus that improvisation helps address material shortages. The mean of 4.1 and a low standard deviation of 0.3 confirm the strong and consistent agreement.

For the statement, "Improvisation sensitizes both students and teachers that alternatives for some of the conventional science teaching materials are possible," 27 teachers (33.3%) strongly agreed, while 37 (45.7%) agreed. However, 9 teachers (11.1%) disagreed, and 1 (1.2%) strongly disagreed, suggesting that while the majority recognize the value of improvisation in promoting alternatives, a few remain unconvinced. The mean score of 3.7 and a standard deviation of 0.4 reflect relatively high agreement with minor variability.

Regarding the statement, "I am able to achieve the set educational objectives through the use of improvised instructional materials in teaching," 11 teachers (13.6%) strongly agreed, while 31 (38.3%) agreed. However, a notable number, 15 teachers (18.5%), disagreed, and 7 (8.6%) strongly disagreed, with 17 (21.0%) remaining uncertain. The mean score of 2.8 and a higher standard deviation of 0.9 suggest mixed opinions and greater variation in responses.

For the statement, "I made improvised science equipment which is not readily replaceable," only 6 teachers (7.4%) strongly agreed, and 22 (27.2%) agreed, while the majority, 41 teachers (50.6%) disagreed, and 12 (14.8%) strongly disagreed. This indicates a significant challenge for teachers in creating unique improvised equipment. The low mean score of 2.1 and a small standard deviation of 0.2 highlight this difficulty.

The statement, “I use improvised materials in place of dangerous or sophisticated equipment,” saw 25 teachers (30.9%) strongly agreeing and 43 (53.1%) agreeing, while only 8 teachers (9.9%) disagreed, and 1 (1.2%) strongly disagreed. This suggests a strong preference for using safer, improvised alternatives to hazardous equipment. The mean of 3.4 and a standard deviation of 0.5 indicate a consistent positive response.

Lastly, for the statement, “I use improvised materials to develop an appreciation for discarded scrap or materials,” 18 teachers (22.2%) strongly agreed, and 31 (38.3%) agreed, while 21 (25.9%) remained uncertain. Meanwhile, 8 teachers (8.9%) disagreed, and 3 (3.7%) strongly disagreed, showing some division in responses. The mean score of 3.2 and a higher standard deviation of 0.8 reflect moderate agreement but with more variability in perception.

In summary, the analysis indicates that while teachers generally have positive perceptions toward the use of improvised instructional materials, there are areas of mixed opinions, particularly concerning the ability to achieve educational objectives and create non-replaceable improvised materials.

Research Question 3: How do upper primary science teachers’ make use of improvised instructional materials?

Research Question 3 investigated the practical aspect of upper primary science teachers’ engagement with improvised instructional materials, aiming to understand how these materials are used in their teaching practices. To gain insights into this aspect, interviews were conducted with selected respondents, providing a platform for participants to share their experiences and perspectives. The participants’ voices are woven into the narrative, accompanied by pertinent quotations that illuminate their

views and practices. It's important to note that pseudonyms were used for participant names to maintain anonymity.

Thematic analysis was employed to categorize the data, revealing themes and sub-themes that capture the essence of the participants' responses. Notably, the data revealed a high degree of agreement among the respondents on various issues, strengthening the credibility of the findings. The primary theme explored in this section is the "Use of Improvised Instructional Materials," which is further elucidated through sub-themes derived from participants' shared experiences and perspectives.

Theme: Use of Improvised Instructional Materials

The theme "Use of Improvised Instructional Materials" emerged as a central aspect of upper primary science teachers' practices and experiences. Within this theme, several sub-themes were identified, shedding light on various dimensions of how teachers engage with improvised materials in their teaching. The participants' responses and perspectives collectively provided valuable insights into their use of improvised instructional materials.

Sub-Theme 1: Resourceful Creativity

Many participants highlighted their resourceful creativity when it came to improvising instructional materials. They expressed a willingness to craft their teaching aids using readily available resources. As some participant aptly put it:

> "I make use of whatever is available around me to create materials that can aid my teaching." (Teacher A).

> "In my classroom, I've transformed everyday objects into teaching tools. For instance, I've turned plastic bottles into water pressure demonstration apparatus, and cardboard boxes into simple models for explaining the solar system. It's amazing what you can do with a bit of imagination." (Teacher B).

> "I firmly believe that teaching shouldn't depend on having fancy equipment. I have utilized old newspapers to make papier-mâché globes for geography lessons. It's a hands-on experience that the children love, and it costs almost nothing." (Teacher C).

> "Sometimes, I collect empty containers like yogurt cups, egg cartons, and bottle caps. These little things can become counters for math lessons, sorting tools for science experiments, or even art supplies for creative projects. It's about maximizing what we have." (Teacher D).

> "Nature itself provides an abundance of materials. I encourage my pupils to explore the outdoors and gather leaves, twigs, and stones. We use them to learn about plants, and ecosystems. It's a way to connect with the environment." (Teacher E).

> "I have turned my classroom into a mini science lab with DIY experiments. With some vinegar, baking soda, and a few empty containers, we have simulated volcanic eruptions. It's hands-on science at its best, and the children are always excited." (Teacher F).

Sub-theme 2: Bridging Gaps

Teachers viewed improvised materials as a means of bridging gaps in the availability of conventional instructional materials. They recognized that such materials could fill the void when official resources were lacking or insufficient. The excerpts below provide the views shared by Teacher A, B, C, D, and E):

> "In our school, we often face shortages of textbooks and science equipment. That's when improvisation becomes our lifeline. We create diagrams, models, and charts to ensure students have visual aids even when the official materials are scarce." (Teacher A).

> "Sometimes, we have to share textbooks among several classes, which means limited access to written resources. To overcome this, I have developed simple handouts and worksheets tailored to our lessons. It ensures every student has something to work with." (Teacher B).

> "Our lab equipment is quite outdated, and we can't always get replacements. So, I have devised experiments that rely on everyday items. It's a win-win – pupils get hands-on experience, and we don't have to worry about broken equipment." (Teacher C).

> "In rural areas, access to quality science materials is even more challenging. We have created a network among teachers where we share our improvised resources and ideas. It's a collaborative effort to bridge the gaps." (Teacher D).

> "Improvisation also fosters a can-do perception in pupils. When they see us making the best of what we have, it motivates them to be resourceful and innovative too." (Teacher E).

These responses illustrate how teachers perceive improvised materials as essential tools for overcoming resource limitations and ensuring that pupils have access to quality education, regardless of material constraints.

Sub-theme 3: Promoting Understanding

Participants believed that improvised materials had the potential to enhance pupils' comprehension of scientific concepts. They aimed to make abstract ideas more accessible by creating tangible and relatable teaching aids. Some teachers shared their views as such:

> "Using improvised materials helps pupils to grasp scientific concepts better." (Teacher A).

> "Science can be abstract, and many students struggle to visualize complex ideas. By demonstrating concepts with improvised models and experiments, I can see that the 'aha' moment happens more often." (Teacher B).

> "Some of our students come from backgrounds with little exposure to scientific ideas. When we use everyday objects to explain complex theories, it's like turning on a light bulb in their minds." (Teacher C).

> "I have noticed that when students can touch, see, and interact with materials I have improvised, they become active learners. It's not just about memorizing; it's about truly understanding." (Teacher D).

> "Abstract concepts like the water cycle can be daunting. But when we use simple props and visuals made from everyday items, it's like a magic trick that demystifies science for them." (Teacher E).

> "Improvised materials add a layer of practicality to our lessons. They make scientific principles tangible and relatable. Students aren't just learning; they're experiencing science." (Teacher F).

> "It's about making science real for our students. They're not just reading from textbooks; they're experimenting and exploring with materials that are within their reach." (Teacher G).

These responses underscore how teachers perceive improvised materials as powerful tools for making science more understandable and engaging for students, particularly when dealing with complex or abstract concepts.

Sub-theme 4: Cost-Effective Solutions

Cost-effectiveness was a recurring theme, with teachers emphasizing that improvised materials were affordable alternatives to expensive scientific equipment. This approach allowed them to provide quality education without straining limited resources. As teachers noted:

> "Buying specialized scientific equipment can be a budgetary challenge for schools. But with improvised materials, we can achieve the same learning outcomes without breaking the bank." (Teacher A).

> "It's a win-win situation. We save on costs, and students get to learn hands-on. Plus, it's environmentally friendly since we are recycling materials." (Teacher B).

> "As an teacher, I want the best for my pupils, but I also have to be mindful of the limited money the school receives from government. Improvised materials strike that balance." (Teacher C).

This sub-theme underscores the teachers' practical approach to education, where they find innovative and cost-effective ways to deliver quality learning experiences to their students. The use of improvised materials not only addresses budgetary constraints but also aligns with environmental sustainability principles, further enhancing the overall educational experience.

Sub-theme 5: Fostering Practical Learning

Teachers stressed the importance of hands-on learning experiences facilitated by improvised materials. They believed that these materials encouraged students to actively participate in practical activities, promoting a deeper understanding of science.

> "With improvised materials, students engage in practical experiments, which is crucial for science," (Teacher A).

> "Learning by doing is the essence of science. Improvised materials make it possible for students to roll up their sleeves and actively explore scientific concepts." (Teacher B).

> "In the end, science isn't just about theory; it's about applying knowledge. Improvised materials facilitate practical learning, which is essential for future scientists." (Teacher C).

> "When students see science in action through improvised experiments, it sparks curiosity and critical thinking. They start asking questions and seeking answers on their own." (Teacher D).

> "Practical learning stays with students longer than theory alone. When they handle materials and conduct experiments, they remember the concepts better." (Teacher E).

These comments from the teachers' responses emphasize the pedagogical value of hands-on learning experiences with improvised materials in science education. This approach not only deepens students' understanding but also fosters active engagement, critical thinking, and a strong foundation for future scientific pursuits.

To complement and enrich this retrospective view, we turned to the realm of observation a realm where actions speak louder than words. Through systematic and diligent observation, the researcher ventured into classrooms, becoming silent witnesses to the dynamic interplay between teachers, students, and the improvised materials that populate the learning environment. The results of these observations provide a tangible and grounded perspective on the actual application of the concepts and strategies articulated in the interviews. They allow us to explore how the principles discussed in the interviews manifest in the day-to-day instructional practices of these educators. These observations serve not only to validate and substantiate the insights gleaned from interviews but also to offer a deeper and more nuanced understanding of how the inventive spirit of these teachers manifests in their teaching methods. Table 8 presents the results of the observation on the use of improvised Science resources or materials by teachers.

Table 8: Observation on the Use of improvised Science Resources by Teachers

Indicator	Always	Frequently	Quite frequently	Not observed
Frequency of usage of improvised science resources				
Use of improvised resources during science lessons by teacher	0(0.0%)	1 (10.0%)	5(50.0%)	4(40.0%)
Use of improvised resources during science lessons by students	0(0.0%)	0 (0%)	3(30%)	7(70%)
Encouraging and promoting creativity	0(0.0%)	6 (60%)	4(40%)	0(0.0%)
Providing hands-on science experiences in the classroom.	1(10.0%)	2 (20.0%)	5(50%)	2(20.0%)
Create engaging and meaningful science activities.	0(0.0%)	1 (10%)	7(70%)	2(20.0%)
Make science concepts more relatable and accessible.	0(0.0%)	5 (50%)	4(40%)	1(10.0%)
Creating inquiry-based learning activities	2(20.0%)	4(40.0%)	1(10.0%)	3(30.0%)
Enhancing students' learning and increasing engagement in the classroom.	2(20.0%)	4(40.0%)	1(10.0%)	3(30.0%)
Conducting experiments	0(0.0%)	3 (30.0%)	2(20.0%)	5(50.0%)
Making models that illustrate scientific concepts	0(0.0%)	3 (30.0%)	3(30.0%)	4(40.0%)

Source: Field Data, 2023

Table 8 presents the insightful results of observations regarding the use of improvised science resources by teachers and students in the classroom. The observation results in Table 8 provided insights into the frequency with which upper primary science teachers utilize improvised instructional materials.

Notably, the majority of teachers were observed using improvised resources quite frequently during their science lessons, constituting 5 (50.0%) of the observed cases. This observation underscores the significance of these materials in the classroom, where teachers turn to them as valuable tools to enrich the learning experience. However, it's worth acknowledging that there were instances 4 (40.0%) where the use of improvised resources was not observed. This variation in usage highlights the diverse teaching approaches employed by educators.

A prominent finding revealed that 6 (60.0%) of teachers frequently use these materials to encourage and promote creativity in their students. This observation emphasizes the role of improvised resources in fostering a creative and interactive learning environment. Moreover, improvised materials play a significant role in providing hands-on science experiences, with 5 (50.0%) of teachers observed doing so quite frequently. This hands-on approach aligns with the notion that practical engagement enhances students' understanding of scientific concepts.

Another noteworthy aspect is the use of improvised materials to create engaging and meaningful science activities, observed in 7 (70.0%) of cases quite frequently. This finding highlights how teachers harness these materials to make science more engaging and relatable to students, ultimately enhancing the learning experience. Additionally, improvised resources were employed to make science concepts more relatable and accessible, with 5 (50.0%) of teachers frequently utilizing them for this purpose. This suggests that these materials serve as bridges that connect abstract scientific concepts to tangible, relatable experiences for students.

Observations also shed light on the role of improvised resources in fostering inquiry-based learning. In 4 (40.0%) of cases, teachers were frequently seen creating inquiry-

based learning activities using these materials. This finding underscores how improvised materials stimulate students' curiosity and critical thinking, encouraging them to explore scientific concepts independently. Furthermore, although not as prevalent, experimentation remains a significant aspect of science education. In 3 (30.0%) of cases, teachers frequently conducted experiments with improvised materials, offering students hands-on opportunities to explore scientific phenomena and principles.

Lastly, the observations revealed that teachers frequently used improvised materials 3 (30.0%) to make models that illustrate scientific concepts. This visual and tangible representation aids students in grasping complex ideas.

Generally, the observation results in Table 8 provide a comprehensive view of how upper primary science teachers effectively utilize improvised instructional materials. These materials not only enhance engagement, accessibility, and creativity but also foster inquiry-based learning and experimentation. They serve as valuable tools that bridge the gap between theoretical knowledge and practical application in the science classroom, ultimately enriching the educational experience for students.

Research Question 4: What challenges do upper primary science teachers encounter in the use of improvised instructional materials?

Research Question 4 investigated challenges faced by upper primary science teachers when integrating improvised teaching resources into their science instruction. This question sought to identify and analyze the specific challenges that impeded the effective utilization of improvised materials in the classroom, shedding light on the practical constraints and issues teachers confront in their teaching practices. The

results on challenges upper primary science teachers encounter in the use of improvised instructional materials are presented in Table 9.

Table 9: Challenges in Using Improvised Instructional Materials

Statement	SA+A F (%)	U F (%)	D+SD F (%)	M	SDV
Lack of knowledge on improvisation hinders me from using improvised resources.	49(60.5)	17(21.0)	15(18.5)	3.3	0.7
I am unable to create improvised resources for teaching science due to time constraints.	73(90.1)	0(0.0)	8(9.9)	4.6	0.3
The absence of support from school authorities hinders me from using improvised resources.	74(91.4)	1(1.2)	6(7.4)	3.7	0.2
I am unable to develop or use improvised resources due to lack of skills on improvisation.	50(61.7)	20(24.7)	11(13.6)	3.3	0.6
Financial constraints deter me from producing improvised resources for science teaching and learning.	53(65.4)	13(16.0)	15(18.5)	3.4	0.4
Students' negative perception towards the use of improvised instructional materials deters teachers from using these resources during science lessons.	68(84.0)	4(4.9)	9(11.1)	3.5	0.3
Improvised resources are inappropriateness for effective science lesson delivery	49(60.5)	21(25.9)	11(13.6)	3.3	0.7
Large class size prevents me and other science teachers from using improvised resources for science learning.	49(60.5)	13(16.0)	19(23.5)	3.4	0.4
Lack of motivation is a factor that hinders science teachers from improvising.	76(93.8)	2(2.5)	3(3.7)	4.1	0.2
Lack of knowledge on the importance of improvisation is a contributing factor to their low	10(12.3)	7(8.6)	64(79.0)	3.7	0.5

usage among teachers.					
Lack of storage facilities for improvised resources contributes to the failure of teachers to develop or use them for lesson delivery.	22(27.1)	7(8.6)	52(64.2)	3.4	0.7

Source: Field Data, 2023

Key: Strongly Disagree (SD); Agree (A); Strongly Disagree (SD); Disagree (D); Uncertain (U); Mean (M); Standard Deviation (SDV); Frequency (F); Percentage (%).

The results in Table 9 reveal that substantial percentage (60.5%) of teachers highlighted their deficiency in improvisational knowledge, which in turn obstructs their utilization of improvised resources. This is underscored by the mean score of 3.3, reflecting a moderate consensus among educators. Furthermore, the relatively modest standard deviation of 0.7 implies a reasonably consistent response pattern within this context.

In a parallel vein, an overwhelming majority (90.1%) of teachers grappled with a significant barrier: time constraints that hamper their capacity to create improvised resources. This obstacle resonates powerfully, as indicated by the robust mean score of 4.6, signifying a near-universal concurrence among the surveyed teachers. The minuscule variability, represented by a standard deviation of 0.3, accentuates the ubiquity of this concern in their professional lives.

Another noteworthy finding surfaces as a significant percentage (91.4%) of teachers articulated their struggle due to the lack of support from school authorities. This challenge is substantiated by the mean score of 3.7, reflecting a high degree of consensus, while the minimal standard deviation of 0.2 indicates a uniform perception among teachers regarding this issue.

Approximately 61.7% of teachers conveyed their impediment arising from their inadequate improvisational skills, hindering their proficiency in crafting or employing improvised resources. The moderate mean score of 3.3 underscores a prevailing sentiment among educators, while the standard deviation of 0.6 signifies some variance in their responses.

Financial constraints emerged as a considerable challenge for a notable percentage (65.4%) of teachers, restraining their ability to generate improvised resources. The mean score of 3.4 underscores the resonance of this challenge, while the standard deviation of 0.4 acknowledges some degree of response diversity.

A substantial majority (84.0%) of teachers grappled with the deterrent effect of students' negative perceptions toward improvised instructional materials. The robust mean score of 3.5 indicates a profound consensus among educators, with minimal response variability represented by the standard deviation of 0.3.

Approximately 60.5% of teachers expressed reservations regarding the appropriateness of improvised resources for effective science lesson delivery. This concern is substantiated by the mean score of 3.3, indicating a moderate level of consensus, while the standard deviation of 0.7 suggests variability in their responses.

In tandem, around 60.5% of teachers cited the challenges posed by large class sizes. This obstacle is reflected in the mean score of 3.4, signifying a moderate consensus, with some response variability denoted by the standard deviation of 0.4. Notably, an overwhelming majority (93.8%) of teachers underscored the significant hindrance posed by a lack of motivation. This sentiment is amplified by the robust mean score of 4.1, revealing a deep-seated consensus, while the standard deviation of 0.2 implies minimal diversity in their responses.

On a different note, a small percentage (12.3%) of teachers reported a dearth of knowledge regarding the importance of improvisation. This finding is reflected in the mean score of 3.7, suggesting moderate consensus, with some response variance denoted by the standard deviation of 0.5.

Lastly, approximately 27.1% of teachers confronted challenges stemming from the absence of storage facilities for improvised resources. This issue is mirrored in the mean score of 3.4, indicating a moderate level of consensus, while the standard deviation of 0.7 acknowledges variability in their responses.

Collectively, these findings reveal a nuanced landscape of challenges faced by upper primary science teachers. These challenges vary in their extent and impact, with time constraints, lack of motivation, and lack of support from school authorities standing out as particularly significant obstacles. Addressing these challenges is crucial to facilitate effective integration and maximize the potential of improvised materials in science education.

Testing Hypotheses

The following null hypotheses were tested in the study.

H_{o1}: There is no statistically significant difference between upper primary science teachers' knowledge and their perception in the use of Improvised Instructional Materials (IIM).

The results are shown in Tables 10 and 11.

Table 10: Levene's Test of Equality of Error Variancesa

F	df1	df2**a**	Sig.
0.167	1	79	0 .683

Tests the null hypothesis that the error variance of the dependent

Table 10 showed the Levene's Test of Equality of Error Variances. The results show that the assumption of homogeneity of variance was not violated. In other words, equal variances were assumed. This is evident in the significance (2-tailed) value, (p >0.50) = 0.683.

H_{o1}: There is no statistically significant difference between male and female upper primary science teachers' knowledge in the use of Improvised Instructional Materials (IIM).

Table 11: Gender and Knowledge in the use of Improvised Instructional Materials

Level	**N**	**Mean**	**Std. Dev.**	**T**	**Df**	**Sig-Value**
Male	49	8.9	3.9			
				0.467	79	0.641
Female	32	3.2	5.0			

Source: Field Data, 2023

From the results in Table 11, the significance (2-tailed) value is 0.041. This value is greater than the cut-off point of 0.05 (P =0.641). The t-value is 0.467, indicating the difference between the mean knowledge score and the mean perception score. Since the significance level (Sig-Value) is greater than 0.05, the researcher fail to reject the

null hypothesis (Ho1). Thus, there is no statistically significant difference between the knowledge of male and female upper primary science teachers in the use of Improvised Instructional Materials (IIM). This suggests that, there is no strong evidence to support the claim that there is a significant difference between male and female upper primary teachers' knowledge regarding the use of IIM. The t-value of 0.467 further supports this conclusion, as it is relatively close to zero, indicating a lack of substantial difference between knowledge and perception scores. The result suggests that, on average, the knowledge of male and female teachers about using IIM are relatively consistent.

H_{o2} : There is no statistically significant relationship between the perception of upper primary science teachers and the challenges they encounter in the use of improvised instructional materials.

In order to establish the statistically significant relationship or otherwise between the perception of upper primary science teachers and the challenges they encounter in the use of improvised instructional materials, the hypothesis for the study was tested using the Pearson's product moment correlation at 0.05 level, 2-tailed. The result of the relationship between teachers' Challenges and Perception in the use of improvised instructional materials is presented in Table 12.

Table 12: Relationship between teachers' Challenges and Perception in the use of improvised instructional materials

Variable	N	Mean	*Sd*	*R*	*P*
Challenges Encountered	81	20.7	5.2	-.254	.000
Perception in using IIM	81	30.2	4.7		

Source: Field Data, 2023

Table 12 presents the results of correlations matrices between teachers' Challenges and use of improvised instructional materials. The $p < 0.05$ (Sig. = 0.000) means that there is a statistically significant relationship between teachers' challenges and use of improvised instructional materials. The correlation coefficient, r = -0.254 shows that the relationship between the perception of upper primary science teachers and the challenges they encounter in the use of improvised instructional materials is negative. The R-value of -0.254 suggests that the relationship between the two variables is in opposite direction. The negative correlation suggests that teachers having negative perception will encounter more challenges in using improvised materials in their teaching and teachers with positive perception will encounter less challenges in using improvised materials. This implies that, as teachers' perception increases, their challenges towards the use of improvised instructional materials decreases and as teachers' perception decreases, their challenges in the use of improvised instructional materials increases. The results provide evidence to suggest that there exists a significant negative relationship between teachers' perception and the challenges they encounter in their use of improvised instructional materials, hence the null hypothesis ($H0_2$) was rejected.

4.3 Discussion of Results

4.3.1 Upper primary science teachers' knowledge on improvisation of instructional materials

Research objective 1 sought to find out Upper Primary Science teachers' knowledge on improvisation of instructional materials. The findings revealed that Upper Primary Science teachers are equipped with the knowledge necessary to engage in the improvisation of instructional materials. A significant portion of the teachers exhibit an average level of knowledge. These teachers scored moderately on the assessment, reflecting a certain degree of familiarity with the improvisation of instructional materials. The distribution of teachers across these knowledge levels offers valuable insights into the overall landscape of teacher preparedness in this critical aspect of science education.

The finding that Upper Primary Science teachers have a moderate level of knowledge about the improvisation of instructional materials is a positive indication of their preparedness and adaptability in the context of science education. Improvisation is a crucial skill for teachers, particularly in the context of science education. It allows educators to create customized materials that cater to the specific needs and abilities of their students, making learning more engaging and effective. The moderate scores suggest that these teachers possess a foundational understanding of instructional material improvisation, which can positively impact their teaching strategies (Ajaja, Ogunlela, & Bamgbose, 2019).

Several previous studies consistently underscore the importance of teachers' ability to create or adapt teaching materials. For instance, in a study by Kisirisa and Akun (2016), it was found that teachers with higher levels of improvisation skills were more

effective in enhancing students' understanding of science concepts. This aligns with the current finding that upper primary science teachers have an average level of knowledge in instructional material improvisation, suggesting their capacity to provide tailored and engaging learning experiences for their students.

4.3.2 Upper primary science teachers' perception on improvisation of instructional materials

Research objective 2 investigated upper primary science teachers' perceptions on improvisation of instructional materials. The finding revealed that upper primary science teachers exhibit varying perceptions towards instructional material improvisation highlights the complexity and multifaceted nature of their perceptions regarding the practicality and effectiveness of improvised materials. The mixed perceptions towards instructional material improvisation reflect that teachers generally acknowledge the practicality of improvised materials in their teaching. These materials serve as solutions to address shortages of conventional teaching resources. This recognition suggests that teachers are open to innovative approaches and are willing to adapt to resource limitations. The study also indicates that teachers appreciate the potential of improvised materials to introduce alternative teaching resources. These concerns raised in the present study about the effectiveness of improvised materials corroborate with the assertion of Boateng and Jang (2019) which highlighted the need for instructional materials to align with educational objectives and adapt to evolving teaching methods.

While there is a general acknowledgment of the practicality of improvised materials, there is some variation in perceptions. This variability primarily revolves around two key dimensions; the effectiveness of improvised materials in achieving educational

objectives and concerns about the creation of non-replaceable materials. The finding that teachers exhibit diverse perceptions towards instructional material improvisation aligns with previous studies in the field of education. Research by Yapıcı (2017) explored teachers' perceptions towards using improvised teaching materials and found that while teachers recognized the practicality of improvisation, they had reservations about the effectiveness of these materials in meeting educational goals. This concurs with the present study's finding of varying perceptions regarding the effectiveness of improvised materials.

The theory of multiple intelligences, proposed by Howard Gardner, posits that individuals possess different types of intelligence. Teachers' perceptions towards instructional material improvisation may be influenced by their own dominant intelligences. For example, a teacher with a strong visual-spatial intelligence may have a positive perception towards using visual aids as improvised materials. Acheampong (2017) revealed that teachers with strong visual-spatial intelligences were more inclined to use visual aids and improvised materials in their teaching. This supports the theory of multiple intelligences, indicating that teachers' perceptions towards instructional material improvisation may be influenced by their dominant intelligences. Recognizing and catering to these different intelligences among students can enhance the effectiveness of improvised materials in addressing diverse learning needs. The perceptions of teachers towards instructional material improvisation also relate to instructional material theory. Teachers may view improvised materials as a response to the scarcity of traditional resources. However, concerns about the effectiveness of these materials and their longevity can be seen as a reflection of teachers' awareness of the quality and adaptability of instructional materials.

Effective instructional materials, whether improvised or traditional, should align with educational objectives and adapt to evolving teaching methods.

4.3.3 How upper primary science teachers' use improvised instructional materials

Research objective 3 examined how upper primary science teachers' use improvised instructional materials. The finding that upper primary science teachers utilize improvised instructional materials to enhance students' engagement, accessibility, creativity, and inquiry-based learning aligns with previous studies and is connected to the theory of multiple intelligences and instructional material theory.

The use of improvised instructional materials to enhance students' engagement and accessibility is consistent with educational research both in Ghana and internationally. A study by Oduro et al. (2018) in Ghana investigated the impact of improvised teaching materials in primary education. The research found that teachers commonly used improvised materials to make lessons more engaging and accessible. The materials were especially valuable in making abstract concepts tangible, which corresponds with the finding that improvised materials bridge the gap between theoretical knowledge and practical application. Recently, Swaminathan and Araujo (2020) explored the use of improvised materials in science education. The study revealed that teachers adopted these materials to create interactive and engaging learning experiences for students. This international perspective echoes the finding that improvisation fosters students' engagement and accessibility in science education.

The finding that improvised instructional materials foster creativity and inquiry-based learning is supported by educational research and aligned with Adeyemo and Aderinoye (2016) study which found that teachers encouraged students to create their own improvised materials, promoting creativity and inquiry-based learning. This resonates with the finding that improvised materials serve as tools for fostering inquiry-based learning and experimentation. Also, Jenkins and Hundhausen (1999) found that such materials encouraged students to explore scientific concepts through hands-on experimentation. This aligns with the finding that improvised materials promote inquiry-based learning, which is vital in science education.

The utilization of improvised materials to enrich students' educational experience connects with the theory of multiple intelligences. Teachers who encourage creativity and inquiry-based learning through improvised materials may cater for students with varying dominant intelligences. Yeboah (2017) indicated that students with strong kinesthetic intelligences preferred hands-on and experimental learning approaches. By utilizing improvised materials for experimentation, teachers may appeal to students with kinesthetic intelligences, thus aligning with the theory of multiple intelligences. Kharb, Samanta, and Jindal (2013) revealed that students with high interpersonal intelligences preferred cooperative and experiential learning. By fostering inquiry-based learning through improvised materials, teachers may cater for students with such intelligences, illustrating the global relevance of the theory of multiple intelligences.

4.3.4: Challenges upper primary science teachers encounter in the use of improvised instructional materials

Research objective 4 investigated the challenges that upper primary science teachers encounter in the use of improvised instructional materials. Upper primary teachers' challenges in the use of improvised instructional materials vary in their extent and impact, with time constraints, lack of motivation, and lack of support from school authorities standing out as particularly significant obstacles. Addressing these challenges is crucial to facilitate effective integration and maximize the potential of improvised materials in science education.

The challenge of time constraints in utilizing improvised instructional materials is a well-documented issue in educational research. A study by Nuworsoo and Agbenyega (2016) revealed that teachers often cited time constraints as a barrier to effectively using improvised materials. This local study is in line with the finding that time constraints are a significant challenge for upper primary science teachers. Similarly, Sang et al. (2010) also highlighted time as a major constraint for teachers using improvised materials. The study found that teachers reported insufficient time for materials preparation and implementation. This global perspective supports the notion that time constraints are a common challenge.

The challenge of a lack of motivation is not unique to Ghana and has been reported in various educational contexts. Tetteh (2018) indicated that the absence of recognition and incentives often led to a lack of motivation among teachers. This local study aligns with the finding that a lack of motivation is a challenge for upper primary science teachers. Ingersoll (2003) emphasized the importance of recognizing and valuing teachers' efforts to boost motivation.

The challenge of lacking support from school authorities is a recurring issue in curriculum implementation. A study by Addeh (2017) explored the role of school leadership in curriculum implementation. The research found that when school authorities did not provide support and resources for teachers, it hindered effective curriculum delivery. This local study aligns with the finding that a lack of support from school authorities is a significant obstacle. For this reason, Hallinger and Heck (1996) concluded that leadership support was essential for effective curriculum implementation.The challenges faced by upper primary science teachers, such as time constraints and a lack of motivation, may hinder the application of multiple intelligences theory. Teachers need time and motivation to cater to students with diverse intelligences effectively. The challenges highlighted in this finding may impede teachers' capacity to adapt their teaching methods to meet various intelligences in the classroom. These challenges are closely linked to instructional material theory. Lack of time and motivation can hinder the preparation and use of instructional materials, which are crucial for effective teaching and learning. Moreover, the absence of support from school authorities can impede the provision of necessary instructional materials, affecting the quality of education.

4.3.5: Discussion of Hypotheses

H_{o1}: There is no statistically significant difference between male and female upper primary science teachers' knowledge in the use of improvised instructional materials.

The finding for research hypothesis 1 revealed that there is no statistically significant difference between male and female upper primary science teachers' knowledge in the use of improvised instructional materials. The result suggests that, on average, the

knowledge teachers about using IIM are relatively consistent across gender. This finding aligns with previous studies that emphasize the importance of teachers' knowledge and perception in effectively utilizing instructional materials (Tare et al., 2016). It implies that male and female teachers, on average, have a balanced level of knowledge and perception necessary for using improvised materials effectively.

H_{o2} : There is no statistically significant relationship between upper primary science teachers' perception and the challenges they encounter in the use of improvised instructional materials.

The findings for hypothesis 2 revealed that there is a statistically significant negative relationship between upper primary science teachers' perception and the challenges they encounter in the use of improvised instructional materials. The negative correlation suggests that teachers who encounter more challenges in using improvised materials have negative perceptions towards the use of IIM while teachers having positive perception are most likely to encounter less challenges in using improvised materials. This finding is supported by research indicating that teachers may be less inclined to use instructional materials when they perceive challenges in their application (Adamu et al., 2019). It underscores the importance of addressing these challenges to encourage the effective integration of improvised materials into teaching. Generally, these findings indicate that teachers, on average, have consistent perception regarding the use of improvised instructional materials. However, when teachers perceive significant challenges, their utilization of improvised materials tends to decrease. To enhance the use of these materials, it is crucial to address and mitigate the challenges teachers face.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATION

5.0 Overview

This chapter discusses the summary of the study, key findings, conclusions, and recommendations. The chapter also contains suggestions for further research.

5.1 Summary of the Study

The purpose of the study was to investigate upper primary science teachers' knowledge, perception and use of improvised instructional materials in the Okaikwei North Municipality. Specifically, the study sought to:

1. Investigate upper primary science teachers' knowledge on improvisation of instructional materials;
2. Examine upper primary science teachers' perception towards the improvisation of instructional materials;
3. Investigate how upper primary science teachers' use improvised instructional materials and
4. Investigate the challenges upper primary science teachers encounter in the use of improvised instructional materials.

Four (4) research questions were answered and two (2) hypotheses were tested. The study was anchored in the pragmatist research philosophy, influenced by the mixed method approach, and was directed by embedded mixed method design. In all a sample size of eighty-one (81) upper primary teachers were selected for the study. The sample were selected using census and purposive sampling technique. Data were collected using closed-ended questionnaire, semi-structured interview guide and observation checklist. The instrument was pre-tested to ensure reliability and validity.

Both quantitative and qualitative data analysis procedures were employed to analyse the data and information collected. Quantitative analysis involved the use of descriptive and inferential statistics (frequencies, percentages, mean, standard, independent samples t-test and correlation). Research questions one, two and four were analysed using frequency, percentages, mean and standard deviations. While the hypothesis 1 was tested using an independent samples t-test, Pearson's correlation was used to test hypothesis 2. Qualitative data (interview) collected on research question three (3) was analysed using thematic analysis and observation report was analysed. The data were analysed based on themes taking into account important comments, common trends, as well as the commonalities and thematic differences.

5.2 Key Findings

The key findings are presented in this section. The study revealed six (6) key findings. The findings of the study revealed that:

1. Upper primary science teachers are equipped with the knowledge necessary to engage in the improvisation of instructional materials. A significant portion of the teachers exhibit an average level of knowledge. These teachers scored moderately on the assessment, reflecting a certain degree of familiarity with the improvisation of instructional materials. The distribution of teachers across these knowledge levels offers valuable insights into the overall landscape of teacher preparedness in this critical aspect of science education.
2. The perceptions of upper primary science teachers towards instructional material improvisation encompass recognition of the practicality of improvised materials, their role in addressing material shortages, and their potential to raise awareness of alternative teaching resources. However, there

is some variability in perceptions, particularly regarding the effectiveness of improvised materials in achieving educational objectives and the creation of non-replaceable materials.

3. Upper primary science teachers utilize improvised instructional materials to enhance students' engagement, accessibility, and creativity but also foster inquiry-based learning and experimentation. The improvised instructional materials serve as valuable tools that bridge the gap between theoretical knowledge and practical application in the science classroom, ultimately enriching the educational experience for students.
4. Upper primary teachers' challenges in the use of improvised instructional materials vary in their extent and impact, with time constraints, lack of motivation, and lack of support from school authorities standing out as particularly significant obstacles. Addressing these challenges is crucial to facilitate effective integration and maximize the potential of improvised materials in science education.
5. There is no statistically significant difference between the knowledge of male and female upper primary science teachers in the use of Improvised Instructional Materials (IIM). The result suggests that, on average, the knowledge towards using IIM is relatively consistent among male and female Upper primary science teachers.
6. There is a statistically significant negative relationship between upper primary science teachers' perception and challenges they encounter in the use of improvised instructional materials. The negative correlation suggests that as the perception of Upper primary science teachers increases (positive), the

challenges they encounter lessons and negative perception will necessitate an increase in the challenges they encounter in using IIM in teaching.

5.3 Limitations of the Study

The findings of the study may be limited in their generalizability to a broader population of teachers beyond the specific context of the study. Also, the data in the study are largely based on self-reporting by teachers. This introduces the potential for social desirability bias, where teachers may provide responses, they believe are expected or favorable rather than their true perceptions and behaviours.

5.4 Conclusions

Based on the findings presented in the study, conclusions are drawn regarding the knowledge, perceptions, practices, and challenges faced by upper primary science teachers in the use of improvised instructional materials (IIM).

The findings of the study indicate that upper primary science teachers generally have the requisite knowledge for creating improvised instructional materials, which is a positive sign. It implies that teachers have the fundamental know-how needed for this crucial aspect of science education. However, there is a range of perceptions among teachers regarding the practicality and effectiveness of improvised materials. While many teachers see the value of improvised materials in addressing resource shortages and enhancing engagement and creativity among students, some express reservations about their effectiveness in achieving educational objectives. This diversity in perceptions highlights the need for tailored support and training to address concerns and boost teachers' confidence.

Moreover, the study highlights that the use of improvised instructional materials significantly improves students' engagement, accessibility to learning, creativity, and their ability to engage in inquiry-based learning and experimentation. This underscores the importance of improvised materials as effective teaching tools that bridge the gap between theoretical knowledge and its practical application in the science classroom. However, the study also uncovers various challenges faced by teachers, including time constraints, lack of motivation, and limited support from school authorities. These challenges pose substantial barriers to the effective incorporation of improvised materials into science education. Consequently, it is imperative to address these obstacles to fully unlock the potential of improvised instructional materials.

Furthermore, the study finds that there is no statistically significant difference between teachers' knowledge and their perception regarding the use of improvised instructional materials. In essence, teachers who possess knowledge about improvised materials tend to hold positive perceptions toward their utilization. This alignment presents an opportunity to design interventions and training programmes that simultaneously enhance both knowledge and perception, thus promoting more effective teaching practices.

Lastly, a noteworthy observation from the study is the statistically significant negative relationship between the challenges encountered by teachers and their use of improvised instructional materials. This means that as challenges increase, the adoption of improvised materials tends to decrease. It emphasizes the critical importance of addressing these challenges as a means to facilitate and encourage effective teaching practices using improvised materials.

Generally, the study provides valuable insights into the landscape of upper primary science education, emphasizing the potential of improvised instructional materials to enrich the educational experience for students. However, it also highlights the need for targeted support and interventions to address challenges and promote the effective integration of IIM. Ultimately, fostering a positive environment that aligns knowledge, perceptions, and practices can enhance science education and benefit both teachers and students.

5.5 Recommendations

Based on the key findings of the study and conclusions drawn, the following recommendations are provided to improve the use of improvised instructional materials (IIM) among upper primary science teachers:

1. Upper primary science teachers in the Okaikwei North Municipality should continue to build on their existing knowledge and skills in improvising instructional materials. Teachers should actively seek out professional development opportunities, attend workshops, and access available resources to enhance their proficiency in creating and using improvised materials.
2. Teachers should take the initiative to explore and incorporate improvised instructional materials into their lessons. By understanding the educational benefits and practical uses of these materials, teachers can enhance student engagement and learning outcomes.
3. Teachers should collaborate with their peers to share successful strategies and experiences in using improvised instructional materials. Establishing platforms for exchanging ideas and materials can promote innovation and improve the

overall teaching experience. Celebrating creativity in the classroom will also motivate others to adopt similar approaches.

4. Teachers should acknowledge the challenges they face, such as time constraints, and find ways to manage these issues, such as setting aside time for material preparation. Additionally, collaborating with colleagues to share the workload or using existing networks to obtain materials can help overcome some of the challenges in using IIM effectively.
5. Teachers should work together to design and participate in collaborative learning programmes that enhance their knowledge of IIM while reinforcing positive perceptions about their use. Sharing best practices and learning from one another can lead to more effective teaching and better student outcomes.
6. Teachers should advocate for more structured time within their schedules to prepare instructional materials. They can also work with school authorities to secure the necessary resources and infrastructure, ensuring that they have adequate support to create and use improvised materials effectively.

5.6 Suggestions for Further Studies

There are several avenues for future studies that can further enrich our understanding of the use of improvised instructional materials (IIM) among upper primary science teachers and related areas. It is therefore suggested that future researchers:

1. Conduct longitudinal studies to track changes in teachers' knowledge, perceptions, and practices regarding IIM over an extended period. This would provide insights into the sustainability and long-term impact of interventions and training programmes.

2. Conduct in-depth qualitative studies, such as interviews or focus group discussions, to gain a deeper understanding of the experiences, motivations, and challenges faced by teachers when using IIM.
3. Explore innovative approaches and technologies for creating and using improvised instructional materials.

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APPENDIX A

QUESTIONNAIRE FOR TEACHERS

Dear Sir/Madam,

This questionnaire is designed to elicit information from teachers in order to find out upper primary science teachers' knowledge, perception and use of improvised instructional materials towards the implementation of the standard-based curriculum in the Okaikwei North Municipality. You have been selected because you are one of the teachers involved in the implementation of the standard-based curriculum at the upper primary level. If you answer the following questions as frankly and truly as possible, you will be contributing IIMensely towards the successful implementation of the standard based curriculum through the use of improvised instructional materials. Your name is not required, and any information you give will be treated as confidential. Thank you in anticipation of your co-operation.

Do you consent to voluntarily participating in this study? Yes [ ] No [ ]

SECTION A: DEMOGRAPHIC INFORMATION

Tick **(✓)** in one of the spaces provided to answer each question posed.

1. What is your gender?

A. Male [ ] B. Female [ ]

2. What is your age bracket?

   A. Below 30 years [ ] B. 41-50years [ ] C. 31-40years [ ] D. 51-60years [ ]

3. What is your highest academic qualification?

   A. Certificate [ ] B. Degree [ ] C. Diploma [ ] D. Masters [ ] E. Others[ ]

4. How many years have you been teaching?

   A. Below 5 years [ ] 6-10years [ ] 10-20 years [ ] Above 20 years [ ]

5. Have you ever used an improvised instructional material?

Yes [ ] No [ ]

6. Will you recommend the use of improvised instructional materials for colleague teachers?

Yes [ ] No [ ]

SECTION B: TEACHERS' KNOWLEDGE ON IMPROVISATION OF INSTRUCTIONAL MATERIALS.

Please indicate by ticking (√) your knowledge on improvisation of instructional materials in the implementation of the standard based curriculum. Indicate your response by selecting the correct response or filling in the space provided. **Please answer all the questions.**

1. There are _____types of improvisation of teaching and learning materials.

   A. 2

   B. 3

   C. 4

2. Using improvised instructional material in place of real or original materials is termed as_____

   A. Improvisation

   B. Substitution

   C. Construction

3. Flower extract (after conducting chemical analysis) acts as an indicator for _____

    A. Acid

    B. Base

    C. Acid and Base

4. Electric bulbs can be used for measuring any_____

    A. known liquid

    B. unknown liquid

    C. liquid

5. Plastic bottle open at base can be used for transferring liquid.

    A. True

    B. False

    C. Uncertain

6. Stripped cardboard is an improvised material for D.N.A model

    A. True

    B. False

    C. Uncertain

7. Developing improvised materials to operate just as the original one to perform the same function as the original one is called_____

8. Graduated feeding bottle is an improvised material for measuring cylinder

    A. True

    B. False

    C. Uncertain

9. Kerosene stove is an improvised material for Bunsen burner.

    A. True

B. False

C. Uncertain

10. Unused stove frame can be used as_____

11. Funnel Plastic bottle open at base is an improvised material for funnel

A. True

B. False

C. Uncertain

12. Cloths hanger (peg) is an improvised instructional material for Test-tube holder.

A. True

B. False

C. Uncertain

13. Using clean cloth in place of filter paper is a form of improvisation by _____

14. Syringe, straw, rubber balloon, transparent bottle, white electronic pack, syringe can be substituted for diffusion chamber.

A. True

B. False

C. Uncertain

15. Using beam balance in place of the original one is an example of improvisation by _____

A. Innovation

B. Substitution

C. Construction

SECTION C: PERCEPTION OF TEACHERS IN THE USE OF IMPROVISED MATERIALS

Please respond to all items given below by putting a tick [ ] in the appropriate space using the following scale: 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Uncertain (U), 2 = Disagree (D), and1 = Strongly Disagree (SD). Please indicate your respond to each of the following statements by ticking **(√)** the number that represents your level of agreement or disagreement on the perception indicators Thank you for your cooperation.

SN	**Statement**	**SA**	**A**	**U**	**D**	**SD**
17	I use improvised material because they have practical and physical links between science and theory					
18	Improvisation eradicate the menace of lack of or inadequate instructional materials for science					
19	Improvisation sensitize both students and teachers that alternatives for some of the conventional science teaching materials are possible.					
20	I am able to achieve the set out educational objectives through the use of improvised instructional materials in teaching.					
21	My student learns to handle tools through the development of manipulative skills					
22	I made improvised science equipment which are not readily replaceable					
23	I improvised materials because it enables students					

	to be involved in practical activity
24	I use improvised materials in place of dangerous/sophisticated /unavailable equipment
25	I use improvised materials to develop an appreciation for discarded scrap or materials
26	I use improvised materials to makes science learning interesting
27	The use of improvised materials makes me more resourceful
28	Improvisation have practical and physical links between science and theory

SECTION D: CHALLENGES OF USING IMPROVISED INSTRUCTIONAL MATERIAL

Please respond to all items given below by putting a tick [ ] in the appropriate space using the following scale: 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Uncertain (U), 2 = Disagree (D), and1 = Strongly Disagree (SD). Please indicate your respond to each of the following statements by ticking **(**√**)** the number that represents your level of agreement or disagreement to the challenges teachers face in the use of improvised instructional materials. Thank you for your cooperation

SN	**Statement**	**SA**	**A**	**U**	**D**	**SD**
29	Lack of exposure and knowledge on improvisation.					
30	Time constraint					
31	Lack of support from authority,					
32	Lack of skills and strategies on improvisation,					
33	Financial constraints					
34	Students negative perception towards the use of improvised instructional materials					
35	Inappropriateness of Instructional resources					
36	Large class size					
37	Lack of motivations to deserving teachers					
38	Lack of sensitization on the importance of improvisation of teaching materials					
39	Lack of storage facilities for the improvised materials in order to maximize usage within their life span.					

APPENDIX B

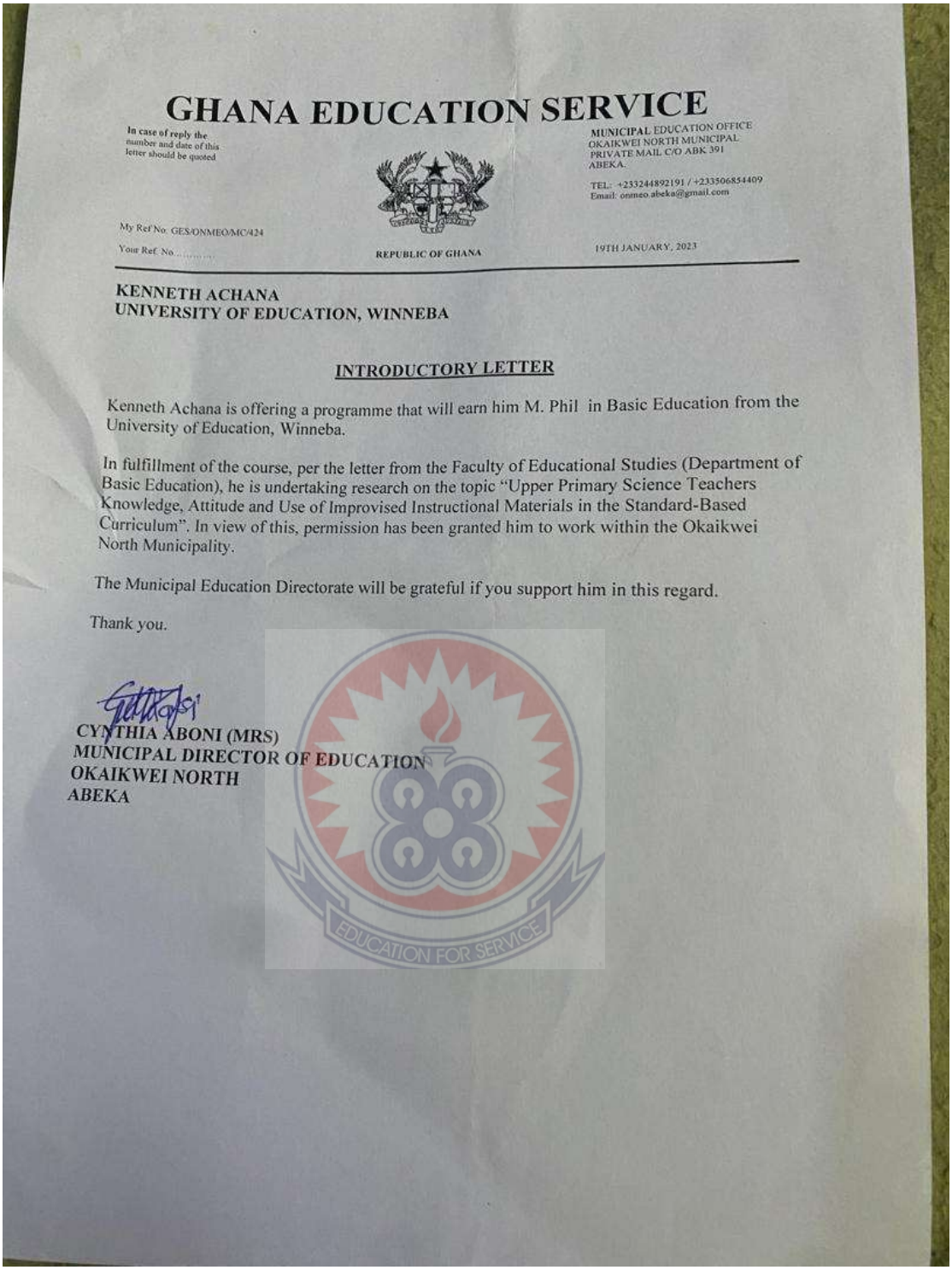
SEMI-STRUCTURED INTERVIEW GUIDE

This semi-structured interview guide is intended to investigate upper primary science teachers' knowledge, perception and use of improvised instructional materials toward the implementation of the standard-based curriculum in the Okaikwei North Municipality.

The information gathered will be used for academic research purposes only. You are requested to provide answers that correspond to each question as frankly as you can. This exercise shall take about 30 minutes. Thank you for taking time off to contribute to this study.

INTERVIEW QUESTIONS ON HOW TEACHERS USE IMPROVISED INSTRUCTIONAL MATERIALS

1. What is your perception about the use of improvised materials for teaching and learning integrated Science?
2. Why do you think it is important to for teachers to improvised materials for teaching and learning of Integrated Science?
3. How knowledgeable are you in the use of improvised instructional materials?
4. What are some improvised instructional materials you recently used?
5. Do you think the use of improvised instructional materials promotes effective learning? Explain how?
6. How do you use improvised instructional materials for teaching and learning of Integrated Science?
7. How effective are improvised instructional materials on students learning?



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In case of reply the number and date of this letter should be quoted

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Email: onmeo.abeka@gmail.com

My Ref No. GES/ONMEO/MC/424

Your Ref. No .....

REPUBLIC OF GHANA

19TH JANUARY, 2023

KENNETH ACHANA
UNIVERSITY OF EDUCATION, WINNEBA

INTRODUCTORY LETTER

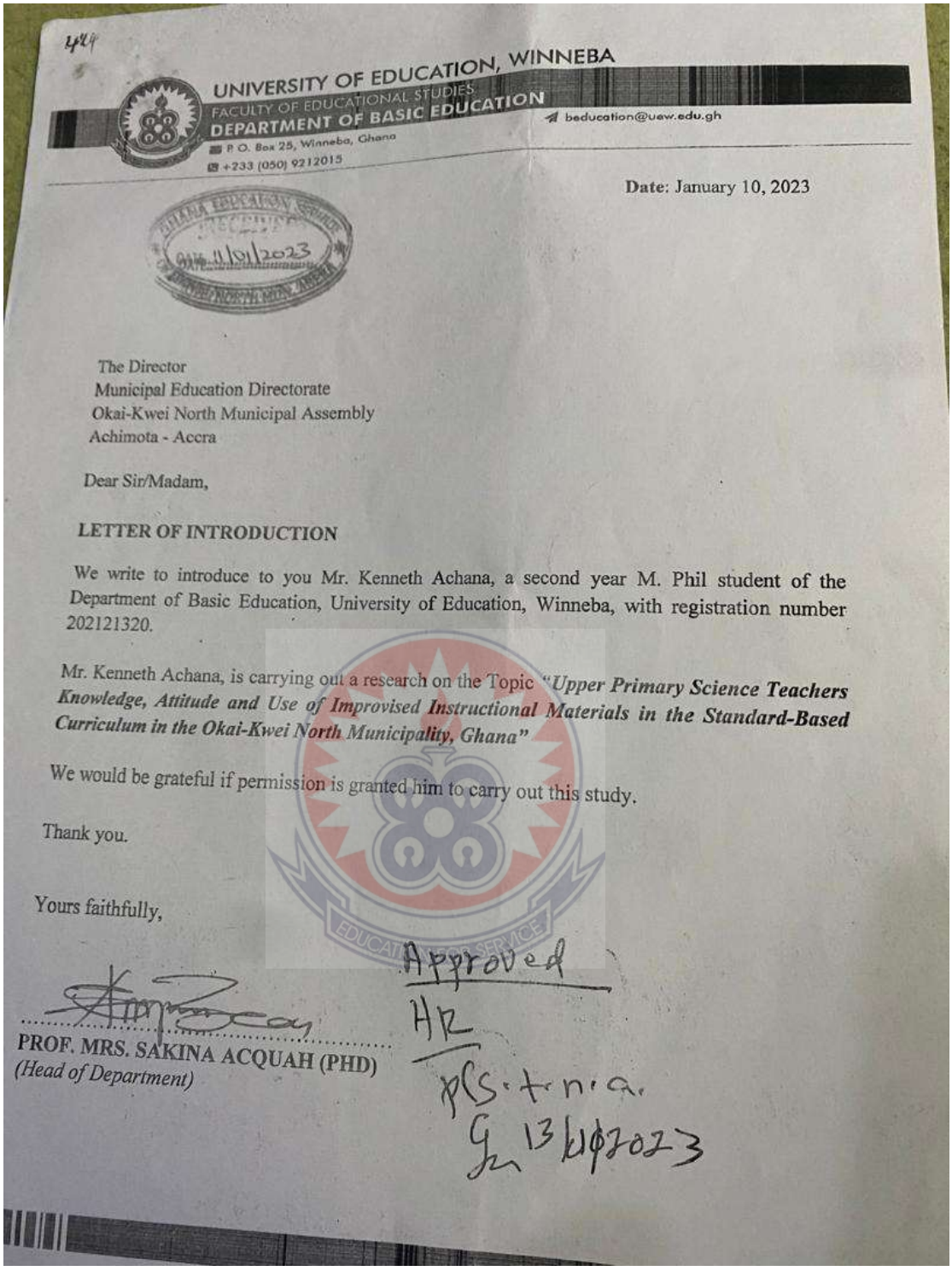
Kenneth Achana is offering a programme that will earn him M. Phil in Basic Education from the University of Education, Winneba.

In fulfillment of the course, per the letter from the Faculty of Educational Studies (Department of Basic Education), he is undertaking research on the topic "Upper Primary Science Teachers Knowledge, Attitude and Use of Improvised Instructional Materials in the Standard-Based Curriculum". In view of this, permission has been granted him to work within the Okaikwei North Municipality.

The Municipal Education Directorate will be grateful if you support him in this regard.

Thank you.

CYNTHIA ABONI (MRS)
MUNICIPAL DIRECTOR OF EDUCATION
OKAIKWEI NORTH
ABEKA



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Date: January 10, 2023

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RECEIVED
11/01/2023
OKAI-KWEI NORTH MUN. ASSEMBLY

The Director
Municipal Education Directorate
Okai-Kwei North Municipal Assembly
Achimota - Accra

Dear Sir/Madam,

LETTER OF INTRODUCTION

We write to introduce to you Mr. Kenneth Achana, a second year M. Phil student of the Department of Basic Education, University of Education, Winneba, with registration number 202121320.

Mr. Kenneth Achana, is carrying out a research on the Topic "***Upper Primary Science Teachers Knowledge, Attitude and Use of Improvised Instructional Materials in the Standard-Based Curriculum in the Okai-Kwei North Municipality, Ghana***"

We would be grateful if permission is granted him to carry out this study.

Thank you.

Yours faithfully,

Approved
HR
pp S.t.n.a.
13/1/2023

PROF. MRS. SAKINA ACQUAH (PHD)
(Head of Department)