

**A STUDIO EXPLORATION OF MAIZE HUSK AS A MATERIAL FOR
TEACHING AND LEARNING AIDS TO PUPILS OF UPPER PRIMARY**

A Case Study of Purongo Hill P.7 School, Nwoya District

OLANGO Patrick

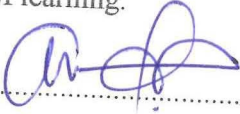
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DECLARATION

This thesis is my original work and has never been presented for a degree in any other institution of learning.

Signed: 


OLANGO Patrick

(16/U/13537/GMID/PE)

Date: *9th, 02, 2022*

APPROVAL

We confirm that the work was done by the candidate under our supervision.

Signed.....

Mr. KIMANI MUTURI

(Principal supervisor)

Date.....*9th February 2022*

Signed.....

Mr. MUJJUZI HENRY

(Second supervisor)

Date.....*9th February, 2022*

DEDICATION

I dedicate this study to my children; Happy Israel Olango, Celine Harmony Olango, Lenny Vallette Olango, and my wife Nalukenge Noeline for the spiritual and moral support given to me during the completion of this course.

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LIST OF ACRONYMS

CIA	Central Intelligence Agency
GPE	Global Partnership for Education
ICT	Information and communications technology
MoES	Ministry of Education and Sports
SDGs	Sustainable Development Goals
UIRI	Uganda Industrial Research Institute
PTA	Parent Teacher`s Association
UNEB	Uganda National Examinations Board
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children`s Emergency Fund
UPE	Universal Primary Education
USAID	The United States Agency for International Development
USGS	United States Geological Survey
WASC	Western Association of Schools and Colleges.

ABSTRACT

The study was carried out under the title, “*A studio exploration of maize husk as material for teaching and learning aids to upper primary.*” The study carried out a studio exploration of maize husk to find out the possibility of turning it into teaching and learning aids for upper primary pupils. The objectives of the study were determined by the challenges that teachers in Purongo Hill P.7 school, Nwoya district face in accessing teaching and learning aids. A case study design was employed where a qualitative approach of data collection and analysis was adopted to collect data from head teacher, deputy head teacher, teachers, Parent Teacher’s Association (PTA) chairpersons, and 88 pupils using interview guides, observation, and photography. A studio exploration was used to analyse the data through sketches and prototypes. The study found out why a majority of the teaching and learning aids are not made from local materials such as maize husk for primary schools, which led to the production of teaching and learning aids from maize husk for upper primary pupils in Purongo Hill P.7 school. The Literature reviewed was sourced widely from the articles, books, Journals. The study selected 20 participants who were selected purposively and included; school’s staff, pupils, and technicians. The study found that most teachers were facing financial problems to access commercial-based teaching and learning aids, lack of awareness and motivation of preparing them among teachers. The reasons why teaching and learning aid are not made from local materials included lack of funds in primary schools. Very little support was received from local governments and communities. The study concluded that it was possible to make soft boards, papers, and blackboards using maize husk using local means.

CHAPTER ONE

INTRODUCTION

1.0. Overview

This chapter presents the background of the study, the statement of the problem, the purpose of the study, the objectives, the research questions, the significance of the study, the scope of the study, the limitation, and definitions of key terms.

1.1. Background to the study

The motivation behind this project was that some teachers lack the essential skills to make quality teaching and learning aids. According to a Bartleby.com (n.d) and Mupa & Chinooneka (2015), some schools completely lack material resources such as textbooks, charts, writing boards, exercise books. The lack of adequate materials most especially in rural areas needs to be addressed. For the government to support educational reform that boost pupil performance, the government would need to create a venture to provide sufficient teaching and learning aids (UNESCO, 2019). Thus, equipping teachers with relevant skills to produce teaching and learning aids is one step closer to better learners' performance (Meiers, 2007).

Globally, the educational sector is growing at a rapid pace as a consequence of the increased population. Mphahlele (1986) states that the current rate of world population growth is one of today's major problems and constitutes a threat to the future of all mankind. In 2011 Ugandan population was growing to 30.6 million with a rapid population growth rate of 3.6 percent according to studies made by the USGS and USAID (2012) in CIA (2011). Many private schools were established by the communities under acknowledgment from the government. There is a need to reduce poverty through promoting education as observed by GPE Secretariats (2016). The informative global demand has raised the need for educational teaching and learning aids such as papers, books, writing boards, notice boards, among others

which are some of the essential products for both beginners and learners at a higher level, in most developing countries in sub-Saharan Africa.

In sub-Saharan African countries, the availability of resources in a school significantly determines the teaching methods used by teachers (Musaazi, 1982). In situations where materials such as books, pens, chalk are lacking, teacher-centered methods of delivery tend to dominate (UNESCO, 2019). Besides, where the materials are available, well-qualified and motivated teachers will skillfully use the available resources to engage learners in practical activities that allow the learners to experiment, solve problems, discuss with each other, thereby stimulating curiosity, critical thinking, and innovativeness (Nold, 2017; Smith et al. 2009).

Teaching and learning materials are considered important in teaching and learning in all levels of education because textbooks and other resource materials are basic tools. Absence or inadequacy makes teachers handle subjects abstractly, portraying them as dry and non-exciting (Eshiwani, 1984). For example, textbooks, charts, maps, audio-visual, and writing boards contribute much to making learning more interesting (Shabiralyani et al, 2015). The importance of these materials is also evident in the performance of pupils (Sephania et al, 2017). Even though education was free, many parents could not afford to buy the school requirements and books for their children, hence resulting in poor performance of children leading to high levels of school dropouts.

The government of Uganda considers education a basic human right. Participating in education is also viewed as part of the solution to reducing poverty. The government is dedicated to providing equitable access to quality and affordable education to all Ugandans. However, the quality of education in Uganda's government-aided secondary schools does not meet the expectations of the public (MoES, 2015). Teachers in most schools in Uganda lack the

necessary resources to teach effectively; where the resources are available, the teachers hardly make proper use of these resources (MoES, 2015; [UNEB], 2015).

In Nwoya District, schools whose teachers use more resources perform better than schools with teachers who do not use materials (MoES, 2018). Schools at all levels of education have been advised by the Ministry of Education and Sports to have quality and adequate facilities to raise the academic performance of their pupils. However, in most rural schools especially the government-aided schools, there is an outcry of limited teaching aids. Therefore, the need to improve the educational system in the rural area of Uganda requires using local material such as maize husk to produce teaching and learning aids. This is intended to make teaching and learning aids such as blackboards, mats, soft boards, and paper affordable for all learners in rural areas.

1.2 Statement of the problem

Teaching and learning become easier for the learner when teaching aids are used to demonstrate the subject matter. Whereas the use of teaching and learning aids is promoted among schools in Uganda, in Purongo Hills P.7 School in Nwoya District there is scarcity of teaching and learning aids. In Purongo Hills P.7 School, most of the lessons are conducted without using any aid. Teachers write some examples on the chalkboards but these are usually rubbed when another comes in. Consequently, learners do not understand the content taught because they do not have any practical examples to refer to. The practice of teaching and learning without aids has affected the standards of education in Purongo Hills P.7 School and even the entire district of Nwoya. School administrations argue that teaching and learning aids are expensive and schools cannot afford to acquire them. More so they argue that parents are poor and cannot contribute to the purchase of teaching and learning aids. If this practice of teaching without aids continues, the standards in Nwoya district will continue to decrease. In the long run, the

Sustainable Development Goals (SDGs) especially Goal 4 of ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all will not be achieved.

Basing on the background,

1.4 Purpose of the study

The purpose of the study was to explore maize husk as an affordable source of raw materials for producing teaching and learning aids for upper primary pupils in Purongo Hill P.7 School, Nwoya District.

1.5 Specific objectives

The study was guided by the following objectives:

1. To determine the challenges that teachers in Purongo Hills P.7 School, Nwoya district face in accessing teaching and learning aids.
2. To find out why the majority of the teaching and learning aids for primary schools were not made from local materials such as maize husk.
3. To produce teaching and learning aids from maize husk for upper primary specifically for Purongo Hill P.7 School.

1.6 Study guide questions

1. What are the challenges that teachers in Purongo Hills P.7 School, Nwoya District face in accessing teaching and learning aids?
2. Why are the majority of the teaching and learning aids not made from local materials such as maize husk for primary schools?
3. How are teaching and learning aids produced from maize husk for upper primary specifically for Purongo Hill P.7 School?

1.7 Scope of the Study

The scope of the study covered the geographical, content, and time scope.

1.7.1 Geographical scope

The study was conducted in Purongo Hill P.7 School, Purongo sub-county Nwoya District. Purongo Hill P.7 school is located in Northern Uganda, 252km from Kampala's capital city, along the Kampala-Arua highway (Figure 1). The school was chosen because it has limited access to teaching and learning aids yet has a high enrolment in the areas.

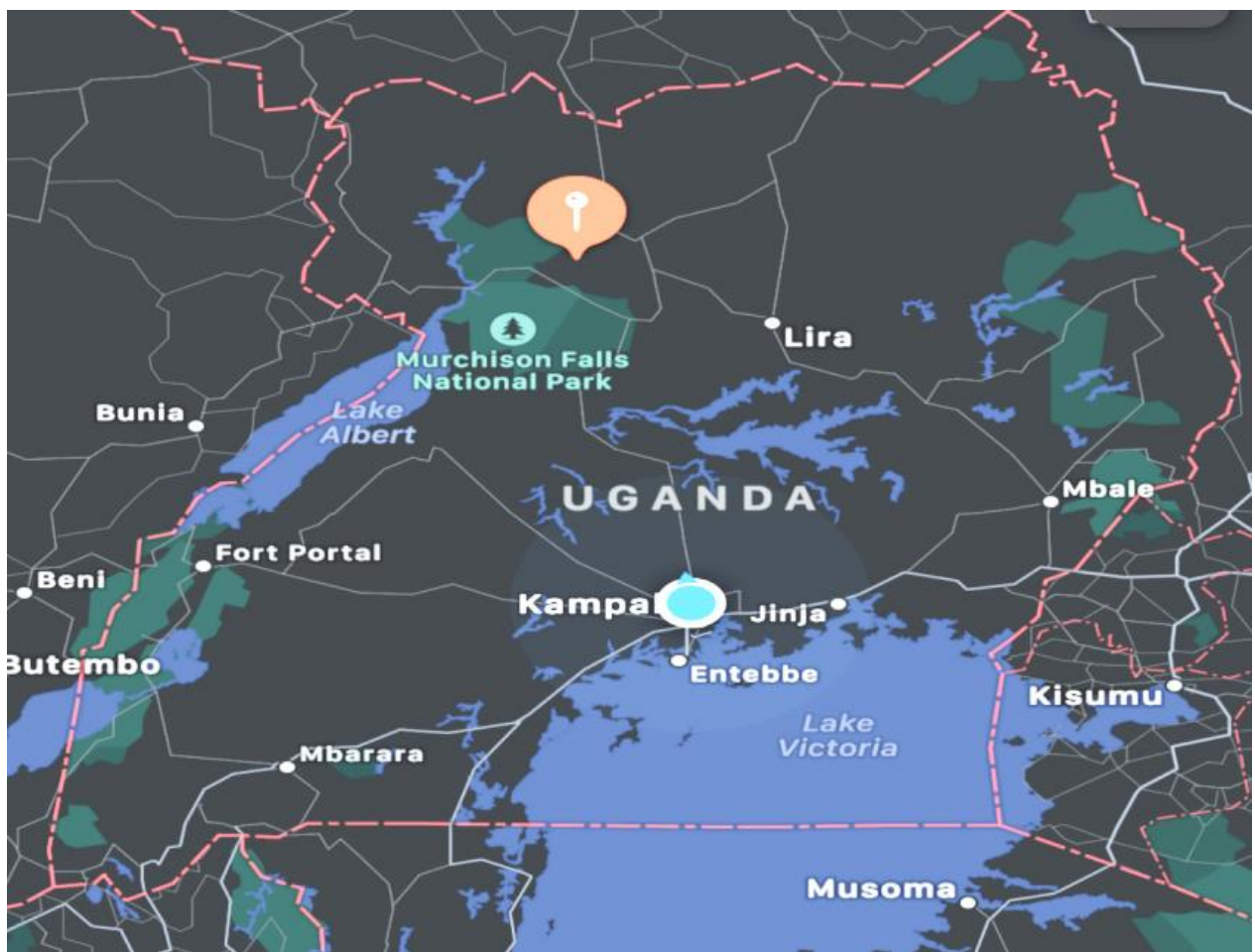


Figure 1: A map showing the direction of Purongo Hills P.7 school in northern Uganda, Nwoya district. Source: google maps

1.7.2 Content scope

The study carried out a studio exploration of maize husk as material for teaching and learning aids to upper primary pupils and produced selected teaching and learning aids using maize husk for rural schools. The study was guided by the following objectives as presented below:

In the first objective, the study sought to determine the challenges that teachers in Purongo Hills P.7 School, Nwoya District face in accessing teaching and learning aids. Secondly, the study sought to find out why the majority of the teaching and learning aids are not made from local materials such as maize husk for primary schools. While the third objective sought to produce teaching and learning aids from maize husk for upper primary specifically for Purongo Hill P.7 School. Maize husks were chosen because they could be used for making various teaching and learning aids. The study considered the important elements and content in both dry and fresh maize husk. Both dry and fresh maize husk can absorb and lose water from their surroundings naturally depending on the atmosphere. Maize husk has starch which contains glucose molecules which help to bond together to form bigger molecules known as polysaccharide this help to bind Pulps to form paper, boards and Pulps are broken expanded fibre when exposed to dry water is lost by dripping in mass quantity and evaporation inform of vapor when molded on mould and a sheet of paper is formed.

1.7.3 Time scope

The study was conducted for a period of eight months from August 2020 to May 2021. This was the allowed time to conduct the project on the study program.

1.8 Significance of the study

The study intended to carry out a studio exploration of maize husk as material for teaching and learning aids to upper primary pupils and produced selected teaching and learning aids using

maize husk for rural schools. The knowledge obtained will help the government specifically, local government, and educators to reflect and make an evaluation on the requirements of other teaching and learning materials apart from classrooms alone. The government and local communities have put more emphasis on the construction of new classrooms. However, the provision of quality education requires more than just classrooms. The evaluation of teaching and learning materials, along with other reform movements, allows educators and planners to plan for an appropriate environment for teaching and learning to provide quality primary school education

Primary school teachers will get relevant information about how to make teaching and learning aids such as writing boards, notice boards, soft-boards paper, and books from maize husk to the academicians.

The findings will add information to the existing literature for the scholars. The completed practical research will provide the baseline for other researchers and will provide new platforms of using maize husk for the production of teaching and learning aids as a solution to the insufficient teaching and learning aids.

The government of Uganda can adopt the methods and procedures used in the production of the teaching and learning aids in this project to produce aids for schools around Uganda.

1.9 Limitation

The study experienced some limitations such as financial constraints to buy stationery, type, and print out the report. However, the researcher tried as much as possible to work within the limits of scarce financial resources.

Time for the research was short since it was done within a stipulated period yet some respondents took their time to respond. I planned ahead of time how to reach the distant school.

The researcher faced the challenge of bad weather. I went to the field during the rain period and it was difficult to collect data. To minimize this, I focused on doing other work which was not being affected by the weather such as the studio work.

1.10 Definition of operational terms

1. **Maize husk:** includes the protective outer covering of maize
2. **Teaching:** can be defined as engagement with learners to enable their understanding and application of knowledge, concepts, and processes. It includes design, content selection, delivery, assessment, and reflection.
3. **Learning:** is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences.
4. **Teaching and learning aid:** are materials that teachers use in the classroom to help children understand better.
5. **Pupils:** is one under the close supervision of a teacher, either because of youth or of specialization in some branch of study: a grade-school pupil.
6. **Material:** is a generic term used to describe the resources teachers use to deliver instruction.
7. **Studio:** a room where an artist, photographer, sculptor, etc. works.
8. **Exploration** is the act of searching for the discovery of information or resources.
9. **Primary:** is typically the first stage of formal education, coming after preschool and before secondary school
10. **Resources:** are used in a learning environment to help and assist with people's development and learning.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This chapter contains information related to the research and presented according to the objectives of the study. The study was guided by the following objectives: to determine the challenges that teachers in Purongo Hills P.7 School, Nwoya District face in accessing teaching and learning aids, to find out why the majority of the teaching and learning aids are not made from local materials such as maize husk for primary schools, and to produce teaching and learning aids from maize husk for upper primary class specifically for Purongo Hill P.7 School.

2.2. Theoretical Framework

2.2.1 Sociocultural Theory of Teaching, Learning, and Development

The sociocultural theory of teaching, learning, and development is the theory that framed this study. Largely inspired by the seminal works of Lev Vygotsky, this theory assumes that human minds do not develop by some predetermined cognitive structures that unfold as one matures. Rather, this theory argues that human minds develop as a result of constant interactions with the social material world.

Vygotsky (1934), stated that the human mind develops through interaction with materials in the learning process where individuals learn from one another, and use the similar experiences to successfully make sense of the materials that they interact with. Using this theory, learners have to master such tools to develop specific knowledge such as making teaching and learning materials like mat, blackboard, and skills in solving specific problems, and in the process become competent in a specific profession. In this study, these tools can be a picture, a model, or a pattern of solving a problem. Most often, however, such tools are combinations of elements of different orders, and human language is the multi-level tool par excellence, combining

culturally evolved arrangements of meanings, sounds, melody, rules of communication, and so forth.

Learning by using such tools is not something that simply helps the mind to develop. Rather, this kind of learning leads to new, more elaborated forms of mental functioning. For example, when learners master such a complex cultural tool as human language, this results not only in their ability to talk but leads to completely new levels of thinking, self-regulation, and mentality in general. It is the specific organization of this tool that calls into being and in effect shapes and forms new facets of the child's mind. Importantly, cultural tools are not merely static 'things' but embodiments of certain ways of acting in human communities. In other words, they represent the functions and meanings of things, as discovered in cultural practices: they are "objects-that-can-be used-for-certain-purposes" in human societies. As such, they can be appropriated by a child only through acting upon and with them, that is, only in the course of actively reconstructing their meaning and function. And such reconstruction of cultural tools is initially possible only in the process of cooperating and interacting with other people who already possess the knowledge of a given cultural tool.

This theory applies to this study in a way that teaching and learning materials lead to cognitive development because they mediate learners' thinking through the tools, and such mediation constitutes the very cornerstone of material development.

2.3. Challenges that teachers face in accessing teaching and learning aids

According to Uwazi (2010), worldwide teachers in primary schools most especially in rural community schools face some challenges in accessing teaching and learning aids. One of the big challenges that teachers in primary school's face in accessing teaching and learning aids is little funds provided by the government to primary schools for purchasing teaching and learning aids (Mtasigazya, 2020). Very little support is received from local government and

communities around the schools most especially in rural areas due to poverty (Dangalo, 2019). 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 teaching and learning material is found at the 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 (Mtasigazya, 2020).

A study done by Solan argues for a school to have a good performance, it must be well equipped with relevant and adequate textbooks and other teaching and learning resources. In Sub-sahara Africa, teachers in primary schools most especially in rural community schools face some challenges in accessing teaching and learning aids (Solan, 2018). One of the big challenges that teachers in primary schools face in accessing teaching and learning aids is the little funds provided by the government to primary schools for purchasing teaching and learning aids (Aslam et al, 2019 & Venda, 2018).

In East African countries especially, Tanzania, teachers lack exposure and limited accessibility to modern instructional facilities (Wankui, 2017). Most primary schools especially in rural areas do not have access to information communication technology (ICT) which could alleviate the shortage of teaching and learning aids (Olam, 2017). As we are in a new millennium, there is an increased awareness of the need to use a modern scientific approach in teaching and learning processes in our schools (Ddumba, 2016).

Another challenge that teachers face in accessing teaching and learning aids is the lack of clear policy and monitoring mechanisms to ensure that enough funds are provided to community secondary schools for purchasing teaching and learning aids and also these funds are used for the intended purpose (Okia, 2017). As Onche (2014) comments, the government's policy towards the 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 backbench of the implication of these policies.

2.4 Teaching and learning aids used in rural schools

According to Shabiralyani et al (2015), teaching and learning aids as the name suggests, are materials of visual, and audiovisual category that helps to make concepts abstracts and ideas concrete in the teaching/learning process. They are also materials which the teacher uses in supplementing his teachings (Marple et al, 2017). Teaching and learning aids include materials used to facilitate learning for better results (Kamuka, 2018). Gbamanja (2015) described teaching and learning aid as any devices with instructional content or function that is used for teaching. To Sudhakar (2017), teaching and learning aid is resource material that helps to facilitate teaching and learning. In most countries across the globe, the use of teaching and learning aids does not only encourage teachers and pupils to work collaboratively but also results in more cooperative learning activities among the pupils (Shabiralyani et al, 2015).

A study by Yeboah et al (2016) in Western African argues that when the learners are given the chance to learn through more senses than one, they can learn faster and easier. The use of teaching and learning aid provides the teacher with interesting and compelling platforms for conveying information since they motivate learners to learn more (Sephania et al, 2017). Teaching and learning aid is a channel of communication through which information passes for usage in the educational situation (Gombe, 2017).

The incompetence of a teacher to improvise teaching and learning aids has been said to be one of the factors responsible for the poor performance of learners (Desh, 2018). Teacher's competency is an underlying characteristic of an individual that is usually related to effective or superior performance (Wing Institute, 2021). These characteristics include enduring

motives, traits, self-concepts, values, knowledge, and skills that can be assessed and differentiated.

To be precise, a teacher's competency is an appropriate prior knowledge, skills, attitudes, and abilities in a given context that adjust and develop with time and needs to effectively and efficiently accomplish a task and that is a measure against a minimum standard (Hendrick, 2014). To be competent is the juxtaposition of knowledge and the application of that knowledge in teaching practice. In another word, a competent individual is the one who effectively and efficiently accomplishes a task. A competent teacher selects, modifies, and uses a wide range of teaching and learning aid (printed, visual and audio-visual) appropriate to the content area and the reading needs and level of each pupil (NTA NET, 2019). Effective teachers are equipped with a repertoire of best teaching practices such as strategies, procedures, and approaches in presenting, implementing, and assessing classroom instruction following the objectives set (Victor, 2017; Londy, 2015; Giana; 2016). They are imbued with values, attitudes, and dispositions that foster a classroom atmosphere of mutual trust for individual characteristics, especially pupil's needs, interests, and abilities (Corpuz & Salandanan 2015).

Poor salary is also another challenge that teachers face in East African countries especially, Tanzania (Lyimo, 2014). Teachers like most civil servants in Tanzania are poorly paid. This becomes a hindrance for them to purchase their teaching materials or acquisition of new ideas, skills, and knowledge by failure in enrolling for further educational programs 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 instructional materials.

When young people engage in art-making, they explore a variety of disciplines and are learning at multiple levels, including learning about the larger group or classroom community as well as their place in it (Peppler, 2010). Arts experiences frequently involve more than one learner. The performing arts, in particular, are steeped in this tradition as actors find their place in the production, musicians learn about their part in the orchestral work, visual artists work on large murals together, and dancers in their role in the dance. Preliminary observations indicate that the arts can create more equitable learning opportunities for at-risk youth (Catterall et al, 2012 and Peppler, 2010). Additionally, it would be interesting to explore whether the arts can serve as a training ground for learning to be part of a group outside of the arts and the conditions for such group learning to occur.

Kerr (2003), states that it is important for teachers to reach all learners in a classroom. Using aids such as graphs, charts, flashcards, videos, provides learners with visual stimulation and the opportunity to access the content from a different vantage point. This allows each learner to interact with the content in a way that allows them to comprehend more easily.

Teaching aids help to make the learning environment interesting and engaging. As we move toward a more digital society, children are being exposed to technology and digital devices at a younger age. Video games and iPods are now what's exciting to pupils, so when they come to school, they have little patience for lecture-style teaching. Pupils are seeking constant excitement and simply have no tolerance for boredom. Teaching aids are improving the quality of education in today's schools while also providing pupils with the sense of excitement they desire (Sudhakar, 2017). Teaching aids are becoming the norm in the classroom. As traditional classrooms with blackboards and chalk become a thing of the past, and smart classrooms become the norm, teaching aids are growing in popularity and advancement.

As Russell-Bowie (2009) argues that the arts can embody and communicate emotions, ideas, beliefs and values, and meanings through aesthetic forms and symbols that evoke emotive responses to life, with or without words. The key to effective education in Creative Arts is the expertise to guide children to communicate through abstract symbols and to decipher the communications of others (Alter et al., 2009). Creative Arts is a significant aspect of learning that is essential to the development of the emotional, material, spiritual and intellectual lives of the child (Kindler, 2008). As Cambridge International (n.d) have explained, creativity can be encouraged through pupils doing various creative exercises that make them think and generate creative ideas in different ways. Although this may not turn pupils into artists, the strategy can help to shape their creative development as they learn the skills required for solving problems, they may encounter in future endeavors.

UNICEF (2018) believes that children's artistic development can be facilitated through structured guided activities with much direction and inputs from the teacher. Ensuring this requires a supply of specialist teachers whose training makes it easy for them to provide the skills, knowledge, and attitudes designed for the syllabus to achieve. Effective education in Creative Arts, therefore, demands teachers who can formulate worthwhile objectives, select appropriate content, use relevant teaching and learning resources, design appropriate teaching and learning activities to address the identified problems, and make appropriate provisions for evaluating the teaching-learning process (University Exeter, 2021 and Little et al, 2009). Unfortunately, more generalist teachers teach Creative Arts than specialist teachers (Alter et al, 2009).

2.5 Production of selected teaching and learning aids from waste plant materials.

Daly, Hamrick, Gereffi, and Guinn (2016) observed that in 2013 Uganda jumped from 1.3 million to 2.7 million tonnes, the same period Uganda solidify its places Africa's three largest

exporters of both maize and maize flour, hence this suggests the prove to extract of maize husk for production of teaching and learning aids.

Fiscal and Dandan (2016), observe that 4 million and equivalent of 35% of trees are cleared annually as raw in the production of scholastic related material leading to heavy depletion of earth's natural resources to meet the growing demand of accelerating population which has led to growth in so many schools both privates and publics who required teaching and learning aids like a blackboard, papers, and others to meet the growing development and school necessity. And many researchers across the world are coming up with and recommending an environmentally friendly product from various waste materials such as plantain, rice husk, coconut husk, maize husk to address a social problem in the community like teaching and learning aids in rural schools.

2.6 Suitability of teaching and learning aids produced out of waste plant products.

A study by Ogbaji (2017) in Moronfolo (1982) investigated the effect of teaching and learning resources on the academic achievements of pupils in Ogun State. Five secondary schools in Abeokuta were used for his study. Questionnaires were designed to elicit responses on instructional materials that were available for the teaching and learning of each of the three school subjects he examined. He collected WASC examination results for five years and compared the achievements of pupils in schools with adequate material resources and the achievements of learners in schools with inadequate material resources. He found a significant difference in the achievements of the two sets of pupils.

In the same vein, Aribu and Dr Nordin (2009) also observed the capacity and suitability of maize husk for the production of Paper. Maize husk is the outer shell of maize fruits, it constitutes almost 30 percent of the total maize fruit obtained during harvest and post-harvest.

Harvest maize the husk is thrown away as a waste though an attempt has been made to utilize maize husk in the production a lot is still regenerated as waste (Aremu *et al.*, 2015)

There is no written documentation to show that a learner of Purongo Hill P.7 school has nowhere to write in form of books, writing boards, and papers and no available statistic reveals that it is among the biggest problem in our educational sector especially in the government schools under universal primary education (UPE) program, however, this does not mean that this problem does not exist, Uganda's main Policy designed for achieving poverty reduction and human development as observed by African Development Bank, African Union Commission, Asian Development Bank, Inter-American Development Bank, New Partnership for Africa's Development and United Nations Economic Commission for Africa (2006). The absence of scholastics materials like books, papers, slats, and as a result lower pupil interest for education hence school dropout, and this is highly examinable in the rural primary schools.

In the same manner, Ogbaji (2017) in Moronfolo (1982) researched the Ilorin local government of Kwara State. She also used questionnaires to tap information on the teaching and learning aids available for the teaching of ten subjects in ten secondary schools. She collected WASC examination results for the past five years and related these to pupils' achievements in each of the ten subjects and the number of resources available for the teaching of the subjects. She also reported a significant effect of teaching resources on the academic achievements of pupils in each of the subjects.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview

This chapter presents the research design, area of the study, the study population, sample and sample size, techniques, instruments and data collection, validity and reliability, and ethical consideration. The purpose of the study was to explore maize husk for teaching and learning aids to upper primary pupils. The study was guided by the following objectives: to determine the challenges that teachers in Purongo Hill P.7 School, Nwoya District face in accessing teaching and learning aids, to find out why the majority of the teaching and learning aids are not made from local materials such as maize husk for primary schools, and to produce teaching and learning aids from maize husk for upper primary specifically for Purongo Hill P.7 School.

3.2 Research design

A case study was used where a qualitative approach of data collection and analysis was adopted. A case study is an intensive investigation of the complex factor that contributes to the individuality of a social component. It emphasizes detailed contextual analysis of a limited number of events or conditions and their relationships, adding that the findings of case studies can be generalized to represent other cases in a population of interest (Mugenda, 1999). The research design involved the inquiry process of understanding the nature of using maize husk as teaching and learning aids were through interviews, photography, and observation. The research design was engaged to generate studio methods, techniques, and ideas for visual expressions of maize husk as teaching and learning aids.

3.3. Sample

3.3.1 Study area

The study was carried out in Purongo Hills P.7 School. The school is located in Pawatomero Parish, Purongo Sub-County, Nwoya District of Uganda. Nwoya District is bordered by Amuru

District to the north, Gulu District to the north-east, Oyam District to the east, Kiryandongo District to the south-east, Masindi District to the south, and Buliisa District to the south-west. Nwoya, the main political, administrative and commercial centre in the district, is approximately 44 kilometres (27 miles), by road, southwest of the city of Gulu, the largest metropolitan area in the sub-region. This location is approximately 330 kilometres (210 miles), by road, north of the city of Kampala, Uganda's capital and largest metropolitan area.

3.3.2 Study population

According to Mugenda et al (1999), a study population is the entire set of individuals, events, or objects having a common observable characteristic about which generalization of research findings will be made. The population for the study consisted of Upper primary pupils, teachers, and administration of Purongo Hill P.7 School, in Purongo Sub County, Pawatomero Parish, Nwoya District. There are 66 Primary Schools in Nwoya District, out of which one school was randomly selected for the study.

The pupils were chosen because of their knowledge and the use of teaching and aids during the learning process, teachers were selected because of their expertise in the different areas of teaching and learning aids. The administrators who included head teacher and deputy head teacher were selected because they had enough information regarding the school especially, the matters of teaching and learning.

3.3.3. Sampling strategy

Simple random sampling and purposive sampling were used in this study to ensure proper representation of the target population. Purposive sampling is a method that entails selected respondents strategically so that those sampled are relevant to the research questions being posed. This approach was used when selecting Purongo Hill P.7 School and the school

administrators. Simple random sampling was used when selecting teachers and Pupils. This method gave participants an equal opportunity of being selected.

3.3.4 Sample size

The sample size of the study included 101 respondents. They included one (1) head teacher, (1) deputy head teacher, (7) teachers, (4) Parent Teacher's Association (PTA) chairpersons, and 88 pupils. The sample size was determined using appropriate allocation and to give a researcher a response that is relevant and reliable information to the research questions.

3.4 Data collection methods and instruments

The methods used for collecting data in this study included interviews, observation, and photography, while the instrument used were the interview guide, observation, photography checklists, and studio exploration.

3.4.1 Interviews

An interview is an oral process where I gathered data through direct interaction with the participant. It was a discussion between an interviewer and interviewee to gather data about the respondent. I used an open-ended interview guide to obtain information from the headteacher, teachers, and pupils using an interview guide as an instrument that helped in controlling and directing the interview. I then moderated the interview session throughout the study as I recorded voices or views of the respective pupils, headteacher, and teachers. I employed individual interviews, addressing the question to a single respondent one at a time.

3.4.2 Observation

One of the possible techniques that I employed was the close use of the observation method. Observation is a method that employs vision as its main means of data collection. It implies the use of eyes rather than of ears and the voice. During the process, I walked and observed

around, the classroom, administration offices, the school compound, and gardens and as far as moving to homes near the school premises and recorded notes.

3.4.3 Photography

I captured images for the materials used and made teaching aids on the phone, camera. This method enabled me to store the images of the materials that I had produced.

3.5 Studio exploration

Studio exploration is the act of conducting an investigation or test to discover new opportunities, methods, materials, and techniques. Studio exploration was used to produce teaching and learning aids using maize husks. The learning aids were analysed and data collected grouped into themes for further interpretation. After collecting data, I developed sketches which I later used to produce teaching and learning aids.

3.6 Data analysis

After collecting data from the field, I arranged it according to the themes derived from the objectives. Then I used studio exploration to analyse the data through sketches and prototypes. I finally developed several teaching and learning aids for upper primary.

3.7 Validity and reliability

The instruments were pretested before going to the field. After developing the tools, the product was also taken to the pilot paper plant in UIRI, and consultations were made for them to comment if they were good enough to generate the required data. More so, the tools were given to some lecturers who were not in the target population to see if they were valid and would generate the deserved data.

3.8 Ethical considerations

After receiving clearance to proceed with the study, the nature and purpose of the study were explained to the respondents clearly. Upon this ground, informed consent of respondents was

sought before the application of data collection tools. During the introduction process, respondents were informed of their voluntary participation and freedom to withdraw from the study at any point in time as they feel. The names of the respondents were withheld to ensure anonymity and confidentiality in terms of any prospects.

CHAPTER FOUR

4.0 PRESENTATION AND DISCUSSION

4.1 Overview

This chapter presents data and discusses it following the objectives. The purpose of the study was to explore maize husk as a material for teaching and learning aids to upper primary pupils. The study was guided by the following objectives: to determine the challenges that teachers in Purongo Hills P.7 School, Nwoya District face in accessing teaching and learning aids, to find out why the majority of the teaching and learning aids are not made from local materials such as maize husk for primary schools, and to produce teaching and learning aids from maize husk for upper primary specifically for Purongo Hill P.7 School.

4.2. Challenges that teachers face in accessing the teaching and learning aids used in Purongo Hills P.7 School

The first objective sought to determine the challenges that teachers in Purongo Hills P.7 School, Nwoya district face in accessing teaching and learning aids. The obtained results are presented below;

Financial challenge

The study found out that majority of the respondents established that most teachers are facing financial problems accessing commercial-based teaching and learning aids. The materials needed for teaching are expensive, yet, some teachers do not want to improvise local materials for teaching while a few teachers affirmed that the access to locally based materials was hindered due to lack of knowledge of preparing them among teachers. This was confirmed in one of the interviews where a participant was quoted,

“many teachers had qualifications and the required professionalism in teaching. The only problem that teachers had was motivation to effectively execute their professionalism which included developing instructional materials”.

The absenteeism of children is collectively blamed on insufficient teaching and learning aids such as writing boards, papers, book, and seats. The problem of seats is shown in Figure 2.



Figure 2: showing nursery class without writing material.

Source: Photo by researcher

Finding 2 showed that the production of teaching and learning aids from available maize husk would create a big impact in the school area if the school uses local material to produce seats for the pupils. Providing teaching aids using local materials would help influence other children who lack the writing material to report back in schools since they know in school, they can make for themselves writing material.



Figure 3a and b: Class teacher practicing basketry, Art, and craft using local material.
Photo by researcher



c



d

Figure 3: Girls and boys discussing difficulties of coming to school without teaching and learning aids.

Source: Photo by researcher

In Figures 3a, b, c and d above shows, a visual representation of student during the discussion about the difficulty of staying in school without teaching and learning aids. The findings indicated that lack of teaching and learning materials makes it hard for pupils to understand in class. The pupils revealed that they found it hard to study without aids.

One of the reasons why teaching and learning aids are not made from local materials such as maize husk was access to funds provided by the government to primary schools. Primary schools depend to the large extent on the 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 study findings agree with Uwazi (2010) who argued that worldwide teachers in primary schools most especially in rural community schools face some challenges in accessing teaching and learning aids. One of the big challenges that teachers in primary schools face in accessing teaching and learning aids is little funds provided by the government to primary schools for purchasing teaching and learning aids (Mtasigazya, 2020). 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 teaching and learning material is found at the 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 (Mtasigazya, 2020).



Figure 4: School Garden of maize.

Sources: Photo by researcher

Lack of motivation for teachers

A significant number of participants claimed that teachers lack motivation to produce teaching and learning materials using local methods. Figure 4 above indicated that Purongo Hills P.7 School has a garden where several crops are grown. The figure showed that maize is grown in the school. This makes it easier for the maize husk to be collected as the raw material. One participant was quoted,

“in rural schools many children do not attend school because of insufficient teaching and learning aids. Parents and schools cannot afford fully to buy teaching and learning aids for their children, as a result, many pupils of this school miss lessons and perform poorly in tests and examinations”. He further elaborated that, *“teacher always requested pupils without writing materials to leave class”.*

In my view, children who are in these categories have lost interest in schooling leading to school dropout. The production of teaching and learning aids using the available maize husk is the best way of improving learner's attendance.

Unclear policy and monitoring mechanisms

The findings also indicated that most of the participants noted that there is no clear policy and monitoring mechanism by the concerned ministry. This was confirmed by one participant who claimed that, *"the government does not have a clear monitoring tool to oversee that the availability or unavailability of teaching and learning aids and that is the reason you see few rural schools have enough aids to help in the learning process"*. This finding concurs with Okia (2017) who claimed that clear policy and monitoring mechanisms ensures that enough funds are provided to schools for purchasing teaching and learning aids and also these funds are used for the intended purpose.

Limited access to information and communication technology

Majority of study participants claimed that one of the challenges faces in accessing teaching and learning aids is the lack of exposure to ICT. One participant was quoted, *"in rural schools, teachers do not have access to ICT facilities due to various reasons such as no electricity, devices, no network, and so on, yet these devices who aid in learning new skills of producing learning aids"*. This is confirmed by a study in Tanzania by Olam (2017) who claimed that most primary schools especially in rural areas do not have access to information communication technology (ICT) which could alleviate the shortage of teaching and learning aids. As we are in a new millennium, there is an increased awareness of the need to use a modern scientific approach in teaching and learning processes in our schools (Ddumba, 2016).

4.3. Teaching and learning aids from maize husk for upper primary class specifically for Purongo Hill P.7 School

This section presents the process followed in making teaching and learning aids using maize husk as a material to address the problem of the respondents. This has been captured into four projects, having gathered the data from the respondents, and data is then transformed in the studio.

4.3.1 Project one: making mats

4.3.1.1 Drawings for the mat:

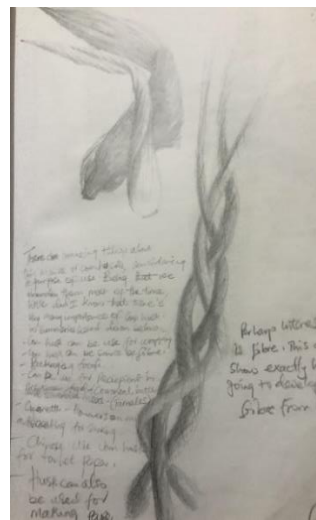
The first step in making a mat was the extraction of drawing and understanding the knot design for the materials as delivered below in figure 6 of several sources of inspiration. The figures below included abstract drawing, the process of weaving, knotting drawing, tire lack drawings, drawing for mould and deckle. The drawing gives room for understanding for knotting, weaving, and creativity.



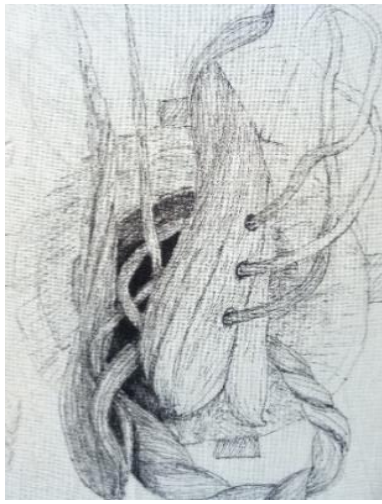
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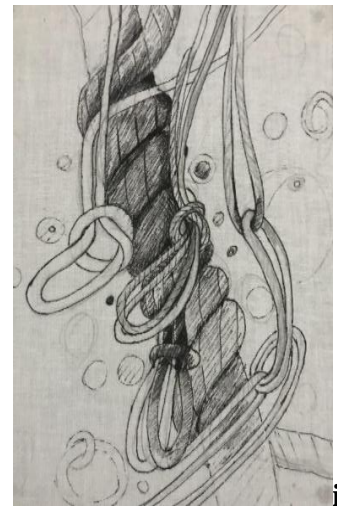
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g



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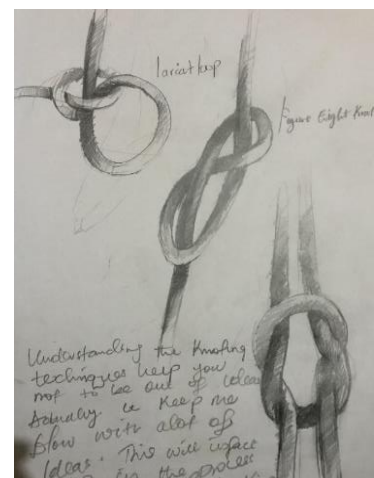
i



J



k



l

Figure 5: Procedure and instructional drawing. Photo by researcher

In figure 5 (g), showing an abstract drawing of extraction and turning maize husk into yarn which could be used for weaving mat and textile, (h) showing roll ropes on bobbin represented by mould and deckle, processed, and ready for weaving. The research chose an abstract style of drawing to promote creativity and deep thinking for the pupils. Abstract art gave pupils the freedom to explore the artwork and assign their meaning to the piece. It was also used as decoration for an interior design, for example, designing a book cover, designing wallpaper, table mat among others. Thaneeya, (2008) observed that the best abstract artists

have excellent drawing skills, a finely honed sense of composition, and a deep understanding of the workings of colour, tones, and texture.

The study used different knotting techniques (figure 5 i, j) such as a specific knot, lark-head for pile weaving technique. Figure 5 (k) shows tapestry weaving techniques, how the yarn is interlaced between the running warp thread on the frame loom. The second step in making the mat involved collecting the materials. Maize husk was collected from Kawempe Market and Watindo bodaboda stage. Maize husk is the outer covering of an ear of maize. In the Kawempe market and Watindo bodaboda stage, maize husk is thrown in a dumping bin. Only fresh maize husk was selected because they were reachable and were easy for processing.



Figure 6: Market place in Kawempe where most women within Kawempe division buy maize and Fresh maize husk dumping bin area in Watindo, Kawanda where maize roaster dump their garbage.

Source: Photo by the researcher.

4.3.1.2 Preparation of material for weaving for teaching and learning aids.

After the maize husk was collected, it was sorted to obtain the inner layer of the maize husk. Thereafter, the sorted material was cleaned using water and put under sunlight for dry but not over-drying. Cleaning was done to remove foreign material such as stones, sand, and insects among others. The dried material was broken into small pieces ready for the next step. Maize husk was split to make it easy for weaving and beautifying. Splitting the material was done to make it easier for easy handling during the process of weaving. The maize husk was dyed into different colours using vegetable dyes. During dyeing, the maize husk was boiled and mixed

with dye. The purpose of dyeing maize husk was to give the material colour and beautify it. Estimated, 20 grams of a dye of each colour cook in a litre of water for 30 minutes, and rinsed the same saucepan with fresh water for the next dye colour cook.

A-frame loom was made from a wooden piece of timber in a rectangle or square shape and nailed from both sides parallel for setting warp thread. After dyeing the maize husk, the frame loom was threaded using acrylic thread to make it ready for weaving. The process took about 15minutes and it was one of the processes that helped in making the mat. Weaving involved using a frame loom to interlace two sets of threads at right angles to each other: the warp which runs longitudinally and the weft that crosses it. The warp threads are held taut and in parallel to each other, typically in a loom. The technique used was pile weaving 90 percent and tapestry weaving 10 percent. To weave 370mm by 510mm take 11 kilograms of fresh maize husk.



o **p**
Figure 7: Weaving in progress and how the mat looks in from the back showing tapestry on the bottom of the woven mat. Photo by researcher

Trimming was the final stage in making the mat. Trimming was done using a pair of scissors to reduce piles to a low-lying mat for use in households. The process of trimming took about one hour.



Figure 8: trimming the mat using pair of scissors.

Sources: Photo by the researcher

The finished mat



Figure 9: Finished mat.

Sources: Photo by researcher

Material: maize husk 80 percent and acrylic yarn 20 percent, size: 510 mm by 370 mm, technique: pile weaves, tools: frame loom, function: doormat, side bed mat, and seating mat, maintenance: do not wash, and storage: protect from mouse and other insects.

The mat Figure 9 above was made by the researcher. The mat was made using weaving and tapestry. Therefore, the mat made by the researcher was recommendable for primary pupils because of the cheap material and ease to weave.

4.3.1.3 Processing fine fibre from maize husk for weaving mat

In Figure 10, the study presents the fibre that was extracted out of maize husk cooked in caustic soda. After the maize husk was collected, it was sorted to obtain a clean maize husk. Thereafter, the sorted material was cleaned using water and weighed 4000 grams, and cook in 40 grams of caustic soda per litre of water for 2 hours. The cooked material was rinsed in freshwater. Fine fibre is got in a processing rinsing and squeezing the pulp out of it. The fibre was washed several times and then displayed under sunlight to dry. The fibre after drying could be spun ready for weaving and to replace the acrylic threads for warp threads. This research, therefore, recommends maize husk as a possible raw material for the textile industry. And on the other hand, the maize farmers produced maize for food and the maize husk for cash to the textile industries.

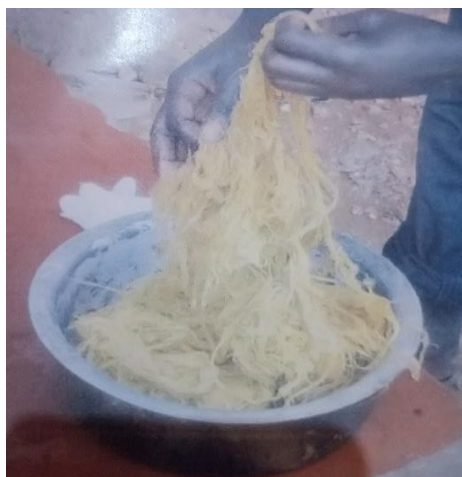




Figure 10: Processed fibres from maize husk for weaving.

Sources: Photo by the researcher

4.3.2 Making soft board

4.3.2.1 Drawings for soft boards.

To make a soft board, drawings were made, and the necessary tools and materials were gathered such as maize husk, caustic soda, and water. 25kg of maize husk was cooked mixed with one kilogram of caustic soda in 20litres of water for 2hours. The cooked mixture was rinsed in fresh cold water to avoid further reactions and after some period, it was put under sunlight for drying. In figure 11 (x) below, the material after the collection was prepared before cooking. Mize husk was cut with scissors as a way of material cleaning, and removal unwanted of the hard part of material like maize husk stalk to enable the material to be cooked fast. And figure 13(y), shows a teaspoon full of caustic soda added in process of cooking. In the process, caustic soda was added when maize husk had over-boiled for quick reaction and fast cook. The normal saucepan was not very good for cooking the material because caustic soda burns and creates a hole on the bottom of the saucepan, the researcher used the metallic drum and pot made of clay for cooking the material.

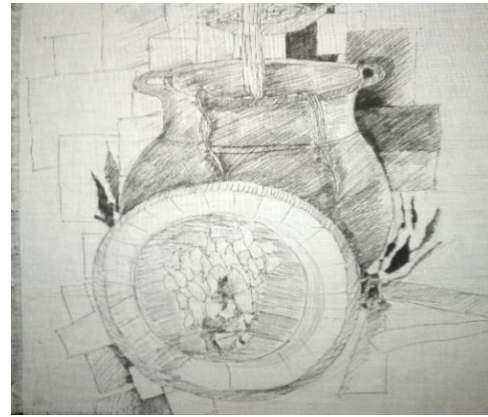


Figure 11: material cutting and cooking process in the studio.

Source: Photo by researcher

4.3.2.2 Materials and tools

These are substance used in the production of products: These includes maize husk, caustic soda, water. While, tools are substances used in the process of production such as pens, pencil, rulers, pair of scissors, trough, saucepan, computer, phone or camera, mould and deckle, hammer, painting brass, drilling machine, and mesh. In soft board making maize husk was the main material which 99 percent, water added to achieve the board, that is to say, water was drained during the process of drying and the caustic soda was thoroughly washed in fresh several time until the caustic was completely drain out. In figure 13 (v) below showed the researcher cleaning material to remove unwanted sand, stones, and insects. In figure 13(w), showed the cooking process and figure 13(x), showed the cooked maize ready for casting. After cooking, the material was given some time to cool, it was collected and dumped in the trough for further processing.



V



W



X

Figure 12: Cleaning, cooking, and cooked maize husk.

Photo by researcher

4.3.2.2 Preparation of trough

For convenience, the researcher got an old piece of furniture that was formally used as a platform for exhibition from the Department of Art and Industrial Design. It was covered carefully with polythene paper on the bottom and side. Using the stapling machine, it was stapled polythene paper on the wooden box. Trough could develop from an open object like wheelbarrow, basin, old bath basin wood boat among others. To rural primary schools specifically Purongo Hill P.7 school, a trough could be made by digging the hole and covering it with the polythene paper from the bottom and whole side. Polythene was found with people around Banda and for 2 meters by 6 metres cost around five thousand Ugandan shillings only

(5000/=). Another material for covering the hole was a tent and a tent cost around twenty thousand Ugandan shillings (20,000/=) which measure 5 meters by 15 meters.



q



r



s



t

Figure 13: Development trough from an old platform

Size: 1700 mm x 1500 mm

Source: Photo by researcher

4.3.2.3 Development of mould and Deckle

Two frames of equal size and form were designed: mould and deckle from pine for easy nailing and pinning of fabric to create a screen using mesh-like fabric material, this is typical to the screen for printing budge and fabric decorators' use. Mould and deckle were of the same measurement and thickness for proper and easy board castings and moulding of Pulps. This mesh-like fabric is bought from a nearby trading centre specifically from a vendor who sells second-hand fabric especially those who sell curtains, A metre costs around two thousand

Uganda shillings (2500/=). A split piece of timber was bought at one thousand Ugandan shillings (1700/=). At UIRI, I found that makes a wire screen with an aluminium frame long last but they were very expensive. It cost around eighty thousand shillings (80,000/=) to design, however it was very good because it was long-lasting, so, anyone could have the option of what to choose when making mould and deckle.



u



w

Figure 14 (u) and w: Mould tightened using rubber string prepared to scope fibre and pulp for board making

Sources: Photo by researcher

4.3.2.4 Board's casting

After cooking pulps, it was poured in a trough containing cold freshwater to weaken the acidic pulps. Pulps in cold freshwater were thoroughly filtered then more freshwater was added twice or more. The researcher wore hand gloves to rinse pulps to select and further break unbroken maize husk. The gloves help to control the researcher getting toxicities and burn from caustic soda. A pair of gloves cost one thousand Uganda shilling only (1000 /=). Mould and deckle were put together and held tight and pulps were poured onto it, a few minutes later after sieves, the material was mortared, then it was left to dry.



x



y

Figure 15: Mould and deckle dip to scoop set fibre using for board

4.3.2.5 Drying of boards

I put boards under the sunlight for drying. The drying was needed to create hard boards. The boards took one week to dry because they contained a lot of water. Therefore, enough sunshine was needed to remove all the water from the boards. In figure 16 (y), mould and deckle containing the material are tied together for some time like in one day until all the water drained out of the board and give the soft board safely before it's exposed to direct sunlight for drying. After the soft board removes from the deckle, it's then exposed to direct sunlight to dry. The stone is put on the edge of the board to avoid wapping and shrinking of the soft board as shown in figure 16 (y).



y



z

Figure 16: Board used for drying indoor the studio and board and stone put on the edge of the board under direct.

Already made soft board



Figure 17: Two dried boards handle.

Source: Photo by researcher

Material: maize husk, caustic soda, and water, **Size:** 500 mm by 500 mm, **Technique:** Board casting, **Tools:** Mould and deckle, **Function:** Ceiling board, display board, blackboard, and **Storage:** Stores in a dry place should not be reachable by mice and insect.



Figure 18: Soft board by researcher



Soft board from www.indiamart.com

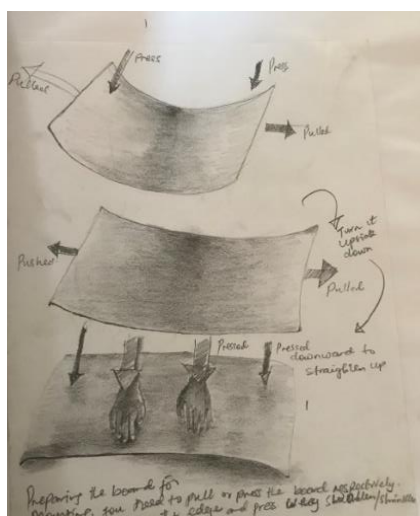
The soft board obtained from www.indiamart.com is smoother compared to the one researcher made. They are served the same purpose. The study found out that the schools could make soft boards from local materials using local production means such as one illustrated in this study.

4.3.3. Project three: making a blackboard

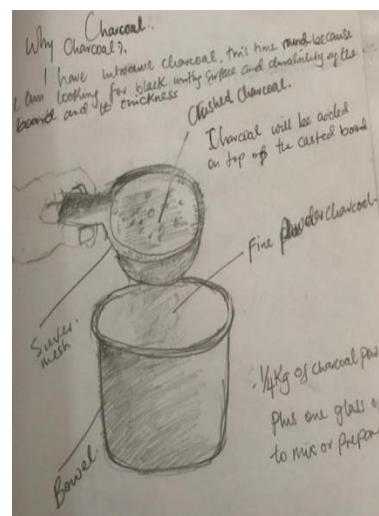
The project involved making sketches, making soft boards, and later developed matt from charcoal powder mixed with paraffin and wood glue with little water. The mixture was then poured into the surface of the soft board. Charcoal was rushed and then sieved to get charcoal powder. After wood glue, little water, and paraffin were mixed to produce a matt which was poured and smeared on the surface of the board, there after the board was left to dry under sunlight.

4.3.3.1 Developing sketches for drawing easel for the boards

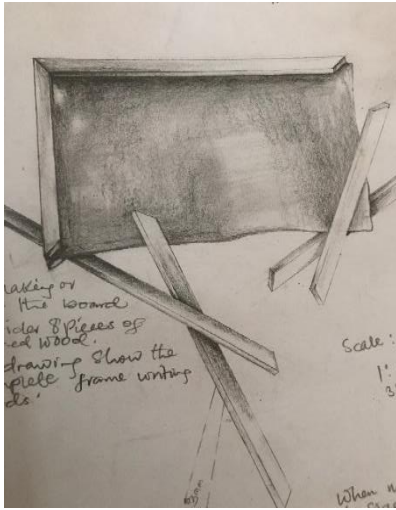
The researcher starts with the sketches of how blackboard could be possibly made and the easels stand for blackboard, designed on three stands in wood. The sketches below showed the function or operation of the easel. Easel's stand is used for supporting the board while using it for writing.



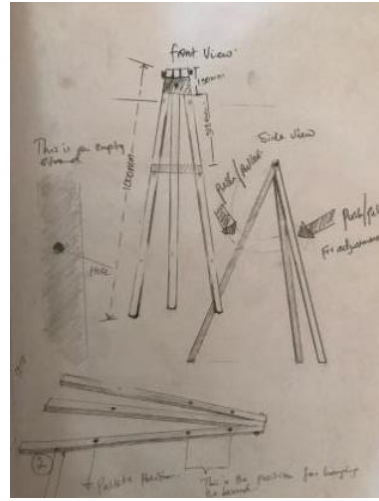
a



b



c



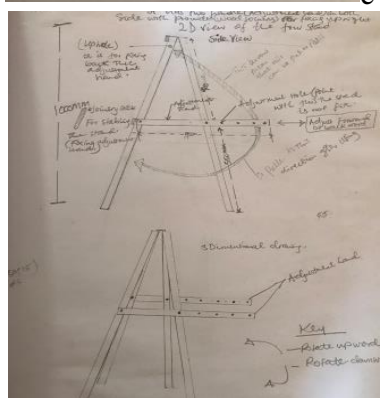
d



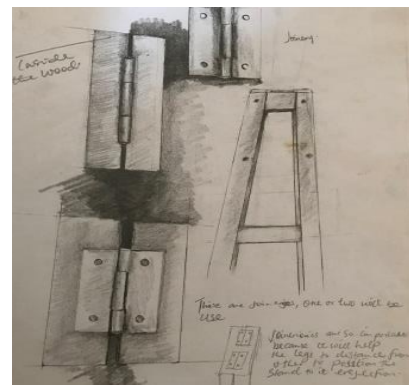
e



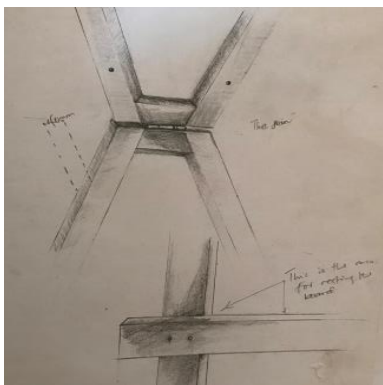
f



g



h



i

Figure 19: Drawing procedure of how to make a complete blackboard.

Source: Photo by the researcher

Figure 19 shows the procedure of how the blackboard is made, figure 20 (a), the sheet of the soft board was stretched and made straight, and (b), sieving the crushed charcoal using a sieve, and (c) shown the framing of the complete blackboard. These pictures showed the steps that were followed in developing a blackboard. The charcoal was crushed and sieved to produce charcoal powder and it was mixed with wood glue, water, and paraffin, and matt is formed. Lastly, the blackboard was framed after drying.

Figure 19 (d), show how easel was operated, function and convenience, (e), bolt and screw, (f), easel adjustment, (g), elongated folding and adjustment, (h) joinery, and foldings, and (I) joint and adjustment. Easel, in this case, refers to a blackboard stand. It helps to display the blackboard upright. Developing an easel for rural school's blackboard was an optional process during the process of blackboard making.

4.3.3.2 Board coating

Charcoal was mixed in powder form, sieve carefully with wood glue of 500ml, 300ml of water, and 150ml of paraffin. It was steered in a bucket together to form charcoal matt. The matt was poured on the board with great care to form the surface of the blackboard and smoothen it. The matted board was put under sunlight to dry. Thereafter, the board surface was painted using black paint for writing, ensure its durability and protection from the harsh weather and insects, the back of the board was also varnished with varnish.



Figure 20: Procedure of making matt from charcoal and how matt is added onto the surface of the soft board to produce the blackboard.

Source: Photos by the researcher

Figure 20 (s), shows a cup of powder charcoal measured for making matt, charcoal was crushed using the stone or piece of wood and sieved to produced charcoal powder. Figure 20(t), a bottle

containing paraffin pouring a bucket of charcoal powder, then it was stirred, and figure 21(u), show a cup of wood glue poured and stirred in figure 20 (v). Finally, figure 20 (w), shows how matt made out of charcoal ready for coating the board and figure (x) shows the coated board. Matt was poured gently onto the surface of the board and left to drip flow slowly to cover the surface of the soft board and it was exposed to sunlight to dry. Paraffin in this process of production was used for making the board surface shiny and glittery because paraffin floats on water, so, when the board was coated, it was exposed to dry. In the process, paraffin rose on top and then evaporated, this made the board surface smooth and shiny. Wood glue was an adhesive agent that adhered matt to the board surface. Water was added to wood glue a measurable amount depending on the size of the board. To make a board of 1000 mm by 500 mm, 2 cups of charcoal powder were mixed in 500 ml of wood glue, 150 ml of paraffin, and water of 300 ml.

4.3.3.3 Board Framing

The researcher established that drying blackboard under direct sunlight made the blackboard dry quickly since black absorbs heat evenly. For the beauty, strength, and final touch of the product, it was necessary to mount the board using a piece of wood. Figure 21 showed the framed blackboard inside the workshop for framing. To frame the blackboard, wood glue, nails, sawdust, and pieces of split wood were used. Sawdust was mixed with wood glue to fill the gap in between the blackboard, to give a proper finish and added beauty to the product.



Figure 21: showing framed writing boards in the studio.

Source: Photo by researcher



Figure 22: Display of black finished blackboard.

Source: Photo by researcher

Material: maize husk and charcoal, **Size:** 550mm by 38mm, **Technique:** mixing and matting

Tools: bucket, sieve, and sticks, **Function:** for writing, **Maintenance:** clean in a dry area

The study established that Purongo Hill P.7 school can make blackboards using local means and maize husk. The study found that charcoal is a readily available material that can be

accessed by the school administration. Through the process of board coating, board mounting, and drying using local maize husk.

4.3.4 Project four: papermaking

4.3.4.1 Process of paper making

Maize husk was cooked and all fibre units were removed to form a pulp. The pulp was further cleaned and any other particle of fibre was removed to make Paper. Some of the pulp was bleached using Jik which contained chlorine and hydrogen peroxide. After bleaching using JIK, a sugar paper was formed. I visited the Uganda Industrial Research Institute (UIRI) in search of how to make a bleached paper, and I was advised to bleach the pulp using calcium hypochlorite to obtain the white paper. Calcium hypochlorite is in crystal form sold from 5kg, costing sixty-nine thousand only (69,000/=). However, there was also a big problem with this when taking the reaction of calcium hypochlorite with the pulps, it was toxic when inhaled, and it also burns starch, which is the glucose that helps paper in bonding when drying. Pulps with burnt sugar content disturb a lot when drying because they tire off from the deckle when there is too much wind compared to none bleached pulps, it does not work well when producing paper of small grammage size. Therefore, schools, such as Purongo Hill P.7 school may make paper and choose not to bleach. Unbleached pulps make strong paper because it has the starch to bond together.



M

N

O

Figure 23: Bleached fibre and unbleached fibre (m), Scoop pulps freshening pulps for bleaching and picking the unbroken fibre (n), and bleached pulps ready for papermaking (o).

Source: Photo by the research assistant

4.3.4.2 Paper casting, grammage, and drying

The mould and deckle were used for making paper. I held mould and deckle together, then dipped in a trough full of pulps and water for few minutes to expose and settle pulps onto the surface of the mould. Then it was lifted slowly and water was drained down in the trough and left to dry. The next step included paper grammage. Paper grammage was useful in measuring the paper thickness. I also used the calendaring method to obtain the same paper size but this system is not sustainable since I need first to take my product to UIRI for pressing. I have not yet come with the procedure and tools that could be used to produce a paper of accurate grammage. There are two methods consider to produce the same paper grammage and that is by seeing, this remains the best tools for production of paper grammage. The method is by labelling the mould with wire and writing using ink. I left made paper to dry under room temperature to avoid the paper to syringe or get torn. Room temperature is a better method for achieving a good paper made using local production methods because the paper won't get torn and it was dried evenly.



Figure 24: Paper drying under room temperature

Source: Photo by the researcher.

Another method I used for drying paper involved putting it under sunlight. The method of drying the paper under room temperature is used for small production, however, for large-scale production, a cylinder machine is employed.



Figure 25: Drying paper under sunlight

Source: Photo by the researcher

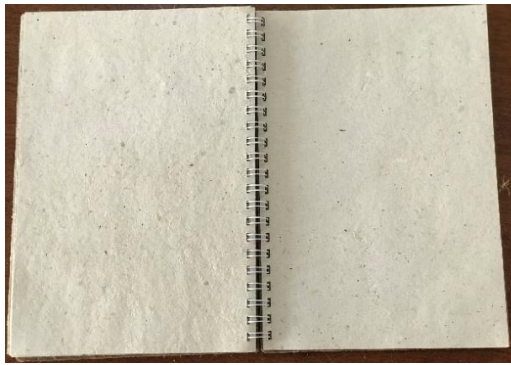
The smoothening and flattening of the paper surface

After drying the paper, some of it becomes folded. This forced me to smoothen it using the calendaring method with the help of a calendaring machine. The whole process was done at the UIRI paper pilot plant in Nakawa.



Figure 26: Calendaring operated to press paper and Pile paper for making books.
Source: Photo by the researcher

It is very easy to spiral bond, with the new technology that we have many machines. To spiral bond a book it cost 2000 /=. Alternatively, these papers can be bind using the ropes that are developed from maize husk, or these paper bind using wood glue. The dry paper was detached from the mould then trimmed and piled for work/development. I sorted and bind together as books. The book cover was developed from the board produced and final trimming was done. The book cover could be decorated using the drawing of maize husk from the source of inspiration which was inserted in a computer-aided program called adobe illustrator and was designed.



a) Bleached paper Book bind



b) Sugar paper book bind



c) ready for use (a)



d) ready for use (b)

Figure 27. Paper made out of maize husk

Sources: Photo by researcher

Material: maize husk, **Technique:** paper casting, calendaring and binding, **Tools:** mould and deckle, **Function:** making books, **Maintenance:** put on a table, **Storage:** Store in a dry place

The papers made were not smooth like the one obtained from the internet. This is because I used local means compared to the one obtained from the internet. The study found that the school could adopt similar steps presented in this paper to make writing paper. The whole process is not expensive for the schools. The school should teach pupils the steps in this paper for them to make writing papers.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Overview

This chapter presents, the summary, conclusions to the study, and recommendations thereafter. The study was guided by three objectives: to determine the challenges that teachers in Purongo Hills P.7 School, Nwoya district face in accessing teaching and learning aids, to find out why the majority of the teaching and learning aids for primary schools were not made from local materials such as maize husk, and to produce teaching and learning aids from maize husk for an upper primary class specifically for Purongo Hill P.7 School.

5.2. Summary

5.2.1 Challenges that teachers Face in accessing teaching and learning aids

Most teachers are facing financial problems accessing commercial-based teaching and learning aids and also teachers do not want to improvise local teaching materials. Teachers lack the motivation to execute effectively their professionalism included developing teaching and learning materials.

5.2.2. Why the majority of the teaching and learning aids for primary schools were not made from local materials such as maize husk

Study findings revealed lack of clear policy and monitoring mechanism to oversee the availability and unavailability of teaching and learning aids in schools. Limited access to information communication and technology (ICT) was also a stumbling block to the access of teaching and learning aids in primary schools. There was also a lack of knowledge of preparing them among teachers.

5.2.3. Production of teaching and learning aids from maize husk for

However, the study found that it was possible to start up to start a factory for the production of teaching and learning aids (such as mats, soft boards, blackboards, and papers) for rural schools at lower prices since maize husk as raw material is cheap and regarded as waste after harvest.

The production of mats starts extraction of drawing and understanding the knot design for the materials. It follows abstract drawing, the process of weaving, knotting drawing, tire lack drawings, drawing for mould and deckle. The technique that can be used in the making of mats include weaving and tapestry.

The process of producing soft boards included drawings were made, and the necessary tools and materials such as maize husk, caustic soda, and water, pens, pencil, rulers, pair of scissors, trough, saucepan, computer, phone or camera, mould and deckle, hammer, painting brass, drilling machine, and mesh. The process of productions follows from drawings for soft boards, preparation of trough, development of mould and deckle, board casting, and drying of boards.

The process of making blackboards involved making sketches, making soft boards, and later developed matt from charcoal powder mixed with paraffin and wood glue with little water. The techniques used included mixing and matting.

The last project involved making books. The process involved cleaning of pulp, pulp bleaching, paper casting, grammage, drying, paper smoothening and flattening. The technique of making paper is paper casting, calendaring and binding.

5.3 Conclusions

The study concludes that; Most teachers are facing financial problems accessing commercial-based teaching and learning aids and also teachers don't want to improvise local teaching materials. Another challenge was the lack of knowledge of preparing them among teachers. Lack of motivation was another challenge faced by teachers in the effective execution of their

professionalism which include developing teaching and learning materials. One of the reasons why aids are not made from environmental materials such as maize husk is the meagre funds provided by the government to primary schools. Very little support was received from local government and communities around the schools most especially in rural areas due to poverty. It was possible to make soft boards, papers, and blackboards using maize husk using local means. However, there was a difference in quality as the materials from the literature have more quality compared to the ones made by the researcher. Therefore, in a situation where there is no even a single teaching and learning aid, the teacher should produce teaching and learning aids from maize husk using the methods advanced by the researcher.

5.4 Recommendations

I recommend that;

1. The government should strive and set aside a reasonable amount of education budget which will be directed to the provision of teaching and learning aids. The heads of schools should raise their voice to be heard by parents as well as the government on the importance of improving and promoting good teaching and learning materials in schools.
2. Teachers should be motivated and trained on the best ways to produce teaching and learning aids from local materials. Government and another development partner should sponsor the procurement of locally produce boards, paper, noticed, and exercise books that are environmentally friendly and to promote local manufacturing industries.
3. In a situation where there is no even a single teaching and learning aid, the teacher should produce teaching and learning aids from maize husk using the methods advanced by the researcher.

5.5. Contributions of the study

The study would be vital to the policy makers, academia world, and the education sector:

1. The results may guide various education authorities such as the (MOES) which are responsible for policy formation, implementation and evaluation, to frame policies that regulate utilization of educational resources in schools.
2. The study may also ignite a platform for interactions about provision of educational resources in schools towards achievement of educational outcomes which may lead to informed decisions for improvement in academic performance.
3. The study findings may also be useful to school proprietors and administrators in ensuring provision, allocation and utilisation of local materials in the production of teaching and learning for improved students' academic performance.

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APPENDICES

APPENDIX I: QUESTIONNAIRE FOR SCHOOL’S ADMINISTRATORS.

Introduction:

Dear respondent, my name is Olango Patrick, a pupil of Kyambogo University offering a Master of Art and Industrial Design. I am carrying a study on “*A studio exploration of maize husk as teaching and learning aids to upper primary pupils.*” I welcome your support and I promise to keep all the information you provide confidentially and only be used for this academic purpose. This questionnaire is to be filled by you or your representative.

Section A: Demographic data.

1. Name of respondent

.....

..... 2. Age.....

Sex..... 3. Place

of work

.....

..... 4. Title/position

held.....

Section B:

What are the challenges that teachers in Purongo Hills P.7 School, Nwoya District face in accessing teaching and learning aids?

.....

.....

Why are the majority of the teaching and learning aids not made from local materials such as maize husk for primary schools?

.....
.....

What are the teaching and learning aids used in Purongo Hills P.7 School?

.....
.....

How can maize husk be used to produce teaching and learning aids for primary schools?

.....
.....

What samples of teaching and learning aids can be produced from maize husk for primary schools.

.....
.....

Thank you for your time

APPENDIX II: WORK PLAN

Activity	Objectives	Mar	Apr	May	Jun	Jul	Aug
Planning, budgeting, and developing sketches for production of the writing of the board							
Collecting and gathering materials and tools							