DEVELOPMENT OF RELIEF SCULPTURES FROM WASTE EGGSHELLS AS AN ALTERNATIVE MATERIAL FOR SCHOOL OF ART AND INDUSTRIAL DESIGN KYAMBOGO UNIVERSITY

ARINDA FRANKLINE

REG NO: 19/U/GMAID/20715/WKD

A THESIS SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING AS PARTIAL FULFILLMENT OF THE REQUIREMENTS OF A DEGREE OF MASTER OF ART AND INDUSTRIAL DESIGN OF KYAMBOGO UNIVERSITY

AUGUST, 2023

DECLARATION

I declare that this thesis entitled **"**DEVELOPMENT OF RELIEF SCULPTURES FROM WASTE EGGSHELLS AS AN ALTERNATIVE MATERIAL FOR SCHOOL OF ART AND INDUSTRIAL DESIGN KYAMBOGO UNIVERSITY", is my own and it has never been submitted to any University for the award of a Master's Degree.

Signed..... Date.....

ARINDA Frankline

19/U/GMID/20715/WKD

APPROVAL

This thesis entitled “DEVELOPMENT OF RELIEF SCULPTURES FROM WASTE EGGSHELLS AS AN ALTERNATIVE MATERIAL FOR SCHOOL OF ART AND INDUSTRIAL DESIGN KYAMBOGO UNIVERSITY” was carried out by ARINDA Frankline 19/U/GMID/20715/WKD under our supervision.

Signed..... Date.....

DR. KEKIMURI Joan (PHD)
(Principal supervisor)

Signed..... Date.....

DR. MPINDI Ronald Kibudde (PHD)
(Second supervisor)

DEDICATION

This book is dedicated to my beloved parents Mr. BYARUSHAYA Titus and Mrs. BYARUSHAYA Christine for the ethical, monetary and divine support given to me throughout this study. I dedicate this book to my mentor Fr. KIKOBA Antanathius for the advice, guidance and support rendered during the course of the study. Also, to my beloved fiancé OKURUT John Chrissostom, my brothers and sisters; MUSIIMENTA Nicoline, NAULA Teddy, AKANKWASA Austin, ATUHEIRE Josephine, MUGARURA Emmanuel and KIRABO Nicolas for their determined provision and inspiration exhibited all through in this study.

May God bless you abundantly!

ACKNOWLEDGEMENTS

I take this opportunity to thank God Almighty for the gift of life, wisdom, knowledge and understanding that have rendered this research a success. It is by his grace and mercy that I was able to complete this research. For God has been there every step of the way. I appreciatively acknowledge my parents for setting a good educational foundation that has kept me moving. I extend gratitude to my mentor Fr. Kikoba Antanathius for all the support rendered throughout the study and family members for your encouragement and love. I cannot thank you enough for being there in my time of need.

In an exceptional manner, I recognize the involvement of Dr. Kekimuli Joan (Principal supervisor) and Dr. Mpindi Ronald Kibudde (Second supervisor) for their intellectual guidance, inspiration and commitment throughout this study.

I humbly acknowledge Mr. Mujjuzi Henry Kipembe, Mr. Wathum Edwin and Mr. Egonu Charles for the time, support and encouragement they extended towards the fruitful accomplishment of this report. I thank sculpture students and lecturers at the Department of Art and Industrial Design Kyambogo University who offered me relevant information and attention during the study. To my colleagues; special thanks to Katesi Jacqueline Kalange, Nanyanzi Mary, Ashaba Gabito, Okia Emmanuel and Kawuki Francis for the extra mile towards motivating me and making this study a success.

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

The purpose of this study was to develop relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design Kyambogo University. It was conducted under three objectives namely; to identify different waste materials that have been used to create sculpture at the School of Art and Industrial Design Kyambogo University, to execute design concepts for producing relief sculptures from waste eggshells for School of Art and Industrial Design, to develop relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design. This study was qualitative in nature and a case study research design used to gain information about waste materials for sculpture and provided an opportunity for innovation. Purposive sampling technique was applied based on sculpture students and lecturers who were practicing sculpture at the School of Art and Industrial Design. The researcher used interviews, direct observation, photography, Library and archival search methods to fulfill the study objectives. The information from different students and lecturers was gathered using interview guide, observation check list, reading list and studio practice guide which directed the researcher during studio exploration. This study observed that conventional materials like clay, cement and wood were commonly used for the production of relief sculptures at the School of Art and Industrial Design. This was due to the complexity of creating relief sculptures that came along with representing figures within a limited space which tended to be difficult while using waste materials like plastic bottles, polythene among others thus discouraging students. The study findings presented in both text and photographic formats were interpreted in consideration of techniques and material. They affirm that eggshells are a reliable and flexible waste material for the production of relief sculptures. This study recommends that waste eggshells can be used as a material by other universities and institutions of learning and also prototypes used for study purposes.

CHAPTER ONE: INTRODUCTION

1.0 Overview

This chapter consists of the background of the study elaborating on the definitions and contexts of sculpture, use of found materials and the different methods for creating sculpture. The chapter through identification of the problem presents objectives of the study from which the research questions, problem statement, significance and scope of the study were formulated.

1.1 Background to the study

Deffor et al (2019) state that Sculpture as an art form has various definitions; the definition is based on materials for production, skills involved in the expression of ideas, themes, and concepts behind the production of artifacts, and the techniques employed in making objects. They further explain that Sculpture, which is a three-dimensional artwork, involves making good use of materials, tools, methods, and space in expressing individual inborn abilities for solving societal issues. In addition, Gamble (1995) also defines Sculpture as an art form that deals with using organic and inorganic materials to produce three-dimensional figures with the aid of tools and equipment. Gamble's definition of sculpture is best appropriate for traditional sculpture since it is an art of solid form, it has no movement and the main techniques employed are modeling and carving. The art of sculpture is no more restricted to traditional sculptural concepts, materials, and methods but it can be in a form of abstract, kinetic, and capable of movement. Today's sculpture can be assembled, glued, projected as well as constructed in a wide variety of ways (Judith, 2007).

Sculpture has been practiced since the prehistoric era and it is still practiced with different techniques and methods in terms of tools, skills, and materials (Bahn, 1998). Sculptures are usually presented either in the round (solid) or in the relief form. Sculpture as a three-dimensional work of art is meant to be viewed from more than one side; this means that sculpture works have depth, volume, and mass. There are several techniques employed in sculpture such as carving, modeling, casting, assemblage, and construction. Sculptures can be permanent such as monumental sculptures and statues honoring famous people and events, situated in prominent positions in city spaces. Most outdoor sculpture works are done using

materials that can stand the test of time such as cement, wood, resin, fabrics, etc. (Stillman, 1999).

Sculpture in the relief form is a two dimensional work of art meant to be viewed from one or more sides depending on the type of relief. Damaskos (2013) defines sculpture in relief form as the protrusion of a design from a plane surface reserving the plane surface as an essential portion of the composition. He considers that relief may be projected or cut back from the plane surface. In other words, it is the type of sculpture that is done on a plane surface such as wood, metal or a wall (Sarfo, 2013). Mainly, there are four types of relief sculpture which include sunken, low, medium and high relief. Sculpture in high relief projects out practically like sculpture in the round but the rear is always fixed to a plane surface. Sculpture in medium relief is neither low nor high. Sculpture in low relief is one in which the protrusion is limited from the plane surface and is maintained by magnificently strained chiseled lines. Sculpture in low relief has the proposed design fixed to the plane surfaces which is the background. Therefore the design can barely be perceived from a distance. An appropriate example of sculpture in low relief is a coin where the design faintly protrudes from the plane surface.

In today's art, Sculpture is one of the visual art subjects which are gaining more attention due to its relevance in the socio-economic development of Uganda. According to Appasamy (2014), durable sculptural processes originally used carving (the removal of material) and modeling (the addition of material, such as clay), in stone, metal, ceramics, wood, and other materials but, since Modernism, there has been almost complete freedom of material process.

Recycling of both biodegradable and non-degradable materials is accepted as a sensible, and necessary activity and responsibility of all including artists (Peterson, 2013). However, the idea of recycling often seems somewhat boring and does not normally have aesthetic attraction. Recycling can be much more than just a necessity hence, when well managed can help preserve the environment and sustain natural resources for future generations. The rationality or material profit of using found objects is probably not great, but creating and recycling at the same time is a very sustainable and joyful concept. This recycling-creating combination also has fascinating symbolic and spiritual connotations to move mankind to act (Reich, 1998). To this end, Bower (2014) viewed environmental art as an umbrella term for an artistic movement that encompasses both historical approaches to nature in art and more recent ecological and politically motivated

types of work. The freedom for material process in sculpture has also inspired many artists to develop more interest in practicing sculpture which has resulted in the exploration of creative ideas in the aspect of skills, materials like paper, polythene, plastics, and banana fiber among others. Based on Bower's definition, it is worth carrying out studio experimentation of using waste eggshells as an alternative material for relief sculpture at the School of Art and Industrial Design at Kyambogo University**.**

O'Doherty (2007) and Wainright (2010) state that artists are allowed space in the studio to liberate practices of imagination and testing; of attention and alteration. The studio offers space for artists' reflection and elaboration: for experimentation, which is essential to the origination of artwork and to produce original products of aesthetic quality. The studio is a space where artists' ideas materialize and take form. The studio is also known as an artistic laboratory. Dewey (1934) argues that experimentation is not restricted to practices in scientists' workspace of the laboratory but it is also part of artists' practices and progress. The contemporary studio is an imagination and knowledge chamber where artists engage in practice based on privacy or reclusion, material production, knowledge, and learned scholarship; a civilized pursuit based on learning (Daniels 2011; Chare, 2006; Buren, 1970). Following this study, experimental processes are explored and portrayed as creative processes based on artistic knowledge. The studio work and production are presented from the perspective of specific knowledge about using waste eggshells that are applied and generated throughout relief sculpture projects and creative processes. Therefore eggshell sculpture can be defined as artworks created from waste eggshells by using different skills and techniques to achieve desired forms.

Eggshells are waste materials from hatcheries, homes, and fast food industries (Phil and Zhihong, 2009; Amu et al., 2005) and can be readily collected in plenty. Eggshell is an agricultural waste as well as a domestic waste largely considered useless and is discarded mostly yet it contributes to pollution through poor disposal. Abdullrahman et al (2014) state that, Agricultural waste is any waste being generated from different farming processes in accumulative concentration. Challenges associated with poor disposal of eggshells include cost, disposal sites, bad smell, flies, and abrasiveness (Phil & Zhihong, 2009) in the case of large-scale production. The high costs of garbage collection demanded by authorities lead to poor disposal of waste eggshells, inadequate disposal sites, bad smell due to the decomposing egg membrane

in the shells, flies which are attracted to the bad smell and abrasiveness as a result of prolonged exposure of eggshells thus causing harm to both humans and animals.

Adequate utilization of eggshell waste reduces environmental problems caused by irresponsible disposal of the waste. The management of agricultural and domestic wastes is necessary and a crucial strategy in global waste management. Waste of any kind in the environment when its concentration is in excess can become a critical factor for humans, animals, and vegetation. The search for an effective way to properly manage agricultural waste, especially eggshells will help protect the environment. For sustainable development, eggshell wastes should be recycled, reused, and channeled toward the production of value-added sculpture. This is to protect the environment on one side and on the other side to obtain value-added products that can inspire artists to use waste materials while establishing a zero waste standard. The utilization of waste is a priority today to achieve sustainable development.

1.2 Statement of the problem

The Sustainable Development Goals 2015 particularly agenda 12, aims at ensuring sustainable consumption and production to reduce the destructive impact on the use of the natural environment and resources. Many sculptures have been created from the recycling of waste to address this issue although conventional materials like clay, cement, and wood are used to create relief sculptures at the School of Art and Industrial Design. These materials are expensive to acquire and yet they are extracted and depleted from the environment. If this problem is not addressed, the environment will continuously be encroached on for raw materials and domestic waste will also increase hence causing environmental degradation and pollution. Therefore, this study intended to use eggshells as one of the wastes found around the School of Art and Industrial Design as a cheaper alternative material for the production of relief sculpture.

1.3 Purpose of the Study

The purpose of this study was to develop relief sculptures from waste eggshells as an alternative material for the School of Art and Industrial Design at Kyambogo University.

1.4 Objectives of the study

1. To identify different waste materials that have been used to create sculptures
2. To execute design concepts for producing relief sculptures from waste eggshells for the School of Art and Industrial Design
3. To develop relief sculptures from waste eggshells as an alternative material for the School of Art and Industrial Design

1.5 Research questions

1. What are the different waste materials that have been used to create sculptures?
2. How can design concepts be executed for producing relief sculptures from waste eggshells for the School of Art and Industrial Design at Kyambogo University?
3. How can relief sculptures be developed from waste eggshells as an alternative material for the School of Art and Industrial Design?

1.6 Significance of the study

It is anticipated that this study will;

Benefit students offering sculpture by presenting a cheap alternative material for relief sculpture.

Encourage students to engage more in recycling, reusing, and reducing waste materials as alternatives, especially in the production of relief sculptures.

Reduce the number of waste materials dumped in our communities.

Be a venture for researchers, and practicing artists, especially those who are interested in recycling waste materials from the environment.

Help the government to implement the use of waste materials in valuable artworks hence saving the environment from pollution.

1.7 Scope of the study

The scope of the study explains the extent to which the research will be explored in the work and specifies that parameters within the study were to be operating (Editage, 2019). Therefore, the scope of the study included; geographical, content, and time scope as explained in detail below;

1.7.1 Content scope

The content scope was based on the study objectives which aimed at creating samples of how eggshells can be used as a sculpture material. The researcher was able to identify the waste material and execute design concepts through sketching and drawing guided by the elements and principles of art and design. The shoebill stork was used as a source of inspiration to create visual concepts as suggested by most respondents. This was because the bird is a highly vulnerable and threatened species that are on a verge of extinction due to environmental degradation and pollution caused by poor disposal of waste through landfills and extraction of raw materials from its habitat. The researcher was also able to produce samples of relief sculptures using waste eggshells as a material through studio practice. Following the set objectives, relevant data for executing each activity was collected from the available literature and studio practice experience as described in the different chapters of this report.

1.7.2 Geographical scope

This study was based at Kyambogo University, School of Art and Industrial Design. This location was selected because it was a source of waste eggshells that were used in the studio exploration process. It also had easy access to sculpture students and lecturers who were key informants in this study. They are well equipped with knowledge regarding different waste materials and how they have been used at the School of Art and Industrial Design. Further, the University location provided the researcher avenue for consultation with the supervisors and interaction with fellow students offering the same discipline.

1.7.3 Time scope

The study was carried out in three (3) semesters at Kyambogo University where the study took place. It included data collection, production of studio artworks, and writing the final report about the exploration study of using waste eggshells as an alternative material for relief sculpture**.**

1.8 Limitation of the study

Transport means were a challenge due to the prolonged COVID19 pandemic lockdowns. This made it very difficult for the researcher to collect waste eggshells from identified sources and to purchase other studio-based tools and materials like adhesives to help in the production process of relief sculpture.

There was a problem of unfavorable weather, especially in the rainy season when artworks took a long period to dry especially those which were produced using wood glue.

The process of preparing eggshells for studio experimentations was time-consuming. Collecting the waste eggshells, sorting and cleaning, drying and crushing the material consumed a lot of time.

1.9 Definition of terms

In this study, the following terms were used as understood by the researcher in reference to the respective context;

Sculpture: This is a two or three-dimensional work made out of eggshells.

Eggshells: Material used to make sculpture

Rolex: A popular food item in Uganda combining egg omelet and vegetables wrapped in a chapati

Casting: Using an internal flame work to build paper onto it using glue.

Material: A substance of which a thing is made or composed like eggshells.

Relief: This is a sculptural method in which the sculpted pieces are bonded to a solid background of the same material.

SAID: School of Art and Industrial Design

Technique: This is a skill or procedure of rendering eggshells to form or create sculptures.

Waste: Something that is discarded or eliminated after the completion of a process.

CHAPTER TWO: LITERATURE REVIEW

2.0 Overview

The purpose of the study was to develop relief sculptures from waste eggshells as an alternative material for the School of Art and Industrial Design at Kyambogo University. Theoretical perspectives and literature related to this topic were reviewed and presented in this chapter. The review was organized and critiqued according to the texture and visual study objectives.

2.1 Theoretical framework

This study was based on the theory of production with waste and recycling by Conrad Klaus (1997) which states that, government should stimulate firms to enhance recycling of resources by a fee on waste. The theory also provides that, product responsibility means that a product will accompany its producer from cradle to grave. According to Conrad (1997), given the increasing rates of gross domestic product (GDP) and the population in most countries in the world, the management of solid waste becomes more and more of an urgent problem. Recycling of natural resources that are depletable is one way to mitigate this problem. The theory takes into account the definition of recycling as the re-processing and re-utilizing of solid (or liquid) waste as a resource at the wrong place in production line and in the wrong consistency. The economic system leaves behind a huge amount of refuse which in turn has a negative impact. Therefore if this process of environmental deterioration in quality and quantities is not acted upon, the conditions for future economic activities (regional and worldwide) will be seriously endangered.

In this theory, Conrad (1997) assumes that, government aims at stimulating the firms to enhance recycling of resources. This activity should yield a double dividend in terms of preservation of depletable resources as well as preventing the degradation of the quality of the environment. This theory therefore supports production by recycling to reduce waste disposal which degrades the environment, increase production and save natural raw materials. The theory also highlights that the producer has to prove that the required treatment technologies and pollution prevention measures have been installed and do function. This means that producers and manufacturers should not only aim at producing commodities but also ensure prevention measures of the effects of the bi-products produced during the production process. It should be

multiple usage, technically long lasting and easy to dispose. An instrument to stimulate recycling activities should be a fee on waste (solid or fluid waste). Such a fee is an indirect way to increase the price of raw materials and hence can induce the firm to substitute material saving technical progress and encourage recycling process. The tax system can also be used to promote recycling by taxing virgin raw materials and subsidizing recycling activities.

The theory of production with waste and recycling is challenged by Seadon (2010) who contends that during the last few decades, resource/ waste management has been developing operationally and technologically in response to resolve contemporary environmental, technical and economic challenges. However, current global waste management practices focus on reducing the impacts rather than preventing them and suggest the so called "end of pipe" solutions to waste problems rather than long-term sustainable measures. In this argument, Seadon (2010) highlights a challenge with the theory of production with waste and recycling by showing the need to prevent the impact of waste, if waste materials are recycled and new products are made, then the need for preventing the impact of waste will be neglected.

According to Kumar (2017), the major problems affecting solid management are on scientific treatment, improper collection of waste and ethical problems. This leads to hazards like environmental degradation, soil pollution, and air pollution. Kumar (2017) shows the different challenges created by waste recycling which can lead to various problems for example, the recycling process of polythene and plastic material produce emissions which cause air pollution hence environmental degradation.

However, the theory of production with waste and recycling was used by Micheal.Y & Sadhan, Kumar.G & Sannidhya. K, (2021). They observe that, the waste pickers who are the main actors in the waste management in most developing countries are not recognized by municipal authorities. Micheal and Kumar (2021) also add that, regulations are incentive driven with technological innovations which is the missing link in the country's development system. Therefore, they suggest that there are opportunities for the country's transformation which can inspire and stimulate youth to engage in waste recycling, industries in utilization of agricultural waste and urban centers in recycling by integrating waste pickers/ scavengers in upstream and downstream of waste management.

Relevancy of the theory to the study

Although this theory is challenged and criticized by many scholars, it is relevant to this study because it suggests goals, aims and strategies for implementing recycling of waste products. The theory also helps in spelling out the importance of recycling for production. For instance, if waste eggshells are recycled as an alternative cheap material to produce relief sculptures and other forms of art, there will be less or no excavation of clay, wood and stone for relief sculpture. Therefore, there will be a reliable, cheap and environmental friendly material for relief sculpture.

2.2 Different waste materials that have been used to create sculptures

Waste is referred to as any material that is left over, thrown away, or rejected from anything we do for example working, playing, or eating. Waste is a material that is not wanted by its producer. To many people, waste is known as rubbish, trash, or garbage. Managing waste has always been a problem, particularly since the Industrial Revolution in the 1800s which marked the introduction of power-driven machinery and the manufacturing of consumer goods on a large scale. Therefore, for a long time, wastes have been dumped wherever it is convenient, released directly onto land or in waterways, or even freely emitted into the air. Fortunately, visual artists at the School of Art and Industrial Design at Kyambogo University have come a long way since then and taken steps to collect wastes like polythene bags, scrap metal, plastics, paper, glass, and discarded electronics among others. Different artists have used these wastes in different ways by adding value to waste, profiling and documenting its importance through reducing, reusing, and recycling.

Recycling is the process of converting the old and used materials for a new use, for the same purpose, or some other purpose (Banumathi & Arokiaraj, 2011). In other words, to recycle means, to make products that can be reprocessed and converted into raw material to be used in another or the same product (Prakash, 2002). The recovery of useful materials such as paper, glass, plastic, and metals among others from trash can be used to make new products thus reducing the amount of virgin raw materials needed. These recovered items save cost and help in avoiding unwanted environmental pollution.

Recycling and reusing are more important today because there is more pollution and fewer natural resources like wood, clay, marble, and bronze which are used to make sculptures. Some people use these recycled materials to make art, especially those who use old tires, pieces of metal, plastics, polythene, and cloth among others. Almost anything can be recycled into art and these materials might come from yard sales or swap meets. In addition, some businesses also give used and unwanted materials like paper, polythene, glass, old computers, and phones among others to artists.

Olbrantz (2006) states that, environmental artists have increasingly turned to junk stores, trash bins, and surplus outlets to satisfy their urge to create while still caring for our planet. For a long time, visual artists have seen creative potential in using waste materials from the environment at the School of Art and Industrial Design at Kyambogo University. In the same way, Pablo Picasso who is one of the twentieth-century artists designed a bull's head from discarded bicycle handlebar and seat in 1942 as shown in figure 1. These objects were seized to serve their original functions and were instead changed into an artwork, a bull's head. It was described by Roland Penrose as Picasso's most famous discovery which was a simple and astonishingly complete metamorphosis. This artwork consisted of a great deal of Picasso's creativity and a degree of technique to work with discarded materials. Therefore, artists can change objects from their original purpose to a more creative idea other than leaving them to destruct the environment. Likewise, this study focused on turning waste eggshells into an alternative material for the production of relief sculptures. This contributed to the advantage of recycling materials by extending their life and reducing the amount of waste generated. The study also painted a new picture of eggshells from the waste they had become into a resourceful material that was used in the production of relief sculpture.

Figure 1 Bull's Head

Artist: Pablo Picasso

Material: bicycle handlebar and seat

Source: en.m.wikipedia.org

Asenso (2020) accounts that to help curb the global threat of environmental degradation and support Sustainable Development Agenda on the environment, some artists in Ghana are increasingly using bits and pieces to create artifacts in educating as well as sustaining and preserving natural resources. Environmental artist like El Anatsui, a Ghanaian sculptor has actively practiced his sculptural work in Nigeria as postulated by the Cultural Trip limited (2019). He got the world's attention for his bottle-top installations as shown in figure 2. The work comprises thousands of aluminum pieces got from alcohol recycling stations and sewn together with copper wire. This is then transformed into metallic cloth-like wall sculptures. Such materials, while seemingly stiff and sturdy are free and flexible, which often helps with manipulation when installing sculptures. Also, such processes of recycling are fascinating tools to awaken society considering the after effects of our actions on the environment. Hence, visual arts are an important aspect of promoting environmental conservation and preservation through recycling and reusing different materials. Similarly, this study advocated for the use of waste

eggshells as an alternative material for relief sculpture and is an important educational tool for caring for the environment, especially for young artists in the field of visual arts. Waste eggshells were identified as a brittle and fragile material to be used for sculpture and they turned out to be strong and flexible through studio exploration.

Figure 2 Metallic cloth-like wall sculpture

Artist: El Anatsui

Material: Bottle tops

Source: www.wikiart.org

Bodjawah (2018) states that artworks have a connection with social reality because in realizing images, or imaging material, the artists start from daily habits. Richard Atugonza (2019) is a Ugandan portrait sculptor and former student at Margaret Trowell School of Industrial and Fine Art, Makerere University whose subject matter and materiality blend people and their environment. A main component of the process is the interaction between the artist and the model. Atugonza carefully chooses his models and establishes an atmosphere in which he can connect with his subjects on a deeper level. His practice is an extension of a recycling line through the use of discarded plastics; saw dust, charcoal residue, and dry grass to make his sculptures more durable and to create different visual and haptic experiences as elaborated in figure 3 below. As well, some of the waste materials that are recycled at Kyambogo University include among others; polythene bags, papers, scrap metal, plastics maize husks, bottle tops, and fabric.

However, eggshells are exceptional waste material used for relief sculpture production. This could be due to limited studio exploration of using the eggshell as the alternative material. Therefore, this study focused on exploring the use of waste eggshells as a cheap and reliable alternative material that could be used in the production of relief sculptures. The relationship between humans and their environment was explored in terms of people's daily habits of poor waste disposal and waste management. This was advantageous in reducing the amount of waste sent to landfills and decreasing the need to collect new raw materials from the environment.

Figure 3 Grace

Artist: Richard Atugonza

Material: Combusted plastics

Source: afriartgallery.org

Ruganzu (2012) contemplated that he is an experimental artist who believes that the work he designs links the gap between the traditional and the present to anticipate the future. His work encourages recycling in Uganda and promotes environmental consciousness. Ruganzu is a former student and lecturer at Kyambogo University who experiments with different waste materials to emphasize the possibilities of recycled alternatives. He believes that Ugandan visual artists should become more aware of locally available resources. Therefore, he works with recycling waste materials such as plastic and polythene bags which are harmful to nature by converting them into play toys for children as displayed in figure 4 below. Additionally, recycling acts as a remembrance of the problems facing our planet and suggests inspiring others to change their lifestyle and reuse waste items in new, creative ways. Art is also one of the many ways of repurposing waste materials. Hence, this study examines the use of waste eggshells as an

alternative material to create relief sculpture since it is locally available. It is meant to inspire students and other artists to use waste eggshells for relief sculpture production. It is far much better to recycle, reuse and reduce existing waste materials than to damage our communities and land in search of new raw materials like wood and clay for relief sculpture.

Figure 4 Play toy

Artist: Bruno Ruganzu

Material: plastic bottle tops

Source: klaart012.wordpress.com

Byomugabe (2019) articulates that waste paper is thrown away as useless yet it acts as a material for sculpture which is cheap and accessible to work with (p.2). He is a former art student at Kyambogo University who uses waste materials, especially paper to produce a sculpture as presented in figure 5. He enlightens that Agenda 17 of the Sustainable Development Goals discusses the undertaking of climate change and conserving the environment from waste pollution (p.4-5). Using waste paper has many essential benefits like redeeming vegetation from exhaustion and decreasing waste that occupies landfills and emits methane as it breaks down. He ventured into creating sculptures out of waste paper since there is a lot of waste paper in buildings under construction, universities, and other institutions of learning. This study also supports the Sustainable Development Goals, especially agenda 12 which focuses on ensuring

sustainable consumption and production to reduce the destructive impact on the use of the natural environment and resources. Many sculptures have been created from recycling and reusing of waste to address this issue; although conventional materials like clay, cement, and wood are still being used to create relief sculptures at the School of Art and Industrial Design. Therefore, the study focused on developing relief sculptures from waste eggshells as an alternative material to use in the School of Art and Industrial Design at Kyambogo University. These waste eggshells were available and cheap to use in the production of relief sculptures hence need to reduce waste pollution by promoting proper waste management within and around Kyambogo University.

Figure 5 The Stamping Mukiga woman

Artist: Byomugabe Mark

Material: Waste paper

Source: kyuspace.kyu.ac.ug

Conclusively, every recycled art form brings to mind emotional feedback since it takes an extra step to tell a story within the final art itself. Regardless of the production process, recycled art takes existing objects and recreates them into new and interesting pieces to learn from. It reduces the pressure on new raw materials and encourages the use of more waste materials. Therefore in this study, the researcher intended to recycle and use eggshells as one of the wastes found within and around the school of Art and Industrial Design at Kyambogo University.

2.3 Design concepts for producing relief sculptures from waste eggshells for School of Art and Industrial Design

Takalo (2019) explains that concept design is about exploring ideas visually through a design process to a brief. If successful, the outcome continues past the design or art phase and into production. Therefore, design creation is a procedure of envisioning and planning the development of a work of art like painting, or sculpture among others through drawing. This means that the design process is a defined system of steps presented to help a visual artist in the planning and execution of artwork in the direction of solving a presented problem. The design process comprises numerous steps like describing the problem, gathering inspirational data, brainstorming and analyzing ideas through sketching to understand how data collected can influence your design, emerging solutions by creating prototypes, gathering feedback through the presentation of ideas to experts, and lastly, improving the design to suit the needs of respondents. These steps of the design process are expounded in figure 6 below.

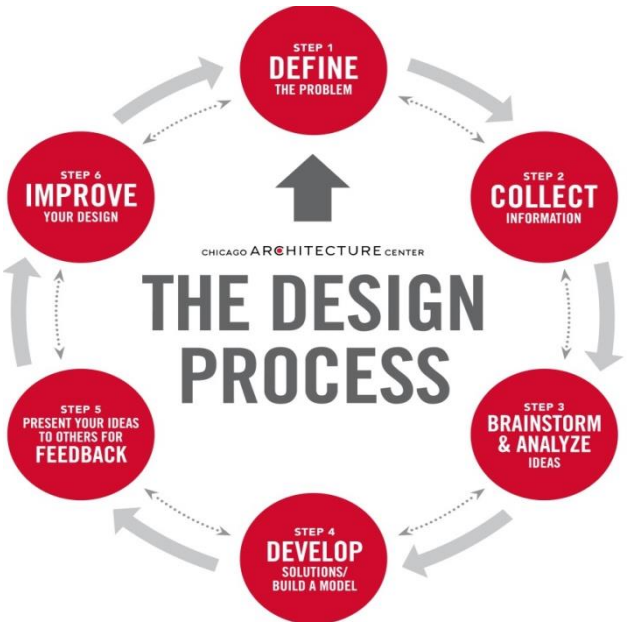

Figure 6 The design process

Source: https://discoverdesign.org

Purcell and Gero (1998) explain that a characteristic of the design process in all areas of design is the use of several different types of drawings. These drawings are associated with different stages of the process, relatively unstructured and ambiguous sketches that may have happened initially in the process. Designers place pronounced emphasis on sketches often because they are associated with creativity and innovation. Each successful work of art should have a series of drawings and sketches to inform idea generation for proper documentation, for example, the product design process by Spark Innovations (2022) in figure 7 below. In this study, the researcher sketched a variety of drawings considering the inspiration object as a shoebill stork which had been suggested by the majority of respondents. Studies of different parts of the bird both external and internal were sketched during the initial stages of idea generation. This helped in understanding the inspirational bird leading to great creative and original ideas which served as a stepping stone in the studio production of relief sculpture with waste eggshells as a material to fulfill the needs of the respondents at the School of Art and Industrial Design Kyambogo University.

Figure 7 Product design process

Source: https://www.sparkinnovations.com

Design creation is very important in expanding one's way of thinking and selecting the best ideas to put into consideration for the production process. Stefanescu (2017) states that sculptors, painters, and architects draw constantly to study, remember, and clarify their ideas. These studies are usually means by which artists develop visual stories meant to be included in detailed art composition. For most artists, drawing is also an ordinary allowance for their creative and innovative processes.

Yokochi & Okada (2007) revealed that artists develop expertise through several phases over the years. This was supported by Anderson (2006) who describes how the famous Italian renaissance artist Leonardo-da-Vinci began his study of birds through drawing when he realized that humans are too heavy to fly. In his drawings, he used bats' wings as the starting point as he saw them as not being heavy because of the nature of the membrane that is on their wings. He also studied flight and came up with a hundred drawings and sketches relating to flight as shown in figure 8. The result was him coming up with different designs for flying machines that are still being used today in the production of aircraft and other machines. Therefore, design creation greatly helped Leonardo-da-Vinci to creatively think about many ideas of flying machines using

one inspirational object and it was part of him to sketch and draw in all his artworks. In this study, there was a need to create a variety of ideas using a shoebill stork as an inspiration for relief sculpture production in studio practice. These ideas helped the researchers in developing different visual narratives through creativity that aided in the selection of the best concepts that were considered and included in the production of relief sculptures.

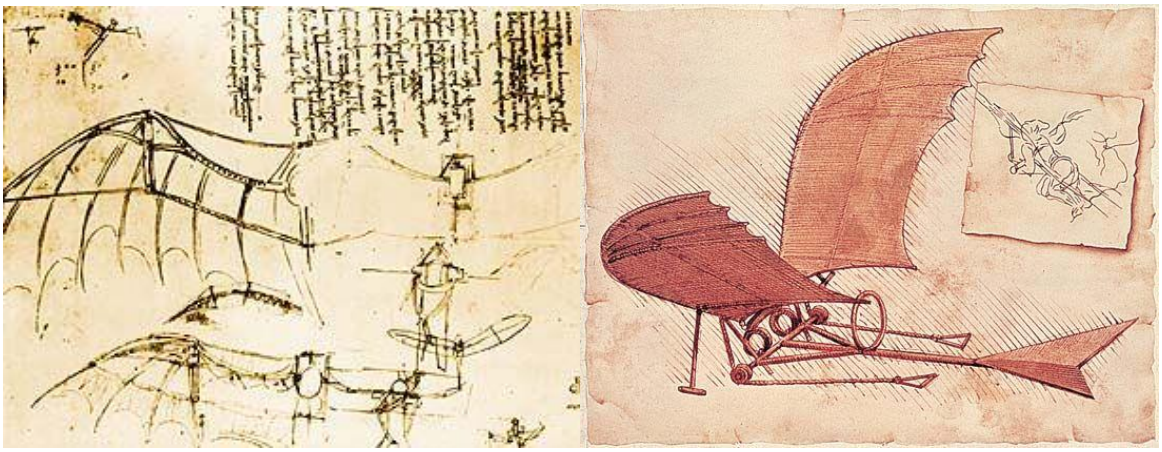

Figure 8 Inspirational designs for a flying machine

Artist: Leonardo-da-Vinci

Source: www.LeonardoDaVinci.net

Drawing has been increasingly extended and intensified at least during the last fifty years to include drawing production and drawing reflection (Milani et al, 2010). Bronya (2018) states that before the execution of the final project work, he created a sequence of sketches on activities done within the various disciplines in his area of study using drawing paper and pencils (p.30) as elaborated in figure 9. Therefore, drawing production during this study helped in idea generation by providing visual information about the characteristics of the inspirational bird and the appearance of the final relief sculptures before they were produced. Creative thinking was also very crucial in the process of conceptualizing ideas to develop relief sculptures from waste eggshells as an alternative material for the School of Art and Industrial Design at Kyambogo University.

Figure 9 Sketches of different activities

Artist: Bronya Moses, 2018

Source: https://www.academia.edu

Drawing is fundamental for productivity in concept creation, Ssenyondwa (2009) stresses that drawing in its widest intellect is used to develop an exciting and personal visual vocabulary. In this sense, drawing is essential to practice and develop sketching skills using different tools and materials like pencils, pens, and paper. It urges artists to select appropriate concepts for different projects in the production process. Closer observation of inspirational objects and the creation of great compositions is significant. This also informs the study by encouraging the use of principles and elements that are essential in a drawing.

Stefanescu (2017) also observes that artists need to register a perception or an idea and they can find instant gratification in the act of drawing. In addition to a quick sketch, there comes a slow and voluntary control of a drawing material that helps in mastering the different techniques used during the process. The artist may opt for an extra precise drawing as a master for a major component like a painting or a sculpture in the desire to carefully make a visual statement. In other words, artists can use drawing to register quick sudden ideas from the surroundings or use it as a process to create final design concepts that depict the appearance of the artwork. Thus, it is important to note that drawing is a crucial process of generating a variety of design ideas from which artists create work. Egonu (2021, p.32) was inspired by a hartebeest in the production of ceramic sculpture pieces as shown in figure 10. He studied the different postures and activities of the inspirational object through sketching and drawing from which he

was able to design a variety of ceramic works like a water pot, and fountains, among others. Therefore, this informs the study with a sense of creative sketches and drawings to develop design concepts for the production of different relief sculptures during the studio practice of manipulating waste eggshells as a material. Whereas he used a hartebeest as his source of inspiration to produce ceramic artifacts through sketching in pencil, in this case, a shoebill stork was used as an inspirational object to create different ideas for relief sculpture prototypes on paper using pencil and ink pen.

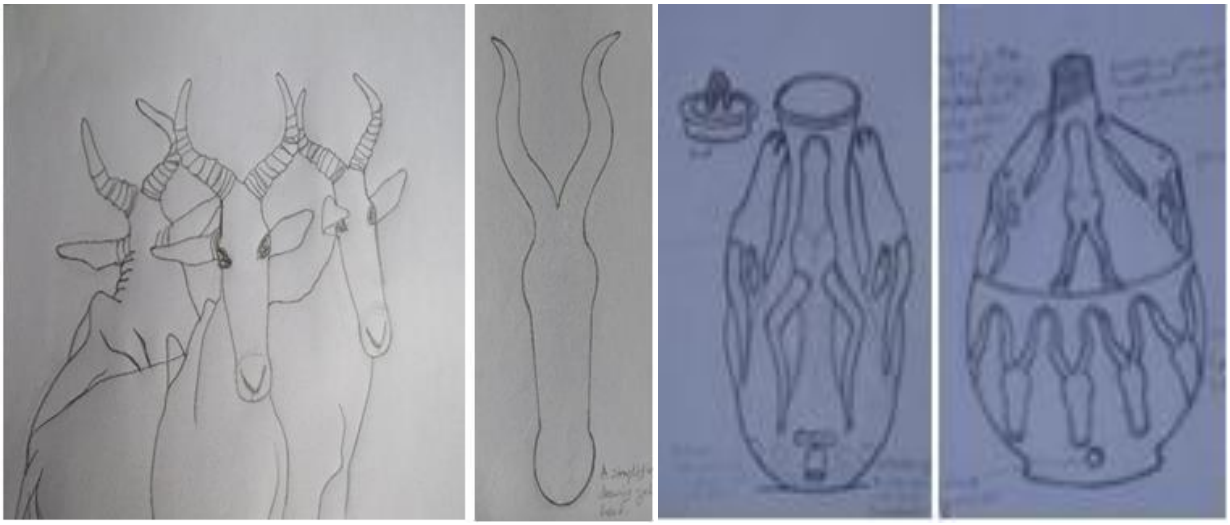

Figure 10 Idea generation of a water pot

Artist: *Egonu Charles, 2021*

Source: *kyuspace.kyu.ac.ug*

In figure 11, the researcher shows the relevance of the design process during this study. Drawing tools like charcoal pencils, ink pens, and 6B pencils were used on bond paper during the drawing process. This was of great importance in helping the researcher to familiarize herself with a shoebill as her source of inspiration from which final designs and prototypes were created.

Figure 11 Design process of relief sculptures

Source: *Researcher, 2021*

2.4 Development of relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design Kyambogo University

Durable sculptural processes originally used carving through subtracting the material and modeling by adding materials like clay, stone, ceramics, wood, and others that were extracted from the environment but, since modernism, there has been almost complete freedom of material process through creativity and innovation. Recycled materials are used differently in the process of sculpture production whether shaping figures in the round (three dimensions) or relief (two dimensions).

2.4.1 Modeling

Modeling is an additive method of manipulating soft materials that can be shaped by the sculptor's hands to create a two or three-dimensional form. According to Ocvirk, (1992), methods of addition may involve greater technology and in terms of nonfunctional sculpture; have brought about the most recent innovations for example software computer sculpture modeling. Artists like Viola Frey, 2002 used modeling to build man kicking the world in paper mache. When using additive methods, artists add materials that may be pliable and fluid, such as

clay, plaster, or cement. Therefore, the additive method was relevant to this study because it was creatively used by the artist to make a sculpture from waste eggshells as an alternative material for relief sculpture.

2.4.2 Casting

According to Orville (2010); Casting is a manufacturing process by which a liquid material is usually poured into a mold, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solid casting is then ejected or broken out to complete the process. Casting may be used to form hot liquid metals or various materials that cold set after mixing components such as papier-mâché, concrete, plaster, and clay. This process is often used for making complex shapes that would otherwise be difficult or uneconomical to make by other methods.

Casting is also one of the techniques in sculpture that involves creative skills and technicalities. Most sculpture figures are converted into permanent materials through casting. For example, Richard Atugonza transforms plastic into a durable casted sculpture through combustion. The technique involved in casting is therefore of much importance to the sculptor because reproductions of sculpture aid in making copies of pieces that are often needed for sale. Sculptors make a replica of objects through casting from indigenous times to this contemporary era and many decorative objects have been made from casting. Casting, therefore, is the first step in manufacturing different components and it comes in several forms such as sand casting, metal casting and lost-wax casting, among others.

According to Orville (2010), Casting is a manufacturing process by which a liquid material is (usually) poured into a mould, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solid casting is then ejected or broken out to complete the process. Casting may be used to form hot liquid metals or various materials that cold set after mixing of components. The artist begins by dressing his models with a bandage to get the negative, after which he manipulates through clay as an editing process to capture the expression of the figure to make a cast. This informs the study because different types of relief sculpture have different characteristics for example bas relief sculpture consists of design projections that are only slightly from the ground and sunken relief sculpture consists of carvings sunk below the level of

the surface. Therefore, both types of relief sculpture require little or no undercutting of outlines thus suitable for the casting method.

2.4.3 Construction and assemblage

Emerging in the twentieth century, the techniques of assemblage and construction consist of combining and joining various materials to form a three-dimensional object. These methods originated from the techniques of collage and mosaic, which are popularized by the cubists during the early part of the twentieth century in which artists cut and paste pre-existing materials such as paper, wood, metal, and others to create their art. Assemblage often includes combining pre-existing or found materials to create the sculpture.

Therefore, an additional method is relevant to the study since various types of relief sculptures especially high relief through assembling material in form of mosaics to express creativity. This is because high relief is characterized by forms that project at least half or more of their natural circumference from the background and some parts may be completely disengaged from the background. Since flat surfaces tend to be more successful than curved surfaces, waste materials are used with adhesives to create flat surfaces and construct projections that are at least half of their natural circumference from the background through assemblage.

Figure 12 Construction and assemblage

Artist: Michelle Stitslein

Material: Found objects

Source: www.artgrange.com

In figure 12, the artist gently and persistently joins the multiple different objects into unusual relationships and on the same surface to unite as a bold visual whole through the process of cutting, dismantling, and placement. Therefore, these already existing techniques that are used to recycle and reuse waste materials in the production of sculpture helped the researcher in studio experimentation to have a well-structured body of work.

2.4.3 Carving

This is a subtractive method of creating sculpture works whereby undesirable portions of solid material are cut bit by bit until the desired shape is attained. Fortuna (2019) defines relief carving as a method of sculpture in which a flat piece of wood is carved to reveal the illusion of a three-dimensional form. The procedure starts with a design from the artist's imagination. The design is coordinated to a piece of wood before it is placed out on tracing paper. Once transferred to wood, the design is reduced into modest forms. The artist must define which cuts will create the desired depth, illusion, and perspective. Using a variety of tools and techniques, the artist brings the design to life. The excess wood taken away with a mallet and chisel gives the depth of the modest shape. Gouging, burnishing, and scraping assist the depths expose their details. Shortly, the impression of a three-dimensional form is shown. Sandpaper is used to eliminate the remaining fragments from the background.

In conclusion, several art works have been created using waste materials from the environment to preserve raw materials such as clay, wood and others for future generations. During the creation of these art works, artists develop design concepts through drawing to help in the execution of two or three dimensional forms. These forms are developed using various methods and techniques of work that vary according to the artist's creativity, innovation and aim of production. The researcher used this process to achieve all the study objectives.

CHAPTER THREE: METHODOLOGY

3.0 Overview

This chapter explains the research design, area of study, study population, sampling procedure and sample size, data collection methods, presentation and interpretation of studio findings, reliability and validity of research instruments, and ethical considerations.

3.1 Research Design

The researcher carried out the study using a case study research design. This was an approach to research under a qualitative method that focused on gaining an in-depth understanding of a specific event or entity at a particular time. This is in agreement with Yin (2014), who describes a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not evident; and in which multiple sources of evidence are used. The case study design was used because; it was a good source of ideas about behavior, provided an opportunity for innovation, and was flexible to collect data through various means. Therefore, this study adopted a case study research design to explore the use of waste eggshells as an alternative material for relief sculpture at the Department of Art and Industrial Design at Kyambogo University. Through this design, different techniques were used to manipulate waste eggshells as a material during studio exploration. It was also helpful in exploring studio experimentations of tools and materials for idea generation. Several relief sculptures were produced as a result of this exploration.

3.2 Study area

This study was based at the School of Art and Industrial Design at Kyambogo University where the sculpture is practiced. This location also provided space for studio-based research and a venue for consultation with supervisors.

3.3 Population of the Study

Amin, (2005) defines population as the complete collection of the entire elements that are of interest in a particular investigation. Following this definition, the study was focusing on lecturers for sculpture and sculpture students at the School of Art and Industrial Design at Kyambogo University. Lecturers were selected as key informants due to their experience in research and publication which was inspirational to studio experimentations. They also provided data regarding waste materials which greatly contributed to studio innovations. Sculpture students were selected because they were knowledgeable about sculpture regarding different waste materials, processes, and tools used. The students selected were in their second and third year of study offering courses like Bachelor of Art and Industrial Design (BAID) and Bachelor of Vocational Art and Design with Education (BVAD) in 2021

3.4 Sampling procedure and sample size

Since the study area had a large population of sculpture students and lecturers, the researcher had to select a manageable number through the sampling procedure. This is supported by Marshall (1996) who states that choosing a study sample is an important step in any research project since it is rarely practical, efficient, or ethical to study the whole population. For that reason, the researcher used the purposive sampling technique which is described by Bryman, (2008) as a method that entails strategically selecting respondents, so that those sampled are relevant to the research questions being posed. The purposive sampling technique was applied based on sculpture students and lecturers who were practicing sculpture and were familiar with different waste materials, tools, and processes

3.4.1 Sample size

A sample size of respondents was selected from students offering sculpture and lecturers for sculpture. This was in support of Lavrakas (2008) who affirms that the selection of respondents to interact within the process of data collection is of great importance. The researcher selected 12 students and 3 lecturers because they had information about using different waste materials, tools, and techniques used in the execution process.

3.5 Instruments of Data Collection

Data is a key component of research and it is described by Mbokane (2001) as information obtained during the study. Therefore, the researcher used various methods of collecting data and these included interviewing, direct visual observation, Library and Archival search, studio experimentation, and photography.

3.5.1 Direct Observation

The observation was of great importance during the research process because it offered an opportunity for the researcher to collect live data from social situations that occurred casually especially studio practice activities. For that reason, the researcher was able to use both structured and unstructured observations during data collection. The structured observation was used in gathering data about recycled materials without involving the researcher directly and the data collection technique was an observation guide. During the observation exercise, the researcher selected areas of interest such as recycled materials used, design process, techniques and source of inspiration that guided her in critiquing different artworks since they communicate in a visual and tangible form.

The unstructured observation was applied during interview sessions with students and lecturers to confirm the information given and this is proven by Robson (2002) who adds that what people do may differ from what they say they do. In the same way, unstructured observation was employed to critically analyze participants' verbal speeches by relating them to their studio practice activities to reduce the difference gap between what they said and what they did.

3.5.2 Interview

The interview was selected because it is one of the methods in which willing respondents provided relevant primary data in line with waste materials used for sculpture, design concepts and methods of production. This study focused on qualitative interviews since they offered an opportunity to explore the use of waste materials which was of interest to the interviewees offering different experiences and perceptions in the field of sculpture. Although based on

everyday life conversations, it is efficient since it is organized with a view of building knowledge through the cooperation between the interviewer and the interviewee (Kabanze, 2012, p. 13). The researcher was able to collect first-hand information about waste materials, techniques and design concepts used in the production of sculpture as the interviews were one-on-one discussions with the respondent.

However, unstructured interviews were carried out on a personal basis by the researcher. It is emphasized that; Individual interviews, which can include key informant interviews, are useful for exploring an individual's beliefs, values, understandings, feelings, experiences, and perspectives of an issue. Individual interviews also allow the researcher to ask into complex issues, learning more about the contextual factors that govern individual experiences (Taylor, 2005).

In agreement with the above explanation, recycled art is an individual entity for students and lecturers since it involves personal experiences and interactions with recycled materials. Although their experiences might be similar, they cannot convey them in the same way. Hence, the researcher selected the personal interview method to allow an efficient procedure of getting in-depth data that was related to the methods of working with waste materials and execution of artworks. Interviews are important as a follow-up to certain responses to questionnaires, for example, to further investigate responses (McNamara, 1999).

To this regard, an interview guide is a tool that was outlined and used by the researcher to ensure that relevant data was collected during the interview discussions. The study objectives in chapter one were considered in the formulation of questions for the interview guide. The researcher made interview appointments with lecturers whereas students were interviewed after revising their study timetable through the class coordinators.

3.5.3 Library and Archival search

Library and archival search made it possible for the researcher to access secondary data by reviewing literature related to waste materials for sculpture, design concepts and methods of sculpture production collected from the internet, textbooks, and journals to meet the study objectives. McNiff and Whitehead (2009) suggested that; the researcher should be seriously

involved in the connection between what is known and the idea under exploration. This can be accomplished through connection with other measures of the issue or by reasoning construction in a wide literature search which teases out the meaning of a particular construct (i.e. a theory of what that construct is) and its constituent elements (Louis Cohen et al. 2011). In the same line, Kerlinger (1979) declares that; he who studies the literature scans his own experience and the experience of others. In the same way, academic works with various ideas concerning waste materials were analyzed. Published and unpublished sources like books, internet sites, newspapers, and reports were reviewed and helped in generating ideas for the study.

3.5.4 Photography

Photography was used by the researcher as one way of collecting visual information which was required to fulfill the study objectives. This was in agreement with Watt Boolsen, (2007) who explains that photographs and images are powerful tools that can describe actions, emotions, and moods in humans and animals. Hence, a digital camera was used to capture photographs of studio activities including drawings from the initial studies of the source of inspiration and other studio based activities. These were finally used throughout the process of conducting this study. Some images related to the study were also acquired from different sources on the internet and incorporated into the research. This method was helpful to the researcher in describing what she saw by studying pictures as stated by Erdner & Magnusson, (2011) who further explain that it is easier to think in pictures than in words.

3.5.5 Studio Experimentation

Studio experimentation is a method which was employed in the fulfillment of objective three of the study. The experimentation process stemmed on collection, preparation and application of waste eggshells as a material under investigation; where the researcher was working independently. Other participants that is to say students, lecturers (supervisors) and other commercial artists joined during the critiquing sessions.

3.6 Data Analysis

All the data collected from the field was analyzed using the inductive coding approach. Also known as open coding, inductive coding approach is where the researcher started from scratch and created themes based on the data collected. All the themes were generated directly from the study responses. The researcher combined both in vivo, process, and value coding methods to represent data in chapter four. Direct quotes and non-verbal information through observation were presented regarding the interpersonal experiences, values, beliefs, and actions of respondents. This helped to avoid misinterpretation of data during the coding process. Working systematically with coding allows the inductive researcher to observe transparency and thus offers reliable interpretations of the empirical material (Gioia, Corley, and Hamilton, 2013). The content was then used to develop relief sculptures from waste eggshells as an alternative material for the School of Art and Industrial Design at Kyambogo University.

3.7 Validity and reliability

Validity and reliability are essential subjects in assessing the quality of research as they indicate the extent to which study findings reflect the world that they are seeking to explore (Kabanze, 2012). To ensure validity, the researcher pre-tested all methods of data collection used. This enabled her to identify and eliminate weaknesses in the instruments before carrying out the final exercise of data collection even though it was time-consuming. Therefore, the researcher used appropriate methods and tools of data collection that best represented the research intent.

To determine reliability, the researcher selected reliable sources of data from the School of Art and Industrial Design at Kyambogo University. She selected participants in the field of sculpture and waste materials who acted a crucial role in giving primary data to the study regarding materials, techniques, and relief sculpture. Lecturers who participated in this study were selected through consultation to confirm their areas of specialization. Therefore, they were able to give dependable information concerning the objectives of the study. Sculpture students were also selected during their sculpture lessons with the help of class coordinators. This is because they were well equipped with knowledge about sculpture regarding different types, materials, processes, and tools used.

3.8 Ethical consideration

The researcher obtained a letter from the School of Art and Industrial Design which was presented to the respondents. All respondents were interviewed by the researcher in person and their views were respected in this study. The participants' concerns were considered and their opinions respected. Documenting data did not involve the names and contact numbers of respondents in order to keep them anonymous and their responses confidential.

CHAPTER FOUR: PRESENTATION AND DICUSSION OF STUDIO FINDINGS

4.0 Overview

In this chapter, the researcher presented findings from the field in various sections according to the objectives of the study. In section one, the researcher presented different waste materials that have been used to create sculptures by means of narratives from respondents whereas section two discussed about the design concepts for producing sculptures from waste eggshells as an alternative material using visuals of sketching and drawing. Lastly in section three, the researcher presented and discussed studio experimentation process of using waste eggshells as an alternative material to create relief sculptures in visual format.

4.1 Different waste materials that have been used to create sculptures

Through recycling, reducing, and reusing, waste materials have been used to produce artworks both on a large and small scale in the School of Art and Industrial Design. This was due to the large amounts of waste discarded from the different working studios. Findings show that using waste materials in the production of artworks helped to reduce environmental degradation within and around the School of Art and Industrial Design. Therefore, well-managed waste could contribute to a clean town and a model for good governance for others (Scheinberg, Jgosse, & Anschütz, 2004, p. 11).

Expectations of the above scholars are related to students' responses, who said that,

> We have seen many students in the department creating work from different waste materials like plastic bottle tops, kavera, plastic bottles, jerricans, scrap metal, paper, and metallic bottle tops. But others use clay, cement, wood, and plaster of paris. Most of them are proud of their work because it is retained in the department, and some of them are excited and want to show every student that they know how to work with waste materials. For example, there was a student who did a project about polythene bags to promote environmental cleanliness and told all of us to go and see his community project. Many people in that community were helping him to collect the "buvera" and clean them so that he could add them to the artwork. Most people especially women and children are now

very proud of their community and treasure kavera because they are earning a living. They make handbags, bracelets, and shoes afterward sell them, and get money.

They added that no one in our class is doing relief sculpture but we studied it. We were using clay but it was complicated because some parts of the work broke off when we were taking them to the exhibition rooms. Others were having cracks after drying. We haven't seen other materials used to make relief sculptures but there are those pieces made in cement and iron bars. They are good because they cover this trench although they look old. When we were studying relief sculpture, we were modeling in clay using our hands. (6th September 2021, face-to-face interview)

Similarly, one of the lecturers also narrated that;

> There is a group of people, some were my students here at Kyambogo offering different specialties in the department and are working with plastic bottles to build houses. They are based in the Mpigi district and have good teamwork. One of them told me that there is an organization supporting them. These guys mobilize community members especially women to collect plastic bottles from the community, they sort them and fill them with sand. These women are earning money daily depending on the work done. I tell you that this place has become a tourist attraction and a center of learning for other artists. They come from all over the country to come and see these built structures. It is very inspiring and I'm glad that other artists have also come up to use these materials in reducing waste. I think that any recycled material can be used to create relief sculptures although it is given less attention. Therefore, materials like metal, plastics, polythene, and paper can be used in making relief sculptures. The only difference we have here is that this other common sculpture you see around the department is 3D (three dimensional) yet relief sculpture is 2D (two dimensional). So we need to see students coming up with more materials and venturing into relief sculpture. There are many ways of coming up with a relief sculpture for example casting in materials like metal, we have assembled relief sculptures and it also depends on what a person wants to achieve. (14th September 2021, interview)

Another lecturer explained that;

> I have a student whom I taught and I remember that student was using waste maize husks. This student became a very powerful artist when it comes to maize husks. That is

> one way how artists have tried to conserve the environment. He is now producing very many works in the same material and making a lot of money. This artist makes slats for nursery schools, mats, and even books. I even bought two books from him and kept them for reference purposes. He is very proud of his work and I'm happy that he went ahead to do mass production. However, on the side of relief sculpture, there are very few students who opt to do it because of limited materials. This is partly because when they come and see these works made from plastic bottles and paper, they become so excited and desire to do something similar. But there are materials like paper mache and sawdust which students have used in relief sculpture through casting. (14th September 2021, interview)

The third lecturer for sculpture also responded by saying;

> I think you have seen many sculptures within the compound of the department made out of recycled material. For example, there is a frog from plastic bottles, a shade from polythene bags, students have used sawdust, scrap metal by Jimmy Gidudu and so many others. Sometimes these artworks end up becoming a problem in the department. So we advise students to reuse them again, especially metal. However, most of these artworks are three-dimensional sculptures. But in relief sculpture, students use clay and cement to produce finished reliefs. Yes, other alternative materials are being used by students for relief sculptures like scrap metal. But relief is very common in interior design and landscaping where materials are assembled though most times they are more of mosaics. (14th September 2021, interview)

This shows that waste materials were used to create not only sculpture but other forms of art like painting, and multimedia crafts among others.

However, some sculpture students responded by saying that;

> They usually see students using recycled materials and their lecturers tell them that recycling is good but their work looks shabby. It is scrap metal which looks good although it is difficult to use. So for them, they produce marquettes in clay and then use cement and wood to build the final works. They even studied a course in materials for sculpture but used clay, metals, binding wires, and wire mesh. They didn't like using these recycled materials because they were not interested. (6th September 2021, interview)

This was evident that while most students focused on conserving the environment, others did not care whether recycling waste material was of any importance. In addition, three-dimensional sculptures are most popular for waste materials than two-dimensional sculptures.

4.2 Design concepts for producing relief sculptures from waste eggshells for School of Art and Industrial Design

To create design concepts that are relevant for addressing the challenge of limited materials for relief sculpture at the School of Art and Industrial Design at Kyambogo University, several ideas were gathered from sculpture students and lecturers teaching sculpture and the following views were given and considered in this study.

The majority of the students preferred to use waste materials in the production of relief sculptures. This was emphasized by students who said that;

> There are many waste materials in our department like paper, banana fibers, scrap metal, eggshells, wrapping papers for sweets and biscuits, pen lids, maize cobs, leaves, and ground nut husks. These can be used to increase the number of materials for relief sculptures that are not expensive to buy and are reliable. This can motivate us to carry out different projects in relief sculpture. (6th September 2021, interview)

Whereas fewer students preferred conventional materials by stressing that;

> "We are using wood and metallic sheets as materials for sculpture because we can afford to buy them. These materials are clean and appealing to work with." (6th September 2021, face-to-face interviews)

All lecturers were interested in using waste materials to produce relief sculptures and they explained that;

> In today's world, professional artists are not limited to using conventional materials only. All waste can be recycled and used as a material in art. Therefore, we need to see more developments in using waste materials for relief sculpture than a sculpture in the round because almost all students tend to run away from relief sculpture due to limited innovations in material culture. (14th, 17th, and 20th September 2021, face-to-face interviews)

To execute design concepts for producing relief sculptures from waste eggshells for the School of Art and Industrial Design, different opinions about inspirational objects for the study were

given by respondents. The majority of the students preferred birds as a source of inspiration as follows;

> If we are using waste eggshells as a material, we should also consider using birds like hens, doves, eagles, shoebill, turaco, marabou stork, and crested crane as sources of inspiration since they lay eggs. This can also help to document the existence of some types of birds that people have never seen. (6th September 2021, face-to-face interviews)

However, very few students preferred animals like zebras and cows as inspirational objects since they feed on grass from the environment.

In addition, lecturers also supplemented by explaining that;

> When you're selecting a source of inspiration, there are certain factors that you should consider for the sake of your research. First, consider the relevance of that particular source of inspiration to your research. If you are using waste eggshells as a material for relief sculpture, then how is the selected source of inspiration related to the eggshells or the concept you are working on. For example, you can help to reduce the amount of waste thrown away in landfills which leads to depletion to protect the habitat of your inspirational object. (14th, 17th, and 20th September 2021, face-to-face interviews)

Having gathered information about the inspirational objects that respondents preferred, more information was needed by the researcher on how to start the design process that led to the production of relief sculptures using waste eggshells as an alternative material for the School of Art and Industrial Design. Different opinions were given by respondents and students described the design process as follows;

> Once you get a source of inspiration, study it very well and make a variety of sketches and drawings to show all the details. Then generate ideas from the drawings and use them to create prototypes in relief sculptures using eggshells. You can first make objective drawings then you make abstract drawings that will help you in the studio. After creating the prototypes, then you start producing masterpieces. This can even help us to follow those steps of production when we want to make our artworks using waste eggshells as a material for relief sculpture. (6th September 2021, face-to-face interviews)

In agreement with students, lecturers were also able to give their views about the design process as follows;

> Usually, the design process is a series of different steps taken one after the other to help you in coming up with prototypes than the final project. You need to have a work plan so that it guides you as you are working. Planning is very essential in the design process because it will help you not to lose track of what you are doing. You need to brainstorm ideas through sketch work and drawings so that you don't forget. It is these sketches of your source of inspiration that will help you to design different ideas. And at the end of the day, you will find it very easy to select the most appropriate design for studio production using eggshells as a material. Therefore after you have given us all those drawings, we shall be interested in seeing tangible products inform of prototypes for relief sculpture. That can be a good start for your studio practice. These sketches you make will even help you in documenting whatever source of inspiration you choose so that it is easier for you to produce work. Now, production of work will be simplified once you have mastered your source of inspiration and you're familiar with it. (14th, 17th, and 20th September 2021, face-to-face interviews)

Respondents were also interviewed about the types of relief sculptures that they wanted to be produced from waste eggshell material. The following ideas were given by different students.

The majority of the students who were interviewed explained that;

> We wish to have a low relief sculpture from eggshells showing beaks of different birds because apart from the colorful feathers, birds also have interesting beaks. Low relief and high relief are easy to make and usually have interesting features with principles and elements than sunken relief sculptures. Also, you can show us birds hunting for food from the environment. This will also help freshers who come to the department to understand the difference between high and low relief sculpture. I think eggshells can be very interesting to work with when you produce an artwork showing many broken eggshells in different sizes. (6th September 2021, face-to-face interviews)

Other students responded by saying;

> You can use medium relief sculpture to produce birds taking care of their young ones. Also, sunken relief sculptures can be used to produce heads of birds sinking to show how the environment has been degraded. You can also create a relief sculpture showing how a shoebill looks like. (6th September 2021, face-to-face interviews)

A student also suggested that;

> "I want to see a high relief sculpture with wild animals in a jungle. It can be a composition of many activities of wild animals like you show some eating, others drinking water and climbing trees." (6th September 2021, face-to-face interviews)

However, lecturers also gave their submissions about what they wanted the researcher to produce as follows;

> Since you are bringing a waste material to light for the School of Art and Industrial Design, produce a relief sculpture that will be used for educational purposes. For example, if we are dealing with new students who don't know anything about relief sculpture, can this artwork help us to demonstrate what relief sculpture is all about. However, we can have tiles created from eggshells in relief for interior designing, skirting for walls, and false ceilings for the interior. (14th, 17th, and 20th September 2021, face-to-face interviews)

In conclusion, the researcher and respondents agreed to produce sketches and drawings of any source of inspiration to guide the studio practice. However, several suggestions were given about the source of inspiration and most respondents were interested in birds. So, the researcher selected a shoebill stork because it is a highly vulnerable and threatened species that is on a verge of extinction due to environmental degradation and contamination caused by poor disposal of waste through landfills. This was to help in documentation of its existence while creating relief sculptures from waste eggshells as an alternative material. Hence, the entire studio activities were guided by drawings created from a shoebill stork. The artworks produced were referred to as projects according to the different themes identified from the data that was collected. These projects were as follows; Project one represented a low relief sculpture under the theme of bills since respondents suggested having an artwork showing the beaks of birds. Project two represented a high relief sculpture under the theme of hunting whereas project three represented medium relief under the theme of mother care as suggested by respondents. Projects four and five represented low reliefs under the themes unity and shattered respectively. Lastly, project six represented three types of relief that are; high, low, and sunken relief under the theme of freedom. Most of the relief sculptures were designed based on the different objective characteristics of a shoebill stork whereas others were subjective through imagination concerning respondents' views as described in the following sections.

4.2.1 Project one: The bills

This artwork was designed using the structure of a shoebill beak. This was because respondents suggested having relief sculptures showing the beaks of birds. According to the source of inspiration selected, the name shoebill originated from the appearance of its large shoe-shaped bill. The beak was therefore found to be the most interesting physical feature of this bird which measures about seven inches. It is very strong enough to decapitate a six-foot lungfish and that is why it is usually compared to a dinosaur. Therefore, objective studies were made and ideas were generated from the shoebill beak to help in the production of a low relief sculpture that was meant to serve both aesthetical and study purposes.

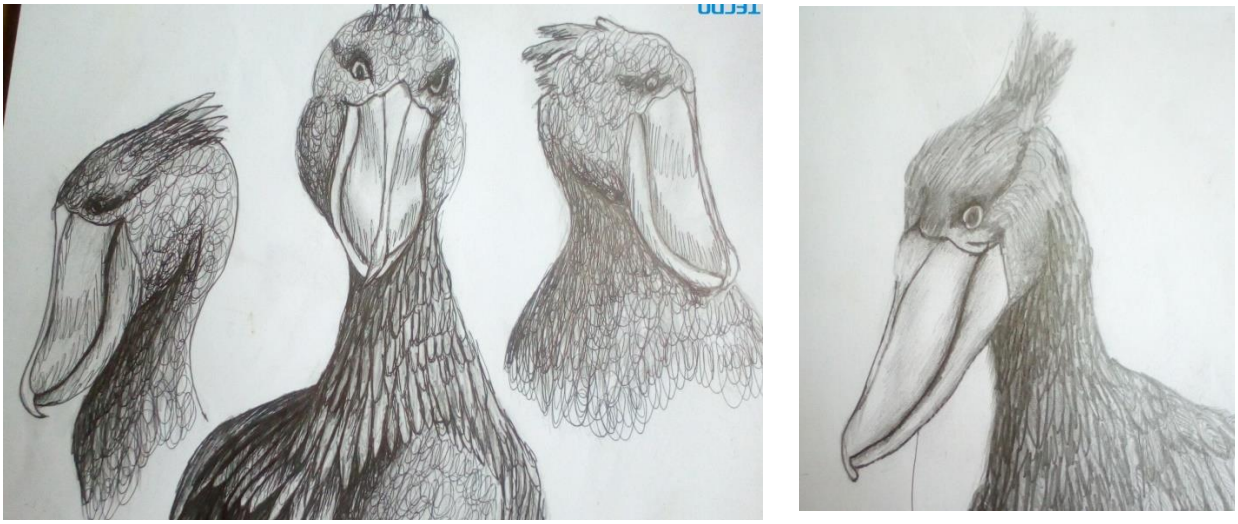

Figure 13 Objective study drawings of a shoebill beak

Source: Researcher, 2021

Figure 14 Idea generation for beaks

Source: Researcher, 2021

Figure 15 Concept drawing for relief sculpture

Source: Researcher, 2021

4.2.2 Project two: Mother care

The shoebill was studied and drawn objectively considering form and posture using pencil and pen on bond paper. Subjective studies were also made during idea generation. It was meant to depict how a mother shoebill takes care by protecting its young ones. A shoebill usually lays up to three dull, chalky-white eggs, and two chicks are hatched and they fight until one of them survives. Usually, the eldest chick is the strongest. It will bully and attack its younger sibling in a deliberate and systematic manner. Therefore, the final idea generated consisted of a shoebill with its young chick.

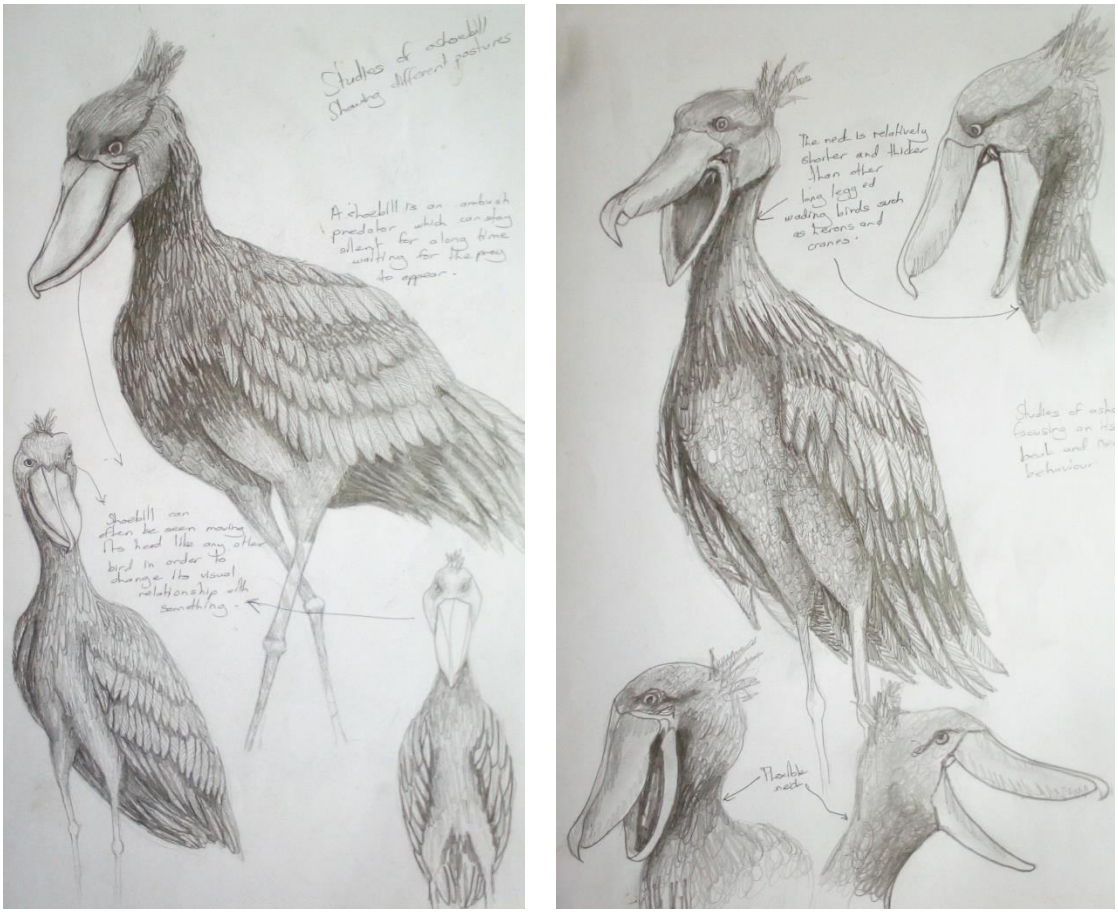

Figure 16 Objective study drawings of a shoebill stork

Source: Researcher, 2021

Figure 17 Idea generation for relief sculpture

Source: Researcher, 2021

Figure 18 Concept drawing for mother care

Source: Researcher, 2021

4.2.3 Project three: Freedom

This artwork shows all the three types of relief sculpture, that is; high, low and sunken relief sculpture. It was inspired by a shoe bill wings in a flying posture to signify freedom. This was because shoebills tend to act like kings of the jungle due to their hunting characteristics to the extent of eating young crocodiles. However, this bird does not fly so high from the ground due to its heavy weight body. Objective studies were made on bond paper using pen and pencil as shown below.

Figure 19 Objective studies of shoebill in motion

Source: Researcher, 2021

Figure 20 Idea generation for freedom

Source: Researcher, 2021

Figure 21 Concept drawing for freedom drawings

Source: Researcher, 2021

4.2.4 Project four: The hunt

This artwork was inspired by the hunting techniques of a shoebill stork. When a shoebill hunts, it knows exactly how to find what they want. Instead of wasting energy flying around, it will find a strategic spot of the swamp and play dead. This bird can stand motionless for some good time without even moving a single feather and then it will strike its prey violently and instantly. When prey comes within range, the shoebill thrusts forward, opens its beak and grabs everything in range including mud, water, grass and its prey. Therefore with a hooked upper ridge of the beak, the shoebill is capable of piercing the skin of its prey. Using its razor-sharp beak, the shoebill rips the head of its prey before proceeding to swallow its victim.

Figure 22 Objective drawings of a shoebill in the hunt for food

Source: Researcher, 2021

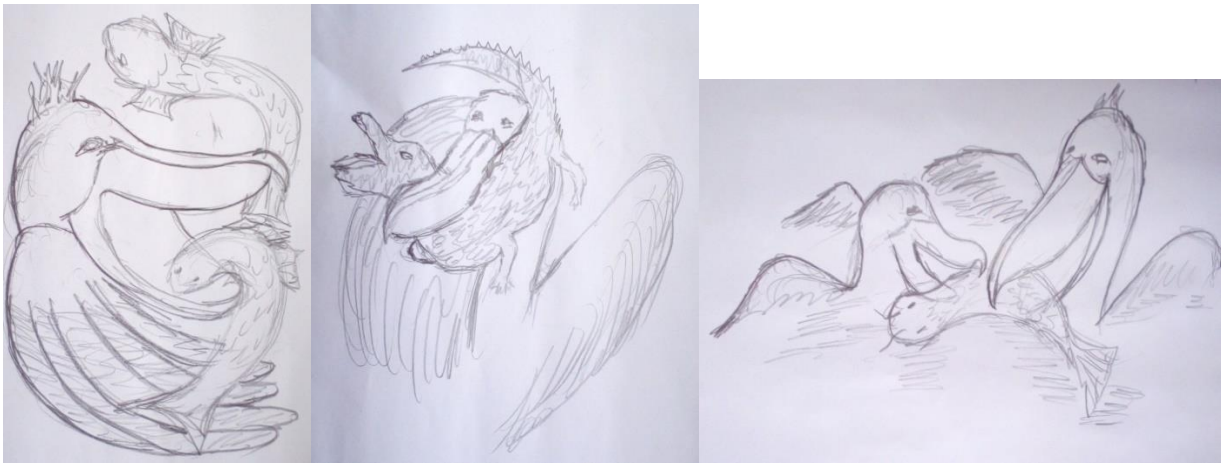

Figure 23 Sketches for idea generation

Source: Researcher, 2021

Figure 24 Sketches for idea generation

Source: Researcher, 2021

4.2.5 Project five: Unity

This project was inspired by the monogamous nature of shoebills. These birds form pairs from an early age and aggressively defend their partners against any rivals. It is from this that the artwork was titled unity. A shoebill stork exists in small localized populations concentrated around swamps and wetlands. Individuals are highly solitary where the male and female in a breeding pair prefer to occupy different ends of their shared territory.

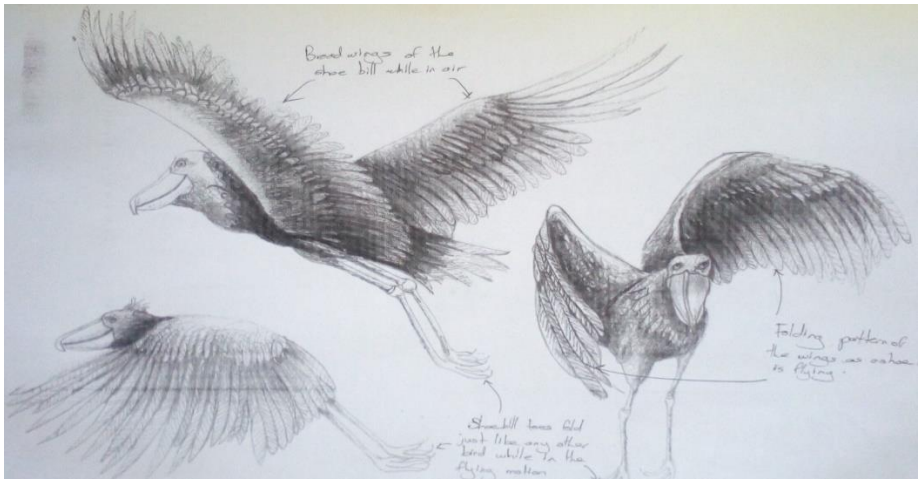

Figure 25 Objective drawings of a shoebill family

Source: Researcher, 2021

Figure 26 Idea generation

Source: Researcher, 2021

Figure 27 Concept drawing:

Source: Researcher, 2021

4.2.6 Project six: Shattered

This art work was inspired by broken eggshells as suggested by respondents. The researcher considered the fact that a shoebill is undergoing a continuing decline due to habitat destruction and degradation, pollution, nest disturbance, hunting, and capture for the live bird trade. This led to the production of a relief sculpture under the theme shattered.

Figure 28 Idea generation

Source: Researcher, 2021

Figure 29 Concept drawing

Source: Researcher, 2021

4.3 Studio experimentation

In this section, studio experimentation was used to fulfill study objective three. The process of experimentation was based on sorting, preparing and applying of waste chicken eggshells as a material under investigation through working with some lecturers and supervisors at the School of Art and Industrial Design.

4.3.1 Identification and collection of materials and tools

The tools and materials collected were adhesives like; wood glue, candle wax and resin which greatly helped to hold eggshells together in a solid form at different stages of production. Clay is a material that helped the researcher to create moulds for the casting process. Cold water dyes were used to add color to the eggshells, digital cameras which were used to capture photographic data during and after studio processes, computer for typing and editing both text and photographic data. The pencils and drawing books helped the researcher to analytically study her source of inspiration which was the shoebill stock. They also helped in drawing development

stages leading towards execution of different artworks in relief sculpture for School of Art and Industrial Design Kyambogo University.

(a) (b) (c)

Figure 30 Candle wax, wood glue, Resin and hardener

Source: Researcher, 2021

4.3.2 Studio practice and findings.

4.3.2.1 Collection and preparation of waste eggshells

Studio investigation involved creation of relief sculptures using specific materials, tools and techniques. Therefore, this section presents the steps which were undertaken in the collection and preparation of waste eggshells for relief sculpture production.

Physical properties of eggshells

The shell of an egg is oval in shape and fragile but somehow it is seen to be strong since it prevents cracking in order to preserve the embryo until hatching in a natural environment. According to Ebubekir et al. (2008), an eggshell should be strong enough to prevent cracking in order to preserve the embryo. Therefore, studies on the physical properties of eggs have shown that normal chicken eggs have elliptical shape (Ebubekir et al., 2008). Hence, eggshell differs in

sizes and colors owing to numerous factors regarding egg production in poultry due to the genetic make-up, the feed intake, the age of the hen during the egg production cycle and environmental conditions such as temperature, aeration and among others (Nys et al., 2011). Eggs must be stored away from strong smelling food since it can cause it to have strong scent. Eggshell quality has almost 2.3g of calcium in the shell and a hen needs to consume about 4g of calcium per day to maintain good shell quality. The shell should be dry, clean and free of any cracks. Egg size is related to shell quality. Smaller eggs have stronger shells and larger eggs have weaker shells. As hens get older, their eggs get larger and as a result egg shell quality can decline. Weaker-shelled eggs will be more prone to cracking. Bacteria can also penetrate the shell and reduce egg quality, particularly when there are cracks. The color of the shell is determined by the genetics of chicken and does not affect the quality of the egg. As a general rule of thumb, white feathered hens lay white eggs and brown feathered hens lay brown eggs. When hens age, there is less intestinal calcium uptake which affects the thickness of an egg negatively but leads to increased egg size and decrease in production level (Rayan et al., 2010).

Identification of different sources of wasted poultry eggshells

During the investigation, different sources of wasted poultry eggshells were identified in addition to the department space and canteens at SAID. These included homes of residence and rolex kiosks in the neighborhood of KYU especially Banda trading center. In the course of the study, it was learned that after removing the egg content, shells are thrown away as waste garbage thus leading to pollution. It was also observed that large quantities of eggshells are found in places where there is poor waste management.

Figure 31 Eggshell waste from homes of residence

Source: Researcher, 2021

Rolex kiosks are small stalls within our communities where people pan fry chapattis and eggs for public consumption. Thus, a rolex is a combination of a chapatti and egg omelet rolled together depending on the customers' preferences. It was observed that these places were constantly polluted with waste eggshells due to poor disposal habits. These were reliable sources of eggshells since one could hardly walk for half a kilometer without spotting a rolex kiosk and are commonly seen on the road sides in Banda trading center which is neighboring Kyambogo University on the southern slopes of Kyambogo hill.

Figure 32 Eggshell waste at rolex kiosks

Source: Researcher, 2021

Collection of wasted poultry eggshells from the identified sources

After identifying the reliable sources of the material, the researcher teamed up with friends to go and start gathering and collecting the waste eggshells. Since these waste eggshells were disposed as unwanted, they were in dirty places piled with different kind of garbage. Therefore, it was for the good of one's health to buy gloves which were used in collecting these eggshells without acquiring infections from the dumpsites.

During the collection process, it was observed that one had to be very careful to avoid cuts and wound caused by broken bottles, glasses and other sharp instruments thrown in the garbage. Some eggshells were in decomposing rubbish which can cause infections if not carefully handled. Also, most of the dumpsites have a bad smell especially during the sorting process and therefore nose masks were also used. It was also observed that some eggs especially those that had gone bad were dumped together with eggshell. Therefore, one had to be extra careful to avoid crashing them since they contain a terrible smell. Even during the collection of waste eggshells from rolex kiosks, caution was taken to avoid burning with fire and destructing the vendors.

Figure 33 Collected dirty eggshells

Source: Researcher, 2021

The cleaning process begins

During the data collection period, it was advised that waste eggshells could be cleaned with either cold water or hot water. In an interview with a lecturer at Kyambogo University, it was realized that boiling water with eggshells for about 15 minutes could help to remove the remaining egg membrane as it hardens thus easy to clean. This also helped to kill germs which are contained within the waste eggshells and prevent infections in case of any open wound on the hands. After, the eggshells were left to soak and water to cool for about 30 minutes before washing them whereas the white hardened membranes from the eggshells were scooped off to avoid unpleasant smell. The eggshells were exposed under the sun to dry as shown. Hence, it was observed that eggshells dried faster when exposed before crashing than when crashed before exposing them to sun dry. Different containers like buckets, saucepans and basins were of great help in the cleaning process.

Figure 34 Cleaning eggshells using hot water

Source: Researcher, 2021

During studio experimentation, it was also observed that eggshells could alternatively be cleaned using cold water. This method was more flexible and could be used at anytime from anywhere since there was no need to boil water. First, the dirty eggshells were put in a container/ basin, cold water was poured and left them for about 15 minutes to soak. The eggshells were then washed and spread to dry under the sun as shown in figures 35 and 36.

Figure 35 Washing eggshells with cold water

Source: Researcher, 2021

Figure 36 Washed eggshells spread to under the sun to dry

Source: Researcher, 2021

These eggshells were then crashed when dry to desirable particles. During the experimentation process, it was observed that clean dried eggshells could be used without crashing. However, interesting visual textures were achieved when these eggshells are crashed into different grades ranging from big particles to powder form as shown in figures 37, 38 and 39. This also made the experimentation process easy since these grades were much more flexible to use with adhesives like wood glue and candle wax in creation of relief sculpture. A mortar and pastel were used to crash the eggshells and obtain different sizes of particles whereas a grinding machine was used to obtain the powder form of eggshells.

Figure 37 Crashed eggshells in different big particles

Source: Researcher, 2021

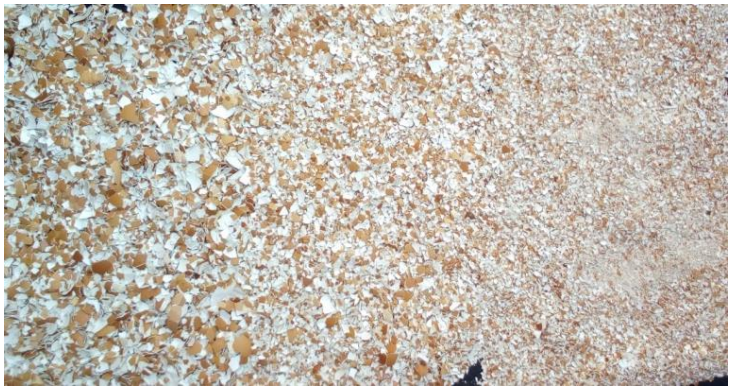

Figure 38 Crashed eggshells in different smaller particles

Source: Researcher, 2021

Figure 39 Clean eggshells grinded into powder form

Source: Researcher, 2021

4.3.2.2 Production of prototype surfaces for relief using different adhesives

Adhesives, also known as binders were very useful in making materials to adhere together when creating artifacts. Some of them were liquid binders like wood glue whereas others were simply liquefied by heating them and dissolve materials from individual particles to solid state. Therefore, adhesives were described as liquid substances that harden by a chemical process and adheres particles when added together. According to Vick (1999), adhesives can effectively transfer and distribute stresses, thereby increasing the strength and stiffness of the composite. Therefore, different adhesives like wood glue were used. Candle wax was also used in studio experimentation process of using eggshells to create relief surfaces.

Once the material was ready for use, the researcher started her studio experimentation process beginning with wood glue as an adhesive. This stage concentrated on testing the potential of different grades of eggshell material to become intact once mixed with different adhesives as shown in figure 40.

Figure 40 Mixing eggshells with wood glue

Source: Researcher, 2021

In figure 41, the researcher mixed eggshell powder and poured it into a frame to create a flat surface from which a relief could be built. Different eggshell particles were also arranged onto it to create variations in tonal values.

(a) (b)

Figure 41 Creating flat surfaces using eggshell powder and wood glue

Source: Researcher, 2021

In figure 42, assemblage technique was used in creating the surfaces. It shows an already made surface that was cut into pieces and assembled to make a new surface and also shows how eggshells were assembled in their natural form to create a surface for relief sculpture.

(a) (b)

Figure 42 Creating eggshell surface using assemblage technique

Source: Researcher, 2021

Using candle wax: During the course of the study, candle wax was also used in studio experimentation to test the strength of waste eggshells. The wax was placed in a pan and put on fire to melt and then poured onto a silver foil paper, eggshells were added and it was set to solidify as shown below

(a) (b)

Figure 43 Melting candle wax and using silver foil to create a relief

Source: Researcher, 2021

4.3.3 Learning outcomes from studio material experimentations

Waste management leads to utilization of waste materials for example eggshells in regard to this study. Therefore, research about materials for relief sculpture production was a priority because it contributed to the unearthing of new ideas. It increased possibilities of gaining new knowledge about the practical and theoretical sections of this study through reading relevant articles and visiting sculpture studios. It helped on improving skills of working with tools and materials, different techniques of creating sculpture and bringing an alternative material for relief sculpture in light. Hence, the following surfaces were achieved through manipulating eggshell material.

Figure 44 Sample surfaces created from waste eggshells using wood glue

Source: Researcher, 2021

Wood glue took a long period of time to dry but the results were effective and long lasting for indoor sculpture as shown in figure 44. The samples created were spread under the sun to dry completely and eggshells turned out to be stronger, harder and resistant to external forces of tension. Wood glue tended to become colorless after drying and this added to the natural feel of eggshells. Also, 500grams of wood glue were used to mix a ratio of 2kilograms of crashed eggshells although powdered eggshells consumed more where 500grams of wood glue mixed a ratio of 1kilogram to obtain a liquid-like paste. However, wood glue was affected by outdoor weather conditions particularly rain because it can soak once it is exposed to water for long.

Candle wax was also used in the experimentation process as an adhesive. It was exposed to heat in order for it to melt and then poured into a silver foil paper because it was available at that time and seemed flexible, easy to use and resistant to hot substances. In addition, silver foil was advantageous in a way that it allowed candle wax to solidify in a shortest time possible. Eggshells tended to sink and at the bottom of hot wax because of their weight and would float in cool wax as it solidified. Candle wax also had some rate transparency since eggshells could be viewed from within the solidified surface as shown in figure 45 below. However, candle tended to melt when exposed to heat and hot sun. Therefore, it is good for indoor sculpture.

(a) (b) (c)

Figure 45 Relief surface created using candle wax

Source: Researcher, 2021

4.4 Production of relief sculpture using waste eggshells as an alternative material

During the study, studio experimentation with waste eggshells as a material to produce relief sculpture involved different techniques such as casting, modeling and assembling. Different tools like knives, spoon, palette knife, wooden frames, brush, sticks and pen lid were also improvised in the process of making relief sculpture. However, there are specific tools such as knives, regular gouges, chisels, mallet among others that are used in creating relief sculptures.

Figure 46 Improvised tools used in studio experimentation

Source: Researcher, 2021

Different relief sculpture works were executed using the modeling technique. Dry eggshells of different sizes were uniformly mixed with wood glue for the modeling technique. This mixture was then applied carefully onto a polythene bag that was placed on the flat surface of a working table using the additive method. The polythene bag was used to prevent the artwork from getting into contact with the wooden table since it contained wood glue adhesive. This also allowed free movement of the artwork in the process of drying it under the sun. Therefore, the modeling technique helped in building different forms both in high, low and sunken relief sculpture.

4.4.1 Project one: The bills

Figure 47 Mixing wood glue and making a flat surface

Source: Researcher, 2021

Figure 48 Using additive method to build a relief sculpture

Source: Researcher, 2021

Figure 49 “The bills” complete prototype of relief sculpture with cold water dyes

Source: Researcher, 2021

4.4.2 Project two: Mother care

Figure 50 Using the modeling technique to build relief sculpture

Source: Researcher, 2021

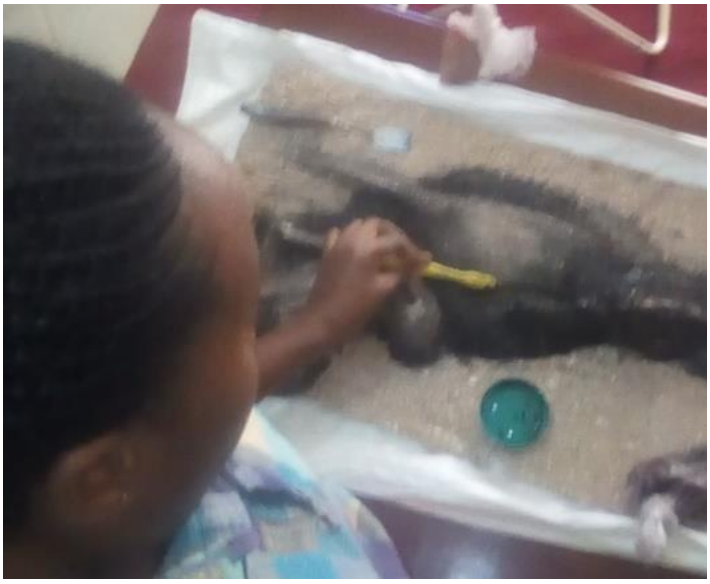

Figure 51 Adding cold water dyes to the work through painting

Source: Researcher, 2021

Figure 52 Relief sculpture after adding dyes

Source: Researcher, 2021

Figure 53 "Mother care" Complete relief sculpture prototype

Source: Researcher, 2021

Since this was an experimental study, cold water dyes were added to the artworks inform of painting using brushes. This was done to add color to the artwork and the results were permanent but also temporary when the artwork was exposed to rain/ water.

4.4.3 Project three: Freedom

In this artwork, a foreign piece of flat wooden board was introduced and used as a base onto which a composition in crashed eggshells mixed with wood glue was modeled. The mixture was later applied on the extreme edges of the wooden board to complete the entire composition. All the three types of relief sculpture namely; high, low and sunken reliefs were achieved in the experimentation process. This was meant to test the strength of eggshell and wood glue mixture.

Figure 54 Modeling relief sculpture on a wooden surface

Source: Researcher, 2021

Figure 55 Building relief sculpture to the extreme edges of the wooden surface

Source: Researcher, 2021

Figure 56 "Freedom" Complete relief sculpture

Source: Researcher, 2021

4.4.4 Project four: The hunt

The modeling and casting technique were used. A mould using clay was created and covered entirely with cooking oil which acted as fuel before applying eggshell paste. Eggshells were grounded into fine powder and mixed with wood glue to form a paste which was later poured onto the clay mould. The high relief sculpture was given ample time to set dry before the solidified eggshell powder cast was remove. The casted eggshell material peeled of the clay as it dried and was easy to remove. However, clay was stuck in some parts which were producing high from the surface. A mallete and chisel were used to remove this extra clay that had remained in the bottom protrusions.

Figure 57 Clay preparation

Source: Researcher, 2021

Figure 58 Mold making with clay

Source: Researcher, 2021

Figure 59 Adding oil to the clay work before the casting process

Source: Researcher, 2021

Figure 60 The casting process begins

Source: Researcher, 2021

Figure 61 Eggshell porridge poured on the clay work

Source: Researcher, 2021

Figure 62 Adding crashed eggshells to enhance the protruding parts

Source: Researcher, 2022

Figure 63 Extracting the eggshell work from clay mold

Source: Researcher, 2022

Figure 64 “The hunt” Completed relief sculpture

Source: Researcher, 2022

4.4.5 Project five: Shatter

Using the same technique, the researcher used candle wax for casting eggshells. Through experimentation, silver foil was carefully wrapped around a mould to obtain the entire form and then removed carefully. Having obtained the various forms on the foil, hot candle wax was poured into the foiled mould and crashed eggshells. The wax was then given time to solidify and later removed to obtain an eggshell candle wax relief sculpture. Eggshells were then poured into the liquid which allowed them to settle at the bottom before candle wax cooled.

Figure 65 Original work that was copied using a silver foil

Source: Researcher, 2022

Figure 66 Silver foil with the obtained shape

Source: Researcher, 2022

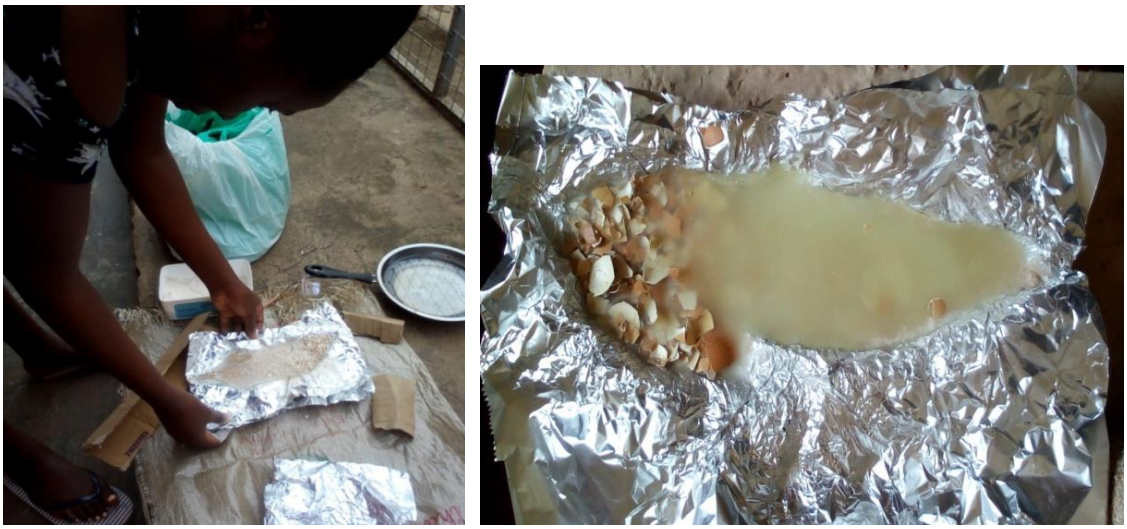

Figure 67 Adding hot candle wax and eggshells

Source: Researcher, 2022

Figure 68 Removing silver foil to obtain a replica of the work

Source: Researcher, 2022

Figure 69 Joining the different parts together

Source: Researcher, 2022

Figure 70 Complete work using candle wax and silver foil

Source: Researcher, 2022

4.4.6 Project six: Unity

Under this project, the assembling technique was used to create relief sculpture. In this technique, waste eggshells were used without pounding them into small particles. However, some eggshells were used without being broken whereas others were broken into big particles using hands to obtain variety which is a principle in art. These were assembled onto a flat surface and glued together following various patterns and form to achieve interesting features of relief sculpture.

Figure 71 Different sizes of eggshells used

Source: Researcher, 2022

Figure 72 Process of assembling and gluing eggshells together

Source: Researcher, 2022

Figure 73 Unity; final work with and without a background

Source: Researcher, 2022

The researcher used broken eggshells to create the relief sculpture in figure 73. She used the assembling technique where eggshells were assembled and glued together. Broken eggshells were sorted according to size and shape then glued together using wood glue following the sketches. The artwork was then displayed under the sun to dry. This method helped the researcher achieve various principles and elements of sculpture like rhythm, pattern, variety, and form among others.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0. Overview

In this chapter, study findings are summarized, concluded and recommendations given according to the purpose and objectives of the study. The main purpose of the study was to develop relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design Kyambogo University. This chapter was presented in sections, where different waste materials that have been used to create sculpture were identified in section one and design concepts for producing relief sculptures from waste eggshells were executed in section two. Section three highlighted a summary, conclusion and recommendations on the development relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design.

5.1 Different waste materials that have been used to create sculpture

Throughout the search, different waste materials were identified as a result of reviewing related literature of the study. This presented a broader understanding about different waste materials that were used to create sculpture at School of Art and Industrial Design Kyambogo University as well as in other countries and institutions of learning in Uganda. Recycling and reusing are more important today because there is more pollution and fewer natural resources like wood, clay, marble and bronze which are used to make sculpture. According to different scholars and artists presented in chapter two, different waste materials used to create sculpture were identified and these include bottle tops, plastic bottles, polythene bags, iron chains and paper. Some of these materials were used to create two dimensional sculptures whereas others were used to create three dimensional sculptures. However, the researcher was able to identify eggshell waste as a material to create relief sculpture during studio experimentations as described in chapter four.

Recycling of different materials is a simple way for people to reduce waste and conserve the environment in places where they live and work as suggested by Olbrantz (2006) and Asenso. K (2020). Similarly, respondents said that there is a group of artists in Uganda who are based in Mpigi district using plastic bottles to build houses. Other artworks were sited at the

School of Art and Industrial Design where students used plastic bottles and jerricans to create sculpture. As a result, waste plastic bottles have continuously been used to create awareness in communities, create employment opportunities and reduce the effects of poor waste disposal. However, using these plastics can lead to pollution depending on the processes used in the creation of artworks. For example, Atugonza Richard is an artist who works with plastics through combustion yet this is a process of burning where dangerous fumes are released in to the atmosphere thus air pollution.

Another artist named El Anatsui creates artworks using a variety of metallic bottle tops thus the different art installations. It was also recorded that students at the School of Art and Industrial Design have made sculpture using both plastic and metallic bottle tops. These waste bottles and bottle tops signify the high rate of production by different beverage companies and high rate of consumption by the public yet there is a poor waste management system. This has become hazardous to the environment due to the overwhelming masses of garbage. Therefore, artists are doing a great work of recycling, reusing and reducing waste materials

Discarded bicycle handlebar and seat were recycled by Pablo Picasso in the twentieth century to create a bull's head in 1942 (Bahn & Orliac, 2015). This was a simple and astonishing art work in which the recycled material appeared in its natural state. Therefore, appreciation of the natural state of recycled waste materials was of great importance to the study during studio experimentation to create sculpture. Waste eggshells were naturally appealing in color contrast during studio practice.

Many materials like discarded metals, papers, plastics among others were also used by artists to create artworks. Through exploration of the relationship between humans and their environment, it was observed that Jimmy Gidudu a student at the school of Art and Industrial Design Kyambogo University created a sculptural musical instrument using discarded mechanical spare parts. These recycled materials are repurposed through working creatively by welding individual pieces of iron together. This helped the researcher to realize that eggshells could actually be repurposed from the waste they have become to a more valuable material in creating relief sculpture. The eggshells were creatively mounted together to form a variety of interesting features protruding from two dimensional surfaces and these were inspirational to the study

Other artists like Michelle Stitzlein also created art from recycled materials like piano keys, pipes, broken brooms, bottle tops, electrical wires, and other items. This helped the artist in the creation of imagery and abstractions through the artists' imagination. In a similar way, Richard Atugonza sees his practice as an extension of a recycling line through the use of discarded plastics; saw dust, charcoal residue and dry grass to make his sculptures more durable and to create different visual and haptic experiences. His subject matter and materiality blended people and their environment in forms that appear brittle yet they become durable through combustion of plastic.

In conclusion, most artists have creatively recycled, reduced and reused many waste materials despite the fact that some of them are not interested in these materials thus opting to use conventional materials like cement, sand, stone, clay and wood. The next section highlights a summary on the design concepts for producing relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design.

5.2 Design concepts for producing relief sculptures from waste eggshells for School of Art and Industrial Design

Among the many ideas suggested by respondents, a shoe bill stork was selected as a source of inspiration because is at a verge of extinction in Uganda due to habitat destruction caused by environmental degradation. This helped the researcher in the documentation of the shoebill existence through the use of waste eggshells to create relief sculptures. It was used in the development of design concepts for relief sculpture for Kyambogo University. A number of ideas were generated through sketching and drawing to show different forms of this bird as shown in the previous chapter. It is from these generated ideas that the outcomes were able to help in studio production, (Takalo, 2019).

Both subjective and objective studies of a shoebill stork were made using tools and materials for drawing like pencil, pen and paper. In objective studies, the ideas generated were based on real visual appearance of the shoebill stork whereas in subjective studies, it was the researcher's interpretation through creativity and imagination. This was suggested by some respondents who were lecturers because it was a good start for studio production. It is therefore true that all visual artists constantly draw to study, to remember or to clarify their own ideas,

Stefanescu (2017). Artists like Alberto Giacometti used drawing to register quick sudden ideas from the surrounding and it was also used in this study to create final design concepts that depict appearance of the artwork. In agreement with Ssenyondwa (2009), respondents explained that drawing is a crucial process of generating a variety of design ideas from which artists create work and thus aiding the research to get from here to there. Principles and elements of drawing were also considered since they are of great importance in the drawing activity.

Anderson (2006) described how Leonardo-da-Vinci begun his study of birds through drawing when he realized that humans are too heavy to fly. In his drawings, he used bats wings as the starting point as he saw them as not being heavy because of the nature of the membrane that is on their wings. In this study, objective sketches and drawings were carried out to study each body part of the shoebill. The results exhibited different designs for relief sculpture production hence a sense of creative drawings. Therefore, designs that were created using different tools and materials during this study could be used in the production of functional sculpture.

Whereas artists like Bronya Moses and Egonu Charles used drawing tools like pencils on drawing paper, the researcher used pen, charcoal pencils and 6B pencil on Manila paper to generate ideas.

5.3 Development of relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design Kyambogo University

The process of production in this study started with collecting tools and material that were meant to be used. Waste eggshells were collected from different homes of residence and rolex kiosks. They were sorted and cleaned using both cold water and hot water. This was in support of respondents who advised that hot water was easier to use in cleaning these waste eggshells in order to kill germs which were contained within the waste. The eggshells were left to soak and water to cool for about 30 minutes before washing them to avoid burning. The eggshells were then spread under the sun to dry. Therefore, eggshells dried faster when spread to dry before crashing than when crashed before spreading them to dry. At this juncture, eggshells were ready to be used in any form. The tools and materials were also collected for example adhesives like; wood glue, candle wax and resin which greatly helped to hold eggshells together

in a solid form at different stages of production. Clay as material was used to help in creating moulds for the casting process. Cold water dyes were used to add color to the eggshells.

On the other hand, responds explained the process of using waste plastic bottles to build houses as unique and creative. In preparation of these materials, artists collect waste plastic bottles from the community, sort them by removing the broken ones and fill the good bottles with sand ready for using in the construction process. In contrary to studio experimentations of using waste eggshells, plastic bottles are filled with sand which is extracted from the environment yet eggshells are washed to remove the decomposing components thus making them ready for use. Different experiments were then made to prove the workable aspect of using eggshells as a material. This was done after eggshells had been crashed and grinded into powder form, thus rendering a success for the various flat surfaces. Therefore, the following methods were discussed with respondents and used in the experimentation process.

5.3.1 Modeling

Modeling as an additive method involved manipulating soft materials that could be shaped by the sculptor's hands to create a two or three dimensional form. Responds explained that clay was used as a material during the modeling process. Since the artist adds material to build the sculpture, modeling was an additive method used in studio experimentation as supported by Ocvirk, (1992). This additive method was also creatively used by other artists to make sculpture from recycled and reused materials like papier-mâché, scrap metal, plastics among others for example Man kicking world by Viola Frey, 2002. In her paper sculptures, she used clay for modeling objects and later applied paper as a finish material. In this study, the additive method was used after mixing different grades of eggshell material with wood glue and creatively building it together onto a flat support surface like table to create relief sculptures. Improvised tools like spoons, knives, pen lids and palette knife were used during the production process. In the same way as Viola Frey a paper artist, the study employed modeling using clay to build forms that were achieved through casting the molds.

5.3.2 Casting

Casting was a manufacturing process that was used by which a liquid material is usually poured onto a mould and then allowed to solidify according to Orville (2010). Casting was used

to form relief sculpture in powdered eggshell as a material that could solidify after mixing it with liquid wood glue. This study aimed at achieving features that project at different angles from a flat surface. Therefore, various shapes were achieved through casting method and eggshells were rendered as a good and alternative material for relief sculpture. Candle wax was also used in casting process. Proper planning for sculpting, mould making and casting of prototypes was very important since every step of production was done physically.

5.3.3 Assemblage and Construction

The techniques of assemblage and construction consisted of combining and joining various materials to form both two and three dimensional objects. These methods originated from the techniques of collage and mosaic. Assemblage often includes combining pre-existing or found materials to create the sculpture. Using additional method, this study aimed at assembling eggshells in various types of relief sculpture especially high relief in form of mosaics to express creativity. This was mainly because high relief is characterized by forms that project at least half or more of their natural circumference from the background and some parts may be completely disengaged from the background. Since flat surfaces tended to be more successful than curved surfaces, eggshells were used as an independent material with adhesives to create flat surfaces and construct projections that are at least half of their natural circumference from the background through assemblage.

However, carving technique was not used despite the fact that it is also one of the methods of creating relief sculpture. This was because of limited time and tools since carving as a process required ample time and specific tools for manipulation of the material.

5.4 Conclusion

The study sought to develop relief sculptures from waste eggshells as an alternative material for School of Art and Industrial Design Kyambogo University. It reflects the use of waste eggshells as a material for relief sculpture and is supported by the researcher's findings. A number of relief sculptures were produced using different techniques with waste eggshells as a material and themes were given to artworks as projects according to data collected from

respondents. The study also concludes that eggshells can work as an independent material to create other forms of artworks such as ceiling boards and partition boards.

5.5 Recommendations

Based on study objectives, the researcher made the following recommendations:

It is recommended that findings from the study can be used by other universities and institutions of learning for study purposes.

The study also recommends artists to use eggshells as a material to create other forms of art like three dimensional sculpture and multimedia crafts.

The study recommends schools and other institutions of learning which are facing lack of materials in art studios to improvise with waste eggshells. This is because waste eggshells are cheap and reliable in our communities.

5.6 Areas for further research

Further studies should be made on more adhesives like resin and hardener which can be used with eggshells to create three dimensional outdoor sculptures. This is because the researcher had limited resources to experiment with all adhesives.

Also, there is need for more research about other techniques of using eggshells to create sculpture especially carving.

Finally, further research should be made on how eggshells can be used to create tiles and terrazzo art for interior and exterior design.

REFERENCES

Adoglah, F. Yalley, P and Arkoh, M. (2016). Improving compressed laterite bricks using powdered Eggshells. The international journal of Engineering and Science

Anderson, M. (2006). *Amazing Leonardo da Vinci Inventions: You Can Build Yourself*. Nomad Press.https://www.amazon.com/Amazing-Leonardo-Vinci-Inventions-Yourself/dp/0974934429

Anton. M, Nau. F and Nys, Y (2006). Bioactive component and their potential uses. World poultry science journal, 62

Appaswami, J. (2014). *Contemporary Indian Sculpture,* Lalit Kala Contemporary, No. 6, Delhi.

Asenso, K., Issah, S. & Som, E. K. (2020). The use of visual arts in environmental conservation in Ghana: The case of Adams Saeed. Journal of African Art Education, 1(1), 66-83. https://www.atagonline.org/?smd_process_download=1&download_id=3032

Atugonza,R.(2019).Artist-AfriartGallery.afriartgallery.org. https://afriartgallery.org/artists/richard-atugonza

Bahn, P., & Bahn, P. G. (1998). *The Cambridge illustrated history of prehistoric art*. Cambridge University Press. https://www.amazon.com/Cambridge-Illustrated-History-Prehistoric-Histories/dp/0521454735

Bahn, P.G., Orliac, C., & Orliac,M. (2015). Picasso and the Easter Island " palm". Rapa Nui Journal, 29 (1), 45-48

Behi, R., & Nolan, M. (1995). Ethical issues in research. *British journal of nursing (Mark Allen Publishing)*, *4*(12), 712.https://www.magonlinelibrary.com/doi/10.12968/bjon.1995.4.12.712

Bjørnskau, T. (2012). Turning Trush into Tresure. *Start Journal of Arts and Culture*(019). https://startjournal.org/2012/03/turning-trash-into-treasure/

Boussou, A., Lim, B., Muriuki, K., & Zouari, L. RETHINK GREEN

Breda, K. L. (2014). Participatory action research. *Nursing research using participatory action research. New York: Springer*, 1-11.

Bronya. M (2018), *A mural of art disciplines*. Department of Art Education, University of Education Winneba https://www.academia.edu/37734891/Long_essay_project_new_final

Bryman, A. (2008). Social research methods, 3 rd edition, Oxord University Press, NewYork. https://www.scirp.org/(S(czeh2tfqyw2orz553k1w0r45))/reference/ReferencesPapers.aspx?ReferenceID=2007281

Buren, D. 1970/71 The function of the studio In 'The Studio' exh cat Dublin City Gallery

Burley,R.W. and V. Vadehra, 1989. The eggshell and shell membranes: Properties and synthesis. In: Theavian egg chemistry and biology, John Wiley, NewYork, pp: 25-64. https://www.researchgate.net/publication/51895246_The_eggshell_structure_composition_and_mineralization

Byarugaba, D. K. (2007). The structure and importance of the commercial and village based poultry industry in Uganda. *Rome, Food and Agriculture Organization of the United Nations*. https://agris.fao.org/agris-search/search.do?recordID=XF2006446641

Byomugabe, M. (2019). *Production of sculpture from waste paper inspired by the Kikiga tradition dance* (Doctoral dissertation, Kyambogo University).

Conrad, K. (1997). A Theory of Production with Waste and Recycling. *Discussion Papers/Institut für Volkswirtschaftslehre und Statistik, 550*.

Damaskos, D. (2013). Free-Standing and Relief Sculpture. *A Companion to Greek Art*, 105-131.

Deffor, B., Agyem, J. A., & Sakoalia, K. D. (2019). Eggshell Powder as a viable sculpture Material: The case of WBM Zion Senior High School, Koforidua, Ghana. *Journal of Arts and Humanities*, *8*(3), 55-72.

Dolińska, B. Jelinska, M. Szulc-Musiol, B. and Ryszka, F. (2011) Uses of Eggshells as a Raw Material for Production of Calcium Preparations. Czech.

Ebubekir (2008) Physical properties of Hen's Egg. Journal of food and animal science.

Erdner, A., & Magnusson, A. (2011). Photography as a Method of Data Collection: Helping People With Long-Term Mental Illness to Convey Their Life World. *Perspectives in psychiatric care*, *47*(3), 145-150.

Fortuna, J. (2019). The Art and Process of Wood Carving as a Meaningful Occupation. *The Open Journal of Occupational Therapy*, *7*(2), 14.

Froning, G.W.(1998). Recent advances in egg products research and development. Presented at the University of California Riverside and Modesto egg processing workshop. June 2-3, 1998.

Galyean, A. (1991) Sculpting an interactive volumetric modeling technique. Massachusetts institute of technology, Cambridge.

Gamble, H., & Gamble, D. (1995). Creating Cast Paper Sculpture: A Simple Lesson in Papermaking and Moldmaking. AMACO [R] Lesson.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, *16*(1), 15-31.

Hagedorn, M. (1994). Hermeneutic photography: an innovative esthetic technique for generating data in nursing research. *Advances in Nursing Science, 17*(1), 44-50.

Hempson, G. J. (2012). *The naturally imperfect form: investigations of the application of digital sculpting methods-extracted art: incorporating and translating 'found art'into the medium of digital sculpture* (Doctoral dissertation, Queensland University of Technology).

Hollweck, T. (2015). Robert K. Yin.(2014). Case Study Research Design and Methods . Thousand Oaks, CA: Sage. 282 pages. *Canadian Journal of Program Evaluation, 30*(1).

Jaensson, S. (2008). Solid waste management implementation, an opportunity not to be wasted: Solid waste management in Babati, Tanzania.

Kerlinger, F. N. (1979). *Behavioral research: A conceptual approach*: Harcourt School.

Kvale, S. & Brinkmann, S. (2008). Interviews: Learning the craft of qualitative research interviewing.

MacNeil, J., 1997. Separation and utilization of waste eggshell. International egg commission annual production and marketing conference. Toronto, Ontario, September.

Marshall, M. N. (1996). Sampling for qualitative research. *Family practice, 13*(6), 522-526. https://www.alnap.org/system/files/content/resource/files/main/family-practice-1996-marshall-522-6.pdf

McNamara, C. (1999). General guidelines for conducting interviews, Minnesota. *Missouri Institute of science*. Milani, S., & Schoonderbeek, M. (2010). Drawing Theory. An Introduction. *Footprint*, 1-8.

Mulhall, A. (2003). In the field: notes on observation in qualitative research. *Journal of advanced nursing, 41*(3), 306-313.

Nakano, T., Ikama, N.I. Ikama and Ozimek,L. 2003. Chemical composition of eggshell and shell membranes. Poult. Sci., 82: 510-514.

Olbrantz. J. Hallie, (2006). Recycled Art; Ford Museum of Art at Willamette University http://willamette.edu/arts/hfma/pdf/teacher-guides/recycled-art.pdf

Peterson, C. (2013). Assessment of solid waste management practices and its vulnerability to climate risks in Maldives Tourism Sector. *Report submitted to Ministry of Tourism, Arts and Culture*.

Phil, G. and M. Zhihong, 2009. High value products from hatchery waste.

Purcell, A. T., & Gero, J. S. (1998). Drawings and the design process: A review of protocol studies in design and other disciplines and related research in cognitive psychology. *Design studies*, *19*(4), 389-430.

Ruganzu,B. (2012).Kampala Contemporary Art Feastival. https://klaart012.wordpress.com/12-artists/ruganzu-bruno/

Sarfo, S. (2013). *Sculpture for School.* Kumasi: Armed Forces Senior high school at Uaddara Barracks-kumasi.

Spurgeon, H. (2016). Reactive and non-reactive binders.

Ssenyondwa, D. (2009). A studio based exploration of metaphors in the art of drawing in Uganda

Stefanescu, M. (2017). 9. The Importance of the Drawing in the Artistic Creation Process. *Review of Artistic Education*, (13/14), 200.

Taylor, M. C. (2005). Interviewing. *Qualitative research in health care*, 29-55.

Vick, C. B. (1999). Adhesive bonding of wood materials. *Wood handbook: wood as an engineering material. Madison, WI: USDA Forest Service, Forest Products Laboratory, 1999. General technical report FPL; GTR-113: Pages 9.1-9.24*, *113*.

Winter, G. (2000). A comparative discussion of the notion of'validity'in qualitative and quantitative research. *The qualitative report*, *4*(3), 1-14.

APPENDICES

Appendix 1: Interview guide for students

1. What do you understand by the term waste materials?
2. Mention examples of waste materials found at the School of Art and Industrial Design
3. How have they been used to make sculpture
4. Why have they been used to create sculpture?
5. What is relief sculpture?
6. State materials used to make sculpture at the School of Art and Industrial Design
7. Which other waste materials can be used to create relief sculpture at the School of Art and Industrial Design
8. Explain the methods that have been used in making relief sculpture
9. Which source of inspiration should be used in production of relief sculpture from eggshells and why should it be used
10. Explain how the design process should be used in idea generation
11. Which projects can be generated from the source of inspiration and what are their meanings
12. Which types of relief sculpture should be developed
13. Which colors should be used in the artworks

Appendix 2: Interview guide for Lecturers

1. Waste materials that been used in sculpture at School of Art and Industrial Design
2. Techniques that have been employed in the production process
3. Which materials are available for relief sculpture
4. How can eggshells be used in the production of relief sculpture
5. How can design concepts for relief sculpture be developed

Appendix 3: Observation guide

The observation process was guided by the following study objectives in gathering literature:

To identify different waste materials that have been used to create sculpture at the School of Art and Industrial Design Kyambogo University

To execute design concepts for producing relief sculptures from waste eggshells for School of Art and Industrial Design

These objectives were analyzed basing on the following:

The artist

The materials used

The tools employed

The design process

Techniques used in production

The source of inspiration

Appendix 4: Map 1: Map of Uganda