MANIPULATING INDIGENOUS VEGETABLE TANNED LEATHER FOR USE IN MACRAMÉ ART

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DECLARATION

I hereby declare that this submission is my own study towards a Master of Philosophy in Integrated Art (Leather Technology) degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any degree of the University, except where due acknowledgment has been made in the text.

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J.A.A.

DEDICATION

This thesis is dedicated to my nuclear family, the Ackah- Arthurs'. God richly bless you.

ABSTRACT

The purpose of the study was to manipulate Ghanaian indigenous vegetable tanned leather towards the production of strips for use in macramé art. Ghanaian indigenous vegetable tanned leathers combine comfort, beauty, style, versatility and uniqueness. Despite the characteristics of the indigenous vegetable tanned leather, its use in creating and producing artefacts is minimal. The study therefore found it appropriate to explore further items that this interesting material can be used for, and macramé knotting, being an equally interesting technique in art production came as a possible area of experimentation where the leather was tested and manipulated in its application. The researcher employed qualitative research using the descriptive and experimental methods. Purposive sampling was employed in the selection of experts and artisans in the fields of macramé art. It was also used in selecting local leather samples from Asawase in Kumasi and for the experiments conducted. The researcher used interview guide and observation as data collection instruments for the study. With observations and interview made, the researcher discovered that the characteristics of the materials used in macramé knotting had some similarities with that of the indigenous vegetable tanned leather. However, through experiments, sketches and rhino renditions, the local leather was cut into strips and used in the production of leather artefacts in macramé art. The artefacts produced were found to be attractive, durable, easy to carry and comfortable to use. However, the researcher recommends that leather and macramé artisans should explore the unexploited locally obtainable materials and tap their potentials in art and technology. The research takes note of using the spiral cutting technique in constructing leather strips for use in macramé art. The researcher recommends that the pounding of leather in its raw state and pounding of oil infused leather should be applied in softening strips suitable for use in macramé art. Lastly, the indigenous vegetable tanned goat leather strip is recommended for use in macramé knotting due to its strength, ability to twist, fold and hold knots when used in producing leather artefacts.

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1.2 Background to the Study

Leather is a dynamic material that has a very long history behind it and its discovery and use are as the time of pre – historic era. The story of leather and leather products began in the very early stages of man whereby the pre- historic man used leather to satisfy his basic needs. He used it to make clothing, shelter, containers and other items. Since then several efforts have been made to use leather for the manufacture of many different artefacts.

The Word Book Encyclopedia Vol.12 (1972) states that as a material, leather is strong and durable, and possesses the ability to stretch, to be as flexible as cloth or as stiff as wood. Some kinds are thick and heavy, others are light. Leather can be dyed, polished until it has a glossy finish or it can be embossed (decorated with raised figures). R. Reed (1972) is of the view that, leather typically dries out to give a generally malleable, opaque article. However, it can be hard or delicate, adaptable or unbending, hardened or supple, thick or stiff, limp or springy relying upon the way of the skin utilized and the procedure utilized.

Vegetable tanned leathers produced in the Northern and Southern parts of Ghana have unique characteristics that can be used to create a variety of leather items. The natural tannins used in tanning these leathers bind with the proteins in the skin and convert

them into leathers. Ghanaian indigenous vegetable tanned leathers combine comfort, beauty, style, versatility and uniqueness. Despite the characteristics of the indigenous vegetable tanned leather, its use in creating art items is minimal.

In the light of this, it is appropriate to explore further items that this interesting material can be used for and macramé knotting being an equally interesting technique in art production, comes as a possible area of experimentation where leather can be tested and manipulated in its application.

1.3 Statement of the Problem

Leather is a material of versatile uses and is known for the making of footwear, sports equipment, containers and clothing since pre-historic time. However, in modern fashion trends, it plays a major role in the decoration of automobile or vehicles and high-quality expensive furnishings.

In Ghana, the indigenous vegetable tanned leather is hardly used in the production of artefacts, majority of these leather item producers prefer the use of imported leathers and leatherettes in their works even though some of these materials lack good characteristics such as breathability, durability and flexibility. As stated in Asubonteng (2010), for instance, observations made in such sectors as footwear, upholstery, bag making, garment and clothing accessories production and exhibition shops in Kumasi, Accra and Takoradi showed that the local leather is not a material of choice and its significance is very limited or unknown for such utility as shoe, sofas, bags, jackets, gloves, car seats, car seat backs and spare tyre covers which are commonly used by Ghanaians.

Macramé art which is fast growing in Ghana is narrowed to the use of foreign materials such as the rayon, leatherette and nylon cords. The characteristics of these foreign

macramé materials which are also exhibited in the Ghanaian indigenous vegetable tanned leather have not been exploited. Therefore, this study is a demonstration of how indigenous vegetable tanned leather can be manipulated into suitable strips for the production of artefacts in macramé art.

1.4 Purpose of the Study

To manipulate Ghanaian indigenous vegetable tanned leather towards the production of strips for use in macramé art.

1.5 Specific Objectives

1. To identify the characteristics of materials and techniques used in macramé knotting.
2. To manipulate Ghanaian indigenous vegetable tanned leather for the production of strips suitable for use in macramé art.
3. To use leather strips developed from Ghanaian indigenous vegetable tanned leathers in macramé knotting for the production of leather artefacts.

1.6 Research Questions

1. What are the characteristics of materials and techniques used in macramé knotting?
2. How would Ghanaian indigenous vegetable tanned leather be manipulated for the production of suitable leather strips for use in macramé art.
3. How would leather strips developed from Ghanaian indigenous vegetable tanned leathers be used in macramé knotting for the production of leather artefacts?

1.7 Significance of the Study

1. This study will help improve the use of Ghanaian indigenous vegetable leather in making strips suitable for use in macramé knotting.
2. This study will encourage macramé and leather artisans in Ghana to use available local leather as resource materials without depending on foreign ones.
3. This study will add and enhance the leather industry through its use to produce macramé leather artefacts.
4. This study will help in teaching and learning in schools by introducing a new technique in leatherwork.
5. The report on the study will serve as a reference material for further studies.

1.8 Delimitations of the Study

The research focused mainly on manipulating Ghanaian indigenous vegetable tanned leather in production of strips for use in macramé art. It was limited to leather samples from Indigenous leather tannery at Asawase, a suburb in Kumasi. It was also limited to the identification and examination of macramé materials and techniques used in the production of artefacts at the Department of Integrated Rural Art and Industry (KNUST), Kotei and Central market all within Kumasi.

1.9 Definition of Terms

Indigenous *– Naturally existing in a place or country.*

Manipulation *–The handling or managing especially with skill in some process of treatment or performance.*

Leather – *Animal skin or hide converted through a chemical process known as tanning to render it suitable for different uses.*

Tanning *– This is the preparation of leather from pelt (hide or skin).*

Vegetable tanning-*The process whereby tanning solutions obtained from plants are used to turn pelts into leather.*

Macramé *- The art of knot tying and a creative and satisfying mode that permits one to find personal expression in a work of art.*

Suede dye- *A local dyestuff obtained in different colours used on leather without disturbing its surface quality.*

Knot- *A usually firm, lump shaped object formed when a strand of something such as string or rope is interlaced with itself or another strand and pulled tight.*

Loop *– A fold in the rope, forming a circular or oval shape.*

Cord *– A length of natural or artificial strong twisted or braided fibre or thread.*

Filler cord *– This is also known as filler; it is the non - working cord around which knotting cords are tied.*

Sinnet*– A vertical chain or braid of repeated knots.*

Yarn *- A natural or synthetic length of twisted fibre for weaving or knitting.*

1.10 Organisation of the Study

This study is presented in five chapters. Chapter One introduces the study. It comprises the background to the study, statement of the problem, general objective, specific objectives, research questions, significance of the study, delimitations of the study, definition of terms and organisation of the study. Chapter Two reviews all related available literature on the study. Chapter Three discusses the methodology of the study. Chapter Four consists of results and findings of the study, where it focuses on the

presentation and discussion on findings. Chapter Five consists of the summary, conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Overview

The thrust of this chapter is a review of literature related to leather and macramé art. For the purpose of this study, the source of the review was books, journals, oral interview and the internet. The review focuses on; Manipulation of leather, Historical background of leather usage, Animal skins, Vegetable tanned leather, Types of leather, Characteristics of leather, Historical background of macramé, Concept of macramé art, Types of macramé art, Knotting techniques in macramé art, Materials for macramé, Characteristics of macramé materials, Tools for macramé art and Leather in Macramé Art.

2.2 Manipulation of Leather

The researcher's intention to manipulate indigenous vegetable tanned leather in the production of strips for use in macramé knotting is a purposeful approach to expand the utility value of this all important cultural material to meet modern needs and aesthetic appeal. Webster (2014), has defined manipulation in different ways among these are; (a) to use or change (numbers, information, etc.) in a skillful way or for a particular purpose, (b) to treat or operate with or as if with the hands or by mechanical means especially in a skillful way (c) to change by artful means so as to serve one's purpose. These definitions are in direct course with what the researcher intended to achieve in the project. Manipulation in this research is therefore the practical process of handling or changing leather into a condition that will make it possible for use in macramé knotting.

2.3 Historical Background of Leather Usage

The use of leather has been recorded since the most distant pre- historic time and can be found in cultures and people from practically the entire world. The use of hides created the need for adapting them, turning a perishable material into a durable one, possibly one of the first transformation processes of material carried out by humankind. Its use has been frequently associated with connotations of nobility and prestige, which makes it more appropriate for the creation of artistic and cultural objects. (Ribai Llado & Pascuali Miro, 2008)

Leather Doctor (http://www.aaaleatherdoctor.com/aboutleather) is of the view that, "Primitive individuals who lived amid the Ice Age somewhere in the range of 500, 000 years back were likely the first to utilize the skins of animals to shield their bodies from the elements. Just as leather today is a by-product, our ancient forbearers chased animals mainly for nourishment, yet once they had eaten the meat, they would clean the skin by scratching off the fleshy tissue and after that hang it over their shoulders as a raw type of a coat. They likewise made footwear to shield their exposed feet from rocks and thistles by taking smaller pieces of animal skin made to fit freely over the foot and tied at the ankle with thin strips of skin or even vines. The fundamental issue that primitive man experienced was that after a relatively brief time the skins rotted and spoiled away. With his constrained information and experience, primitive man had no clue how to conserve these hides. As hundreds of years passed it was seen that several things could hold up the rot of leather. If the skins were stretched out and let to dry in the sun, it made them inflexible and hard however they lasted much longer. Varieties of oily substances were then rubbed into the skins to make them softer. As time passes, it was in the end found that the bark of specific trees contained “tannin” or tannic acid which could be used to change raw skins into what we perceive today as leather. It is

quite difficult to substantiate sequentially at precisely what time this tanning technique emerged, yet the popular " Iceman" dating from at least 5,000 BC found in the Italian Alps quite a long while back, was dressed in very long-lasting leather".

Simply Leather (2006), records that in times past, pieces of leather dating from 1300 B.C. have been found in Egypt. Primitive people in Europe, Asia and North America all developed the technique of transforming skins into leather merchandise autonomously of each other. The Greeks were utilizing leather articles of clothing as a part of the age of the Homeric legends (around 1200 B.C.), and the utilization of leather later spread all through the Roman Empire. Amid the Middle Ages, the Chinese knew the art of making leather. The Indians of North America likewise had developed great skills in leather work before the coming of the white man.

In Mesopotamia between the fifth and the third thousand years B.C for instance, the Sumerians utilized skins for long dresses and diadems for women. The Assyrians utilized leather for footwear additionally for liquid containers and as inflated floats for rafts. The ancient Indian society initially handled the kind of leather known as "Morocco" today. The Egyptians likewise achieved considerable skill in preparing leather, which they utilized for dress (notwithstanding for gloves), devices, arms or basically for decoration. The history specialist, Strabo, recounts an intriguing use created by Phoenicians who made water pipes from it. Amid the Roman times, leather was broadly utilized in all provinces of the empire, and more efficient tanning methods were introduced where they had not been developed locally. (Leather Resource, 2008)

BLC Leather Technology (2007) is additionally of the perspective that, wall paintings and ancient art articles in Egyptian tombs demonstrate that leather was utilized for shoes, garments, gloves, pails, jugs, covers for covering the dead and for military

equipment. The old Greeks and Romans additionally made broad utilization of leather and it has remained a vital industrial raw material since those times. The Romans utilized leather on a wide scale for footwear, garments, and military gear including shields, saddles and harnesses. Uncovering of Roman locales in Great Britain has yielded huge amounts of leather articles, for example, footwear and attire.

According to Boahin (2005), the tanning of leather was utilized by humankind in various topographical zones all through the early times of human development. As certain leather characteristics appeared, man realised leather could be utilized for many purposes other than footwear and dress. The uses and significance of leather expanded greatly. For instance, it was found that water would keep fresh and cool in a leather container. It was additionally discovered suitable for such different things as tents, beds, mats, floor covering, protective covering and bridle. On the other hand, a number of these things are truth be told still produced using leather today.

2.4 Skins

Boahin (2005) defines skin as a pelt or leather obtained from smaller animals, such as sheep and goat. However, in relation with the definition given by Boahin (2005) on skins, Michael (2006) also points out that, the word skin is used for leather from small animals. They are thin and light in weight. Skins are mainly used for smaller leather goods, pockets and linings or are combined with hide for large bags and cases.

A nearby examination of the make-up of a piece of skin as indicated by Thomson (2006), demonstrates that it comprises basically of long thick fibres and fibre bundles interlacing in three dimensions inside of a jelly-like 'ground substance'. Different components, for example, hairs and hair roots, muscles, veins and fat cells are available yet it is complex, three-dimensional, woven structure that prevails and gives skin-based

materials a number of their one of a kind physical qualities. Michael (2006) elaborates on the structure of skins with a diagram on the cross section of skin. See figure 2.1.

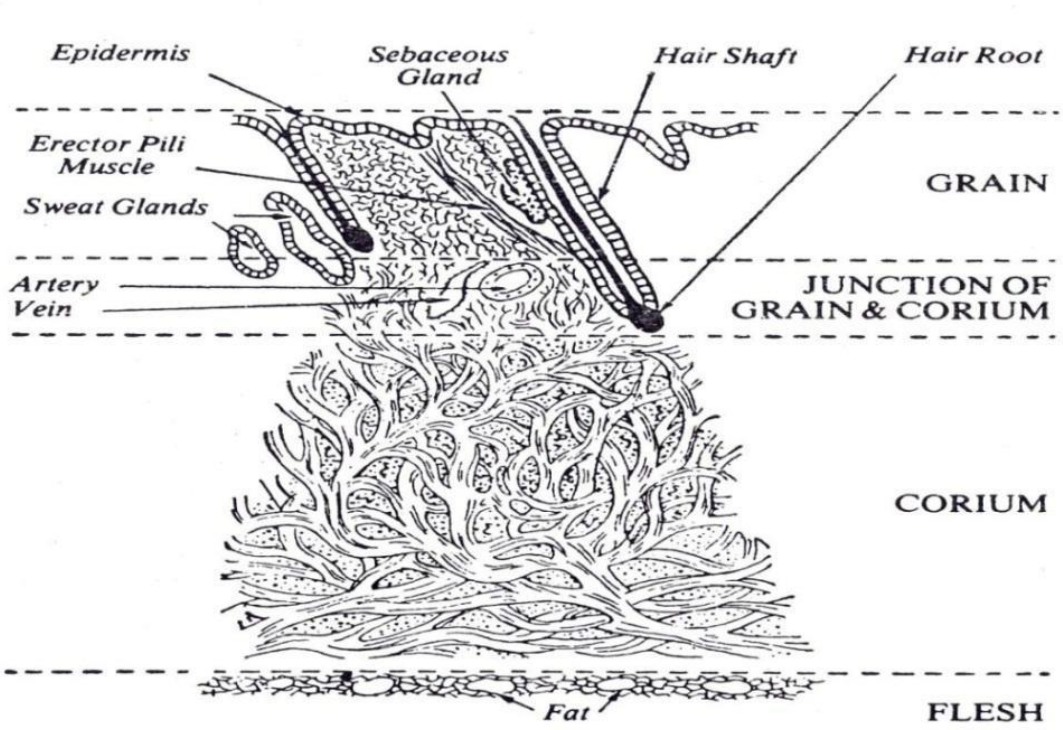


Figure 2.1: A highly magnified cross- section of a piece of skin

(Source: Michael, 2006)

Skins are rarely used in their natural state as they are subject to rotting and temperature. In terms of material classification, skins obtained from animals are categorized as primary materials, but when processed they turn into a secondary material appropriately called leather. However, when the leather is used as input by commercial artists, students and craftsmen to make variety of finished products, it becomes a tertiary product, which Boahin (2005:2008) categorises into clothing, upholstery, containers,

decoration and stationery accessories. Artefacts found in any of these categories serve both industrial and domestic needs of society in diverse ways. (Asubonteng, 2010)

2.5 Vegetable Tanned Leather

According to Adu- Asabere (2011), leather is not leather until it has been tanned. However, before an animal skin or hide can be turned into leather, it must pass through a tanning process and among these tanning processes is the vegetable tanning process. Amberg (2015) is of the view that, vegetable tanning is an old and conventional craft process that tanneries have passed down over the years, utilizing both old formulas and all the more as of late best in class innovation. Vegetable tanning shows off leather in its most natural state and you can truly see the skill in the tanning procedure furthermore the completed item. The change from raw hides into a material that will last a long time is a procedure that happens in wooden drums or tanning pits. Vegetable tanning is the most ecologically friendly approach to tan leather; there are no chemicals utilized regarding the earth because of the utilization of natural ingredients as opposed to chemicals. Jarnagin (1997; 2006) uncovers that, the most significant natural tanning agents are the vegetable tannins present in tanning liquors. They are readied from specific parts of plants by watery extraction. Their tanning power has been acknowledged for a long time and Babylonian writings have recorded their utilization.

Vegetable tanning is generally carried out in big vats filled with tanning solutions, which are made from water and tannin. Tannin is a bitter substance that is gotten from such plants as chestnut wood extract (CastoneaVesca), Hemlock (AbiesCanadies), Oak wood (Quercus family), Mimosa or Golden wattle (Acacia Pymaniha), Myrobalans (Terminalia Chebula), Mallet bark (EucalypiusOccidentalis), Quebracho extract (Quebracho Colorado). The choice of the plant depends on the type, which is available in a particular locality.

Pelts are put in a weaker tanning solutions, this is mostly previously used solution; then they are put in stronger solution and finally in full strength solution. The solution is stirred among the pelts so that its distribution is uniform and the centre layer of the pelt is as thoroughly tanned as the outside layers (Boahin, 2005). Michael (2006) opines that, in vegetable tanning, a solution known as liquor is made from an infusion of ground tree bark, twigs, leaves and water. The skins or hides are immersed in this liquor, either suspended in pits or tumbled in drums, until tanning is completed. However, the author believes that, the choice of tanning material determines not only the time required for the process but also the characteristics and colour of the leather- its density, flexibility and the ease at which it can be cut. Skins that are vegetable tanned, according to Churchill (1983), are water resistant; they can be wetted, stretched, tooled or made into almost any object that leather is used for with excellent results. In the same vein, Thomson (2006) says vegetable tanned leathers are generally firm and dense and have a dimensional stability.

In Ghana, the use of vegetable tanned leather has been in practice over a century. They can be found at the northern parts of the country and southwards through the Ashanti and Greater Accra regions. According to Dangima (2015), the indigenous tanners use tannin from the pods of Acacia Nilotic (bagaruwa) as shown in plate 2.1.It is pounded and mixed with water for tanning the pelts into leather. This natural tannin extract makes the vegetable tanned leather unique, soft and easily distinguishable.

Plate 2.1: Pods of Acacia Nilotic (Bagaruwa)

2.6 Types of Leather

Leather can be made from the skin of virtually any vertebrate animal: mammal, reptile, bird or even fish. The majority of the leather, however, is made from domestic animals: cow, sheep, goat and pig. Skins from hunted animals are used, such as deer skin, but compared to domestic animals, form a small part of the total leather produced today. (Michel, 2014). Boahin (2005) has also outlined the major types of leather as follows:

1. **Calf Skin-** This is one of the most beautiful leathers and is ideal for almost anything, from bags to book covers and such articles as shoe uppers. It is lighter, fine grained and close-textured. It is perfect for tooling and modeling.
2. **Cow Hide-** It is used for anything which must wear well. The light hide can be tooled and is suitable for small projects such as gloves and garments. The heavy hide is used in making carved briefcases, baskets, sandals and machinery belting.

3. **Goat Skin-** This is one of the toughest leathers and can be tooled readily. When it is treated with sumac, it is known as morocco leather. Its primary use is for shoe uppers, fancy leather goods, handbags and aprons.
4. **Pig Skin-** This is tight grained and firm,it wears well and may be tooled to some extent. It is suitable for straight-lined work, gloves fancy leather goods and luggage.
5. **Sheep Skin-** It is extremely versatile, soft and loose grained. It is used for cases, handbags and jackets. It is good for modeling.

2.7 Characteristics of Leather

Leather is a material formed from the skin of a vertebrate, be it mammal, reptile, bird, fish or amphibian, by a procedure or arrangement of procedures which renders it non-putrescible under warm damp conditions. A genuine leather holds this property after rehashed wetting and drying. Leather more often than not dries out to give a generally malleable, opaque, item yet it can be hard or delicate, adaptable or inflexible, solid or supple, thick or thin, limp or springy, contingent upon the way of the skin utilized and the processed employed. (Thomson, 2006). Through histology and critical studies of the fibre structure of leather, several possibilities have been created to complement the natural properties of the skin and increase the capabilities of leather. Leather, breathes, insulates (can be warm and cold), resists abrasion and has individual characteristics which make each hide unique. (Asubonteng, 2010). According to Michael (2006), it is the organization of the bundles of fibres and their ability to move in response to stresses and strains that give leather its characteristics- its flexibility, strength, elasticity, malleability, and ability to breathe. Boahin (2008) opines that the unique characters of leather make it possible for divers' creative techniques to be applied to it. Michel (2014) talks about the characteristics of these leathers in the following manner:

1. **Cattle Hide Leather -** The grain pattern of cattle hide leather has follicles which are all of similar size and are fairly evenly distributed. Full thickness adult cattle hide can be a centimetre thick or more in some areas. Clearly this is much too thick for most purposes other than soling shoes or for some industrial uses. Therefore, the leather usually is split into layers of more manageable thickness.

   In cattle hide leather that has not been split into layers, the grain layer accounts for approximately one fifth of the total thickness of the hide depending on the location. Remembering that the grain layer on its own is relatively weak, when leather is split to the required thickness for use, it is essential that sufficient corium is left to give it leather enough strength. Therefore, to make very thin leather, the correct hides must be selected. Although the thickness of the hide depends on the age and sex of the animal the ratio of approximately one part grain to four parts corium remains the same whatever the hide thickness.

2. **Sheepskin Leather**- Sheepskins can be processed with the wool still on, in which case they are known as woolskins. However, the majority of sheepskins have the wool removed and are processed into what is known as grain leather. Because they have been selectively bred to produce large quantities of wool, the grain pattern of the sheep leather has more follicles per unit area than that of most other animals. The hair follicles are, compared to cattle hide leather, relatively small and closely packed together in groups with spaces between the groups.

   In cross section, sheepskin leather is different from cattle hide. Being much thinner than cattle hide leather, it is not normally necessary to split sheepskin. Since almost half the total thickness of sheepskin is grain layer, weakness

would result if a significant amount of the existing corium was removed. The collagen fibre bundles in the corium are much smaller than those of cattle hide. This means that sheepskin can be used to make suede with a fine, velvety nap that is favoured for clothing purposes.

The much denser structure of the grain layer in sheepskin, results in their skins having lots of hair follicles. This results in more sebaceous glands, blood vessels and related elements. The presence of these structures in the grain layer reduces the available space for the strength giving collagen fibres and thus the grain layer of sheepskin in weaker than that of many other leathers.

Unlike the gradual transition from grain to corium found in cattle hide leather, in domestic sheepskin the structure suddenly changes and sometimes there is a gap between the grain and corium. This is a result of sheep's unusual characteristic of a layer of fat between the grain and corium; most other animals deposit fat between the skin and muscle tissue (subcutaneous fat). The tanner has to remove this fat with detergents to enable the tanning chemicals to penetrate properly. If the skin is very fatty, after it has been degreased there can be gaps left where the fat used to be. When this happens the grain layer is able to move on top of the corium to the point where it can become detached in places. This phenomenon is sometimes called 'looseness' or 'delamination'. The more the leather is flexed, the more the layers delaminate. The tanner has to take great care during processing to prevent this happening once the leather has been made up into a product. This is one of the reasons why sheepskin is not suited where vigorous flexing is likely to take place, such as footwear or seat cushions. Sheepskin leather is most commonly used in clothing.

3. **Goat Skin Leather-** The grain pattern of goat leather is very characteristic. There are usually two different sizes of hair follicle that are arranged in lines; the line of large ones is closely followed by a line of small ones. This is because goats often have two types of hair in their coats; short, fine hairs called 'secondary hairs'(other names for secondary hairs include 'underfur' and 'undercoat'), and longer and stiffer outer hairs called 'primary hairs' (also referred to as 'guard hairs', 'outer hairs' or 'outer coat'), and longer and stiffer outer hairs called 'primary hairs' (also referred to as 'guards hairs', 'outer hairs' or 'outer coat').

   Goats are of similar size to sheep and therefore their leather cannot be used where a large cutting area is required. Unlike sheepskin, the fibre structure of goat leather is more like that of cattle hide. As goats are not wool-producing animals, the density of hair follicles in the grain layer is similar to the cattle hide and therefore the grain layer is slightly stronger than that of sheep. Also, goats do not deposit fat in the middle of the skin like sheep, so there is more of a gradual transition from grain to corium. The result is a lightweight skin that can withstand flexing more readily than sheepskin. It is therefore more versatile and can be used for a wide variety of products such as garments, lightweight foot wear, gloving and smaller items of furniture. Like sheepskin, the collagen fibre bundles are quiet small enabling a very fine 'suede' to be produced.

4. **Hair Sheep**- There are animals known as 'hair sheep' that look very similar to goats and have a skin structure that is more similar to goat than the domestic wool sheep. However, although they are very goat-like, genetically they are sheep. Hair sheep skins are very popular for gloving leather as they have a fine

grain pattern and are quite stretchy. They originate predominantly from African countries.

5. **Pigskin Leather** – The grain surface of pigskin has a very course, modular appearance. The skin grows like this for protection purposes; because the skin is not protected with lots of fur like other animals, the skin grows these modules to minimize the trauma to the skin of the animal caused by scratches, etc. This feature is passed on to the leather. Pigskin leather is very durable and abrasion resistant which makes it ideal for uses where this is important, such as saddle seats. Depending on the location on the skin, the hair follicles of pigskin are often arranged in a triangle shape. The fibre structure of pigskin is quite different to that of the other commonly used skins. Instead of having a grain layer that contains the hair follicles and a corium layer, the hair follicles in pigskin penetrate right through the full thickness of the leather; they can be seen from both surfaces. So, technically, pigskin is all grain layer with no corium, therefore, one might expect the leather to be very weak. But this is not the case as pigskin leather is very strong, because there are few hair follicles present; pigs do not have a thick fur coat like cattle or sheep, they just have a sparse covering of coarse bristles. Consequently, there is plenty of space between the hair follicles for strength giving collagen fibres.

2.8 Historical Background of Macramé Art

According to Milligan (2009), the art of knotting first originated in the Middle East as a means of making nets and decorating the edges of fabric. Sailors created these in their travels and through travel, trade and the conquering of distant lands, macramé spread across the world. Marchen Art (2013) believes that knotting is such a simple handcraft, technique and interpretation evolved all over the world and cultivated within the

customs and culture of every region. The author opines that, it is very difficult, therefore for us to know the precise origins of knotting itself and also hard to be clear about the development of macramé for decorative materials in the modern world. Marchen Art further writes that the word macramé itself is believed to come from an Arabic word meaning "knotting crossways" or "ornamental fringe". Dumont (2000) is also of the view that, the word macramé is not derived from the old Arabic word, *makrama* which loosely translates to "big ugly wall-hanging" but rather comes from the 13th century Turkey and refers to the knotted fringe that decorated towels and linens. This however suggests that the exact date and origin of macramé, an ancient art of decorative knotting is obscure.

Knotting techniques that were originally used to finish off the edges of textiles and cloth gradually took on a more decorative quality, and it is believed that the craft evolved in Eastern Europe, Western Asia, the Middle East and Northern Africa. During the middle ages, techniques that were developed in the Islamic world, which was the most advanced cultural realm of the time, were transmitted to Italy as trade expanded to Asia and Europe. Knotting techniques also seem to have developed independently in various regions in Europe. (Marchen Art, 2013). The use of knots- the type of knot, the colour of the cord and the position of the knot and the cord all helped in conveying complex messages.

The author further writes that, in Italy, artisans in the city of Genoa developed the greatest variety of macramé types in the world. According to Dumont (2000), in Turin, at the turn of the century, Cavandoli macramé was evolving. Named for the school who taught it to her charges, this particular form of knotting conceals and reveals colour using horizontal and vertical half hitching to create a design or picture. In the sixteenth and seventeenth centuries, in Europe, macramé enjoyed tremendous popularity as a

decorative detail in women's clothes. In Victorian Britain in the nineteenth century, after the Queen taught macramé to the ladies of the Court, it became extremely popular there, and many ladies took pleasure from braiding delicate macramé decorations out of fine cords and threads. Concerning this, Milligan (2009) also reiterates that macramé had its heyday in the Victorian ages when the craft was widely regarded.

By the 1920's, macramé according to Dumont (2000) had entered its dormant phase. It however became active again in the late 1960's and 1970's. It was now at the forefront of the arts and crafts renaissance. However, today macramé is enjoying "a twentieth – century renaissance''. The simplicity of macramé makes it a great craft for anyone. Both men and women are turning to working with their hands and are creating not only utilitarian but also aesthetic pieces. In recent years, macramé has been introduced into wood works and clay works as a decorative art.

2.9 Concept of Macramé Art

Macramé as an art form can utilise both natural and synthetic yarns which are readily yielded to knotting in various forms and combination. The concept of macramé art according to Wright (2014) is to use decorative knots to construct a variety of handcrafted items. Most of the time, the knots are combined to form both flat as well as basic shaped items. The flat designs are items like belts, bracelets, clothing, and wall hangings. Basic shaped designs are items like animals, furniture, and plant hangers. Certain knots are used to decorate the items to add interest and appeal. Brown (2002) says, macramé is all about knots. It includes the art of making things out of knots, and things with lanterns. The knots are yarn-based. Grenier (2014) also states that macramé is the art of tying knots in cord or similar materials to create decorative items.

2.10 Types of Macramé Art

According to Wright (2014), there are five types of macramé art: Standard, Micro-macramé, Cavendoli, Complex form and Chinese. She has explained them in the following manner;

1. **Standard Macramé -** These are designs use the basic macramé knots arranged in well-known common shapes like diamonds, triangles, knotted chains, etc.
2. **Micro-Macramé –** This design is unique because very fine cords and threads are used to form the designs. The knots are the same as in standard macramé, but are very tiny. So the overall shape and details are usually quite delicate, and often resemble lace made with Tatting techniques.
3. **Cavendoli –** This design is unique in the fact that only Half Hitches are used in the designs. They are arranged vertically, horizontally, or diagonally. Colourful cord materials are often chosen to form color shifts.
4. **Complex Form –** This is another type of macramé art, and is considered as advanced project. Creations like highly detailed flower arrangements, elaborate stuffed animals, furniture, and many other 3-D shapes are possible, and would be in this category.
5. **Chinese –** This features the creation of combination knots. The basic knots are used to create new knots, which are then used to form unique decorations as well as elaborate works of art. The basic knots are usually challenging to create. In the past, people would compete in knot tying contests, and many elaborate designs came from these events. Some were named and put on display, so are now considered historical knots.

2.11 Knotting Techniques in Macramé Art

Macramé is a crafting technique built from a variety of different knots that create patterns and designs. In Cruz's (2014) view, there are only a few basic knots for macramé. Repetitions and combinations of these knots make other composite knots that are sometimes recognized by their own names. However, according to Mate (2009), Marchen Art (2013) and Wright (2014), there are basically two knots which are most versatile in macramé namely; the square knot and clove hitch. There are other knots which could be created from these basic knots, they include: Lark's Head Knot, Spiral Stitch Knot, Josephine Knot, Overhand Knot, Twist Knot, Wrap Knot, Alternating half hitch and Barrel (Coil knot).

2.11.1 Square Knot

Square knot is one of the basic knots in macramé. Baskett (1999) says it is probably the most important one and a wide variety of patterns can be achieved from this single knot. Milligan (2009) is of the view that, the square knot is one of the most popular and versatile knots. It consists of one half knot tied to the left and other one half tied to the right.

The Square knot is used primarily to form long chains of knots called "Sennits" (or Sinnets). The most common types of projects featuring these long chains are plant hangers and hanging tables. Belts, pet leashes, and bracelets also use the knot in this manner. Another way the Square Knot is used is to create panels of knots, by tying them is rows. By alternating the cords used in every other row, a woven design is formed. This technique is used in items like clothing, handbags, and wall hangings. There are several variations of the Square knot where one can create spirals, V shaped designs,

button knots that are raised above the surface, circular shaped decorations, and more. (Wright, 2014)

2.11.2 Clove Hitch

According to Baskett (1999), Mate (2009) and Marchen Art (2013), the clove hitch is also known as the Double Half Hitch. Clove Hitch is considered the primary macramé knot. It is by far the most versatile of all the knots, and there are endless possible patterns and variations. Most macramé designs use this knot in one form or another. There are many ways it is used, including chains, panels, and free form designs. Since it is a hitch, it can be attached to another cord, or an item like a ring or dowel. (Wright, 2014).Baskett (1999) also says that, this knot is really just two Half Hitches tied around a holding cord, but much more is done with it in macramé. Series of them are used to create raised decorative lines and patterns that can go in most any direction.

2.11.3 Lark's Head Knot

The Lark's Head Knot is one of the most frequently used decorative knots in macramé. Another name for this decorative knot is the **Cow Hitch.** It is regularly utilised as a mounting knot; to attach one cord to another, or onto a ring, dowel or purse handle. (Acajou, 2008). According to Baskett (1999), Lark's Head Knot is used most often as the starting knot to mount cords onto a horizontal holding cord, ring or other item.

2.11.4 Spiral Stitch Knot

The Spiral Stitch Knot is also called the Half Knot Spiral. It is a historical knot and a very popular technique. This knot is made with Half Knots, which is half of a Square Knot. Because it is tied only half of a knot that is usually flat, the sennit would twist as you progress. (Acajou, 2008). According to Milligan (2009), when you repeat the tying

of half knots in the same direction, always starting with the same side, the resulting knots naturally twist. The writer further states that, this simple chain of knots is great for jewellery and straps for purses. It adds a nice textural element to macramé projects of any kind.

2.11.5 Josephine Knot

The Josephine Knot began in the Orient, where it is called the Double Coin Knot. In European nations, it was named for Empress Josephine, who was the wife of Napolean for a period. (Acajou, 2008). Baskett (1999) opines that this knot is most attractive when tied with four, six or eight cords.

2.11.6 Overhand Knot

Overhand knots according to Milligan (2009), are unique knots in that, they can be used to start or finish a piece, or they can be strictly decorative. This knot is very common to most people and is used to start cords or end them to prevent unraveling. It is sometimes called a "simple knot". In this book, it is often used with multiple cords together as one as well with single cords to secure beads on cord ends. (Baskett, 1999). Acajou (2008) also writes that, the Overhand knot is the simplest of all the macramé knots, and it is utilised in many patterns. This decorative knot is used in both the preparation and finishing stages of projects. When tied at the end of a cord, it will prevent unraveling, but it can loosen over time, so you need to apply glue.

2.11.7 Twist Knot

This knot derives its name from hair braiding, the twist or rope. It is a four ply braid but three ends work at a time allowing the fourth one to rest. (Mate, 2009)

2.11.8 Wrap Knot

The Wrap Knot (sometimes called a Gathering Knot) is used to bind many cords together for a neat appearance. This is frequently used at ends of necklaces. (Baskett, 1999)

2.11.9 Alternating Half Hitch

The Alternating Half Hitch is knotted to shape a chain, additionally called a sennit. One cord holds the knot and the other one is utilised to tie the Half Hitch. In more modern texts, this knot is sometimes called the Zigzag Braid. This decorative knot can be utilised to make a straightforward arm ornament or neckband, and a satchel handle. Belts, wind chimes, and other long things can likewise be made with this knot. (Acajou, 2008)

2.11.10 Barrel Knot

The Barrel Knot is like the Overhand Knot, and is frequently utilized in macramé projects, as well as other crafts. In Vintage patterns, this decorative knot is some of the time called the Coil Knot. It is utilised as a finishing knot at the ends of cords, to keep them from disentangling. It can likewise be utilised to secure items, for example, macramé beads or at whatever time you require a firm knot that does not come untied easily. (Acajou, 2008)

2.11.11 Chinese Crown Knot

It was initially made by the local Chinese who intertwined or laced fabric strips or laces together to create turbines for their heads. It can only be used for making ropes or handles. It cannot be woven flat. (Mate, 2009)

2.12 Materials for Macramé

Any pliable material can be used for macramé knotting. According to Milligan (2009), macramé's utilitarian beginnings were with jute, hemp and linen as well as other fibres that were mostly used for nets and fabric. As sailors and traders obtained different types of materials from the lands they ventured to, they helped to develop the craft-and to pass it on, too. Today, new fibres have been found and beautiful pieces are created when used in macramé knotting.

In macramé, one can use any type of cord that can be knotted. Whether you prefer the natural look of hemp, the cool appearance of leather, the intricacy that can be achieved with finer types of cord, the bright colours of perle cotton for friendship bracelets or traditional macramé cords, you can select the type and the thickness you need depending on what you want to make. The selection of the material is one of the joys of macramé. (Marchen Art, 2013). Mate (2009) says that there are vast arrays of knotting materials but basically they are all in form of cords which should not slip when knotted and should be able to join when shortened. She again adds that, they come in natural or synthetic forms. Rayon, nylon, polypropylene, cotton, wool, silk, linen, sisal, soft pliable wire can also be used. Wright (2014) also states that any type of cord materials can be used for macramé, depending on what is being constructed. The writer further states that, the most common natural materials are jute, hemp, and cotton. Common synthetic materials like nylon are also used. The materials less commonly used are flax, leather, silk, satin, and lace. She adds that, macramé cord materials have particular qualities that need to be studied well. It is essentially imperative that the right type is chosen for the intended project. For instance, making hammock requires solid, strong material. Jewellery on the other hand, needs a softer type of material. These days,

there are numerous sorts of cord materials accessible including yarn, ribbon, leather and parachute cord.

2.13 Characteristics of Macramé Materials

Macramé materials have important features that need to be looked at. However, the basic characteristics of cord materials according to Wright (2014) are the following:

1. Flexibility –It is the degree the material can hold the shape of the knots. Materials that resist folding (like thick leather) are not considered to be very flexible. To tie macramé knots, the material needs to be able to be twisted and folded easily, so this is an important quality.
2. Composition- This is sort of fibre used to make the macramé cord materials (synthetic or natural). Certain plants are utilised to create natural materials, for example, hemp, jute and flax linen cord. Leather produced from animal hide so it is considered a natural material.
3. Construction (or Twist) – It refers to how the fibers are combined to form the cord. There are 3 types – Cut, Twisted and Braided. Leather is unique in the fact that it is cut rather than twisted or braided. Twisted cord is made from several small fibers twisted together. Those fibers are further twisted to thicken the material. This twisting may occur several times before the final cord size is reached. Braided cord is the most common, and the fibers are braided together, which means they are usually stronger. Some materials are twisted together initially, and then braided in the final step.
4. Texture -It is the degree of smoothness or roughness of the cord. Satin, for example, is very slick and smooth. Jute is a coarse material.
5. Thickness – It is the actual width of the material from edge to edge, usually described in millimetres.

2.14 Tools for Macramé

Macramé knots, according to Mate (2009), demand the use of very simple tools and one's hands. A cutting tool like a pair of scissors, knife or a sharp blade are some of the tools needed. A knotting board and yarns are all you need to create a project in macramé. Any additional tools you might need for specific projects are inexpensive and easy to acquire a ruler or tape measure, masking or duct tape, sewing needles of various sizes, T – pins and clear drying water proof glue. Marchen Art (2013) has also outlined some tools useful for macramé knotting. Below is a list of these tools:

a. Knotting board- A pinnable board for attaching cords. Specialised boards have a grid printed on them which can serve as a guide to pattern spacing.
b. Macramé pins- These are used to attach the cords to the board. T-pins and push pins work fine.
c. Binder clip - When cords are too thick to be pinned to the board, they can be gripped by a clip that can be pinned instead.
d. Measuring tape, Ruler – Used to measure the length of cords and the dimensions of pattern surfaces. Depending on its size, a ruler can also be used as a spacer to establish row height when knotting mesh patterns.
e. Adhesive tapes – If you are not using a knotting board. You can tape the ends of the cords to your desk. In addition, tape can be wrapped around the cords ends to stop them from fraying. Also, if you need to give your hands a rest, you can use tape to hold your work in place. If you are concerned the tape might impair the surface of the material you are using, use easily removable painter's blue tape.
f. Scissors- It is best to use specially craft scissors.
g. Awl – Poke the tip of an awl between cords to help tighten or loosen the knots.

h. Large- eye sewing needle- Tapestry and yarn needles are needed to weave cord ends into the back of the work when you have finished knotting.
i. Forceps- It can be used to pull a cord through a space between or within a knot. It is not necessary but useful.
j. Glue and bamboo skewers- Strong craft glue can be used to secure final knots and prevent fraying. Bamboo skewers or another tool with a narrow tip can be used to apply glue neatly to protect the fingers.
k. Pliers- It is needed to attach various findings and clasps. This can be a tricky work, small needle-nose pliers are most useful.
l. Small clamp- Use a ring clamp or another "third-hand" to hold part of the work steady when you are attaching clasps or other findings.

2.15 Embellishments or Accessories

These are used to enhance macramé items; they add points of interest or act as a means of fastening or finishing. Various decorative embellishments such as beads can be incorporated into macramé items. Findings such as clasps and rings are often required for jewellery or to affix straps. (Marchen Art, 2013)

2.16 Leather in Macramé Art

For accessories like belts and bags, leather is great choice. There are many variations and textures to choose from, including lace, round cords and suede, each of which comes in many hues. Examples of leather include round, suede, flat leather lace and Knotter's leather. (Marchen Art, 2013). Milligan (2009) says that when deciding which type of hide to use, consider the form and function of your project. Is it a purse? A belt? Should the material be rugged and ready to take a beating, or will be treated more delicately? This however suggests that there is the need to consider the structure of the item to be produced and also treat the leather to suit its purpose.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter discusses the research methodology which serves as a structure for procedures followed to gather necessary information for this study. It includes research design, library research, industrial research, population for the study, sampling design, data collection instruments, data collection procedures and data analysis plan. The chapter chronologically dealt with the general procedures in executing the project.

3.2 Research Design

Research design is defined as the clearly defined structures within which the study is executed. Designing a study helps researchers to plan and execute the study in a way that will offer them some assistance with obtaining the proposed results. (Burns & Grove 2001:223). The qualitative research was used in this study. In this, the descriptive and experimental methods were used to gather data for the study. The descriptive research method was used to describe the entire project and the experimental method was used for the manipulation of the indigenous vegetable tanned leather in the production of strips for use in macramé art.

3.3 Qualitative Research

As indicated by Leedy and Ormond (2005), qualitative research plans to reveal the complexity of an observed phenomenon with the goal of gaining a better understanding of a particular occurrence or experience**.** Merriam (1988) states that qualitative research includes description in that the researcher is interested in procedure, meaning and understanding gained through words or pictures. Qualitative research involves fieldwork. A Descriptive and Experimental method of qualitative method was selected to provide a systematic approach in creating a technique in the manipulation of

indigenous vegetable tanned leather towards the production of strips for use in macramé art.

3.3.1 Experimental Research

According to Key (1997), experimental research is an attempt by the researcher to keep up control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may happen. Experimental research employs different treatments and establishes their effects in the study. The result leads to clear interpretations of effects and findings. The general procedure is the description of the step by step approach by which the entire project was done.

3.3.2 Descriptive Research

Descriptive research describes some situation. The object of descriptive research is to depict on exact profile of persons, events of situations. It is important to have a clear picture of the phenomena on which researcher wish to gather information preceding the accumulation of the information. (Saunders, Lewis and Thronhill 2003). The idea of selecting descriptive research was that, the steps employed for carrying out the experiment, that is, the manipulation of the local leather in the production of strips in macramé knotting, needed to be described chronologically to give a clear and detailed account of all occurrences in connection to the project.

3.4 Library Research

According to George (2008), library research includes identifying and locating sources that give accurate data or personal/ expert opinion on a research question; essential part of every other research method at some point. It provided majority of the secondary data needed. The libraries visited included the KNUST Main library, Art Education Library and Kumasi Centre for National Culture Library.

3.5 Industrial Research

In order for the researcher to know the characteristics of macramé materials and techniques so as to proceed with the study, visits were made to places where the macramé art was being done and studied the nature of the materials and techniques used in macramé art. Interviews and observations were made. The researcher visited individual macramé artisans and experts located at the Department of Integrated Rural Art, KNUST, Kotei and the Central Market all in Kumasi.

3.6 Population for the Study

A population is a collection of objects, events or persons having some common characteristics that the researcher is interested in studying. (Roscoe 155; Selttiz and Cook) in Mouton (2001). The researcher therefore identified the following as the population related to the study:

3.6 .1 Target Population

In this study, the researcher targeted macramé artisans, fibre and fabrics experts and leather technologists.

3.6.2 Accessible Population

A total of 23 people were interviewed. It included macramé artisans, experts in fibre and fabrics and leather technologists in IRAI (KNUST), Kotei and Central Market Kumasi.

3.7 Sampling Technique

Bogopane (2013) states that technically, a sample is a small representation of a whole (population). The most considerations in sampling are the size and representatives. According to Kumekpor (2002), in purposive sampling, the units of the sample are chosen not by a random procedure but rather they are purposefully picked for the study

due to their characteristics or on the grounds that they fulfill certain qualities. Purposive sampling was employed in the selection of experts and artisans in the fields of macramé craft and leather technology. It was also used in selecting local leather samples from Asawase in Kumasi and for the experiments conducted.

3.8 Sample Size for the Study

Table 3.1 Results of Sample Size

Population	**Places**	**Sample size**
Macramé artisans	IRAI(KNUST) Kotei Kumasi Central Market	18
Fibre and fabrics experts	IRAI (KNUST)	2
Leather technologists	IRAI (KNUST)	3
Total		**23**

Table 3.2 Leathers (Skins) Sampled for the Study

Leathers (skins)	**Tannery sources of leathers used**	**Sample size**
Goat	Asawase	12
Sheep	Asawase	1
Total		**13**

3.9 Data Collection Instruments

The main purpose in conducting a qualitative research is to collect and generate data that answer the research questions. Leedy and Ormrod (2005) in Oteng (2011), are of the view that researchers normally make use of multiple forms of data in any single study through observation, interview, objects, written documents, audiovisual

materials, electronic documents (e-mail, websites). However, in this study, the main data collection instruments for the research were observation and interview.

3.9.1 Observation

Observation is a method of gathering information by watching behaviour, events, or noting physical characteristics in their regular setting. The researcher observed and studied the characteristics of the different macramé materials and techniques used in knotting at the places visited. In making on the spot observation, the researcher also directly participated in the studio based experiments carried out to determine the suitability of the local leather for the production of strips for macramé knotting.

3.9.2 Interview

Davies (2006) defines an interview as a method of data collection, information or opinion gathering that specifically includes asking a series of questions. The researcher interviewed macramé artisans, fibre and fabrics experts and leather technologists. The unstructured interview which involves asking relatively open-ended questions of research participants in order to discover their precepts on the topic of interest (Firmin, 2008) was used in collecting data needed for the study. This type of interview was conducted to enable the respondents to open-up and express themselves in their own way. Both English and Twi languages were used in the interview since some of the respondents could neither read nor write in English. Those conducted in Twi were later written out in English.

3.10 Validity and Reliability of Data Collection Instruments

The interview was conducted with a clear plan in mind regarding the objectives of the study. The observation and interview guides were organized and vetted to check the authenticity. In doing this, two leatherwork and fibre and fabric experts were consulted

to make the necessary corrections to improve upon the validity of the instruments. The researcher recorded information on the field with a recorder where necessary, used camera in taking pictures and writing of notes.

3.11 Types of Data

These are data gathered to facilitate the answering of the research questions to meet the objectives of the study. They were mainly the primary and secondary data.

3.11.1 Primary Data

These were the essential data obtained from the use of the observation and interview. It included the experiments performed under art studio conditions to test for the physical characteristics of the Ghanaian indigenous vegetable tanned leather, the manipulation of the local leather in production of strips suitable for macramé knotting and interviews conducted with knowledgeable persons and experts in the field to seek for information needed to carry out the project.

3.11.2 Secondary Data

The secondary data were made up of literary materials needed for the study. They included books, journals, published and unpublished thesis, catalogues, magazines, encyclopedias, internet and other documents that were related to the study.

3.12 Data Collection Procedure

In gathering the primary data, the data were assembled through an unstructured interview. The interview was conducted with a clear plan in mind regarding the objectives and research questions of the study. This guided the study. Interviews were recorded and later transcribed for analysis. Observations done during the experiments conducted were recorded for interpretation. The secondary data were collected through

documentary sources that included books, journals, thesis, catalogues, encyclopedias and the internet.

3.13 Data Analysis Plan

The data were assembled, analysed, interpreted, conclusions were drawn and recommendations were made.

3.14 Tools, Equipment and Materials used for the Practical Project

The tools, equipment and materials used in the working processes have been described.

3.14.1 Tools

According to Microsoft Encarta (2009), a tool is an object designed to do a specific kind of work such as cutting or chopping by directing manually applied force or by means of a motor. The tools used were as follows:

1. Scissors: A cutting tool having two blades whose cutting edges slide past each other. It was used in cutting the leather strips and lining fabric.

2. Digital caliper: A tool having two usual adjustable arms, legs or jaws used especially to measure diameter or thickness. It was used in measuring the thickness of the leather strips.

Plate 3.1: Digital caliper

3. Pliers: A hand tool with two hinged arms ending in jaws that are closed by hand pressure to grip, bend or hold small objects. The plier was used in bending the prongs outwards and flattening them to secure it down.

4. Hammer: A hand tool consisting of a solid head set crosswise on a handle and used for pounding. It was used in hammering the soles of the sandal and slippers after gluing.

Plate 3.2: Hammer

5. Knife: A cutting tool consisting of a sharp blade fastened to a handle. It was used in cutting out the soles for the sandal and slippers.

6. Perforated metal straight edged tool: An improvised metal tool with holes was used in drawing spiral lines on the leather.

Plate 3.3: Perforated metal straight edged tool

7. Pencil: A cylindrical tool used for drawing or writing. It consists of a rod of graphite or some other erasable marking material inside a wooden shaft. It was used in making preliminary sketches of art pieces to be made.

8. Pen: A long thin tool used for writing or drawing with an ink. It was fixed in the holes of the perforated to mark out spiral lines on the leather.

9. Needle: A tool used with a small sharp metal pin with a whole at the blunt end of holding thread used for sewing. It was used in stitching the fabric lining of the purses and bag.

10. Push- pin: A tack with a cylindrical head used to fix lightweight materials to a wall or bulletin board. The push-pin was used to fix the leather in position for the marking of the spiral lines.

11. Thumb tack: A short metal pin with a large flat head. It was used in fixing the sheets of the leathers on the wooden boards during stretching.

12. Bottle: A rigid or semi-rigid container typically of glass or plastic having a comparatively narrow neck or mouth and no handle. The glass bottle was used in beating and burnishing the grain side of the leather.

13. Sanding block: A wooden block wrapped with sand paper for easy handling. It was used in sanding the flesh sides of the leather.

Plate 3.4: Sanding block

14. Tape measure: A long roll or strip of fabric, plastic, paper or thin metal that is marked off in inches or centimeters for measuring something. It was used in taking measurement of strips needed for knotting.

15. Brush: A tool with bristles attached to handle. It was used in applying glue.

16. Ruler: A straight tool for measuring and drawing straight lines. It was used in measuring the radiuses for the circles drawn on the leather.

17. Plastic bowl: A round container usually round in shape. It was used in soaking and dyeing of the leather strips.

18. Last: A wooden, metal or plastic which is shaped like the human foot and over which a shoe is shaped or repaired. It was used in shaping the pair of sandal and slippers.

Plate 3.5: Last

19. Pestle: A club- shaped tool used for pounding or grinding substances in a mortar. It was used in pounding leather strips.

Plate 3.6: Pestle

20. Mortar: A study vessel in which material is pounded with a pestle. The leather strips were pounded in it.

21. Gloves: A covering for the hand having separate sections for each of the fingers and thumb. It was used in covering the hand in dyeing of the leather strips.

Plate 3.7: Gloves

22. Working table: A piece of furniture with wooden flat top fixed on legs. Most of the works were done on it.

Plate 3.8: Working table

23. Stretcher boards: A flat piece of wood. Sheets of leathers and leather strips were stretched on it.

Plates 3.9 and 3.10: Stretcher boards

3.14.2 Equipment

Equipment is an implement or machine used in an operation or activity. The equipment used were as follows:

1. Sewing machine: A machine for sewing materials. It was used in sewing the lining of the bag and purses.

2. Sanding machine: It was used in sanding the edges of the pair of slippers and sandals.

3.14.3 Materials

Materials are items used in making the physical and the visual product of the project. The materials form part of the work (Boahin, 2008). The materials used were as follows:

1. Vegetable tanned leather: Leather prepared with extracts taken from parts of plants. It was the main material used in executing the work.

Plate 3.11: Vegetable tanned leather

2. Glue: An adhesive substance. It was used in gluing the ends of the leather strips and the soles of the pair of sandal and slippers.

Plate 3.12: Glue

3. Bead: A small piece of material pierced for stringing on a cord or sewing fabric. It was used in designing the leather strips during macramé knotting.

Plate 3.13: Beads

4. Suede dye: A local dyestuff. It was used in colouring the local leather strips by soaking it in the colouring solution.

Plate 3.14: Suede dyes

5. Common salt: A crystalline compound NaCl that consists of sodium chloride. It was used in opening the pores of the leather for the absorption of the suede dye.

6. Rivet: A short metal fastener. It was used for fastening the leather strips and straps.

7. Sunflower Oil: A thick greasy liquid. It was applied on leather strips and pounded to soften it.

8. Lining fabric: A material used to line the inner surface of a piece. This was used in lining the inner body of the bag and purses.

Plate 3.15: Lining fabrics

9. Rings: Acircular band for holding, connecting, hanging, pulling, packing, or sealing. It was used in holding the bag straps.

10. Chains: A series of usual metal links or rings connected to or fitted into one another and used for various purposes. They served as straps for the purses.

11. Magnetic snaps: They are made up of two parts; one has a recess in the centre and the other has a bump in the centre. They are used to secure closure to bags and purses.

3.15 Data Collection for Objective One

To identify the characteristics of materials and techniques used in macramé knotting.

3.15.1 Identification of the characteristics of materials and techniques used in Macramé Knotting

The researcher identified the characteristics of macramé materials and techniques in macramé art through interviews and observations. The researcher interviewed macramé artisans and also visited places were the macramé art was being done and studied the nature of the materials and techniques being used in macramé knotting. This was done

in other to have an adequate knowledge in macramé art so as to proceed with the manipulation of the leather in production of strips for macramé knotting. The results have been discussed in the next chapter.

3.14 Data Collection for Objective Two

To manipulate Ghanaian indigenous vegetable tanned leather for the production of suitable leather strips for use in macramé art.

The following activities were carried out to find out whether the characteristics of leather can meet the characteristics of macramé materials used in knotting, since macramé materials are noted for flexibility, thickness, construction, composition and texture.

The indigenous tanned leathers selected for use in macramé knotting were sheep and goat leathers, the researcher selected these two due to the following factors;

1. The sources of raw materials are easily available.
2. Most indigenous tanners find it easy to handle or work with them as compared to cattle hide.
3. The use of the two skins is cost effective hence using technical measures required to prepare them to attain qualities that befit their use for macramé knotting.

The research question two is divided into four projects; **Project One** was to manipulate the selected leathers to make them suitable for use in macramé knotting. **Project Two** was to physically examine the reliability of the two selected types of leathers with the intention of finding out their reliability for macramé knotting. **Project Three** was the application of finishing techniques on leather strips. **Project Four** was to use the

manipulating methods achieved in producing strips for the production of suitable leather strips to be used in macramé knotting for the creation of leather artefacts.

Project One: Manipulation of selected leathers to make them suitable for use in macramé knotting

In manipulating the selected leathers to make them suitable for use in macramé knotting, the following measures were taken;

a) Preliminary preparation: The secondary preparation technique as propounded by Boahin (2008p.202), was applied to both leathers, whereby leathers were treated to protect them from the development of moulds and offensive odour which affect the indigenous tanned leathers produced in local tanneries in Ghana: the secondary preparation involved sanding the flesh side to get rid of excess flesh left after tanning, soaking to get it soft, stretching to open it up to gain its full size and drying in a room temperature. In this improved condition, leathers were made more convenient for the application of the Straight and Spiral leather cutting techniques.

b) Considering the Suitability of Goat and Sheep Leathers for Use in Macramé Knotting.

Considering the features of macramé knotting and the traditional materials regularly used for the production of items, the researcher selected goat and sheep leathers to find out which would be more suitable for making more appropriate knots. Taking into consideration the following qualities associated with macramé cords, that is Flexibility, Strength, Composition, Construction, Texture and Thickness.

The following practical measures were applied to manipulate the selected leathers for use in the research:

Cutting Methods:

i. Straight Cutting Technique

The goat and sheep leathers were marked out individually with the help of a pencil and ruler and then cut into strips with scissors.

Plate 3.33:Marking out on the leather

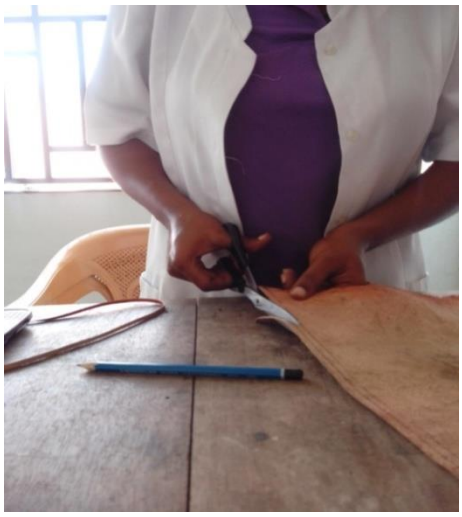


Plate 3.34: Cutting the leather into straight strips

ii. Spiral Cutting Technique

The pieces of goat and sheep leathers were marked in several circles at equal spacing to the centre with the aid of a pair of compasses fitted with pencil. The circles were next joined to each other, afterwards, scissors was used to cut along the marked lines to the centre to secure long strips of leathers useful for the intended project.

Plate 3.35: Marking out on the leather

Plate 3.36: Cutting the leather into straight strips

Softening Methods:

i. Disc-Shaped Drawing Technique

A disc-shaped wood with a hole of 5mm in diameter was prepared. The local leather was marked out and cut into strips, at a width of 10mm after which it was soaked again in water for ten minutes and removed. The strips were pulled over with the hand to remove excess water. The edge of the strip was cut to a point and pulled through the hole about four times, after which it was made to dry in a room temperature. When the strip was about drying, further pulling through the hole of the disc-shaped wood was done to open up the fibres and make it flexible.

Plate 3.37: Pulling leather through hole of the disc-shaped wood

ii. Pounding to Soften Technique

The leathers were marked out and cut into strips. They were then pounded with a pestle and mortar to open up the fibres and to attain flexibility. This took two forms; (i) dry leather strips were pounded at their raw state without any liquid substance with the intention of achieving softness and (ii) strips of leather were oiled and pounded with the hope of getting the oil to penetrate the fibres to attain softness.

Plate 3.38: Pounding of leather strips

Project Two: Physical examination of selected leather types (goat and sheep) with the view of finding out their reliability for macramé knotting

Activity 1: Testing for Flexibility of the Leather

The flexibility of the leather was physically tested by pulling and bending goat and sheep leather strips with the hands continuously.

Plate 3.39: Pulling and bending of leather strip

Activity 2: Testing for Strength of the Leather

The strength of the leather was physically tested by putting force on goat and sheep leather strips by physically pulling them with the hands.

Plate 3.40: Pulling the leather strip

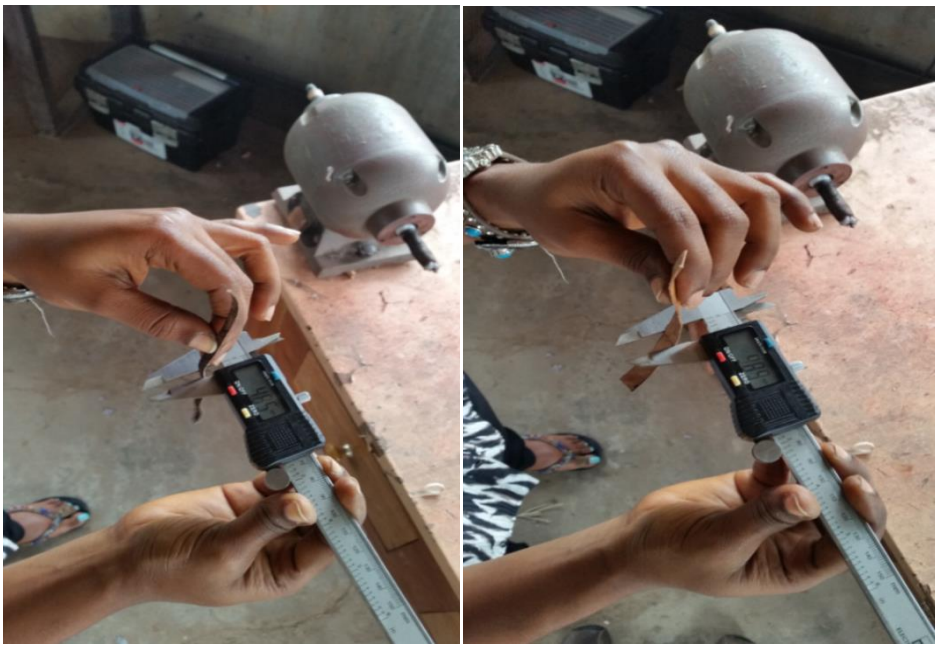
Activity 3: Testing for the Texture (Roughness or Smoothness) of the Leather

The texture was tested by looking at the appearance of the leather surface and using the hands to feel it.

Plate 3.41: Using the hands to feel the leather strips

Activity 4: Testing for Thickness of the Leather

The thickness of the leathers was determined by measuring different widths of leather strips with a digital caliper.



Plates 3.42 and 3.43: Measuring widths of leather strips

Project Three: Application of Finishing Techniques on Leather Strips.

(a). Suede Dyeing and Burnishing.

Procedure

i. **Plain Dyeing**: The leather strip was dipped in water to get it moist. One tablespoonful (4grammes) of orange suede dye and six tablespoonfuls (24grammes) of salt were mixed with warm water in a container and afterwards the leather strip was immersed in the dye solution and stirred for five minutes to enable effective penetration of dye into the fibres of the

leather. It was left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. It was then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched strip on the board was put in the shade for it to dry slowly. It was burnished with a smooth surface bottle to give it a glossy look.

Plate 3.44: Mixing the water with salt

Plate 3.45: Burnishing the leather strip

ii. **Decorated Dyeing:** A second leather strip was once again dipped in water to get it moist, after which the strip was tied with raffia. One tablespoonful (4grammes) of green suede dye and six tablespoonfuls (24grammes) of salt were mixed with warm water in a container and afterwards the leather strip was immersed in the dye solution and stirred for five minutes to accelerate penetrate of dye into the fibres of the leather. It was left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. It was then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched strip on the board was put in the shade for it to dry slowly. It was burnished with a smooth surface bottle to give it a glossy look.

iii. Dyeing Leather Strips Infused with Oil: The procedure used in preparing the suede dye solution for **'a'** and **'b'** was used. However, in this instance, the strip was applied with sunflower oil, and pounded for fifteen minutes before it was immersed in the dye solution.

Project Four: **Production of Leather Strips for the Leather Artefacts**

Having experimented on the various ways to manipulate the Ghanaian indigenous vegetable tanned leather for the production of strips useful in macramé knotting, the following manipulated strips were found suitable for the project.

(a) Pounded leather strips

(b) Pounded leather strips infused with oil

Activity 1. Production of Orange Leather Strips

Working process involved in the Production of Orange Leather Strips:

Step 1: Circles with radiuses of 210mm, 290mm and 330mm were drawn on sheets of leathers respectively with the aid of the perforated metal straight edged tool and pen. Equally spaced lines of the 5mm were marked from the centre on the circular sheet of leather to the edge with the aid of 5 mm spaced perforated metal straight edged tool.

Plate 3.46: Marking the leather

Step 3: The strips were measured and cut into the required measurements needed for knotting the purse and pair of sandals. They were soaked in clean water for thirty minutes after which they were removed and pounded for fifteen minutes in a mortar with a wooden pestle to loosen up the fibres and make them soft.

Plate 3.47: Pounding of leather strips

Step 4: One tablespoonful(4grammes) of orange suede dye and six tablespoonfuls (24grammes)of salt was mixed with warm water in a container and afterwards the leather strips were immersed in the dye solution and stirred for five minutes to enable it penetrate the fibres of the leather well. They were left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. The strips were then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched leather strips on the board was put in the shade for it to slowly dry.

Plate 3.48: Leather strips being removed from orange dye solution

Step 5: After drying, the strips were burnished one after the other with a smooth surface bottle to soften and also give it a glossy look.

Plate 3.49: Orange leather strips

Activity 2.Production of Brownish Black Leather Strips (Suede dyeing of Oil Infused Leather Strips)

Working process involved in the Production of Brownish Black Leather Strips:

Step 1: A sheet of brown coloured leather was marked on the flesh side in a circle of radius 320mm with the aid of special perforated metal edged tool and a pen and cut out.

Step 2: The cut out circular sheet of leather was next fixed on a board and held at the centre with the aid of push-pin. Equally spaced lines of the 5mm were marked from the centre on the circular sheet of leather to the edge with the aid of 5 mm spaced perforated metal straight edged tool.

Step 3: Sun flower oil was next applied on the marked sheet of leather at the flesh side, after which the strips were cut spirally into lengthy strips needed for knotting the ladies' purse.

Step 4. One tablespoonful(4 grammes) of black suede dye and six tablespoonfuls (24 grammes) of salt were mixed with warm water in a container and afterwards the oiled brown leather strips were immersed in the dye solution and stirred for five minutes to enable it penetrate the fibres of the leather well. They were left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. The strips were then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched leather strips on the board were put in the shade for it to slowly dry.

Plate 3.50: Stretching dyed strips on the board

Step 5. After the strips were dried, they were beaten and burnished simultaneously with a smooth rounded bottle to soften the fibres and also give them a glossy look.

Plate 3.51: Brownish black leather strips

Activity 3. Production of Green Leather Strips

Working process involved in the Production of Green Leather Strips:

Step 1: Circles of radiuses of 280mm, 320mm and 210 mm respectively were drawn on the three sheets of leathers with the aid of the perforated tool and a pen. Equally spaced lines of the 5mm were marked from the centre on the circular sheet of leather to the edge. After marking, the sheets of leathers were cut spirally into lengthy strips with a pair of scissors.

Step 2: The strips were measured and cut into the required measurements needed for knotting the ladies' purse and pair of sandals. They were soaked in clean water for thirty minutes after which they were removed and pounded for fifteen minutes in a mortar with a wooden pestle to loosen up the fibres and make them soft.

Step 3: Some of the pounded strips were tied with raffia and dyed to give it a nice look. However, one tablespoonful (4 grammes) of green suede dye and six tablespoonfuls(24

grammes) of salt were mixed with warm water in a container and afterwards the tied leather strips were immersed in the dye solution and stirred for five minutes to enable it penetrate the fibres of the leather well. A tablespoonful of a mixture of green and black dye was put in another container mixed with six tablespoonful of salt and warm water. The strips were immersed in the dye solution and stirred for five minutes. The leather strips were left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. The strips were then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched leather strips on the board were put in the shade for it to slowly dry.

Plate 3.52: Leather strips stretched on the board

Step 4: After drying, the strips were burnished one after the other with a smooth surface bottle to soften and also give it a glossy look.

Plate 3.53: Burnishing the leather strip

Plate 3.54: Green and greenish black strips

Activity 4. Production of Blue - black leather strips

Working process involved in the Production of Blue- black Leather Strips:

Step 1: Circles of radiuses of 300mm, 330mm, 330mm and 290 mm respectively were drawn on four sheets of leathers with the aid of the perforated metal straight edged tool and a pen. Equally spaced lines of the 5mm were marked from the centre on the circular sheet of leather to the edge. After marking, the sheets of leathers were cut spirally into lengthy strips with a pair of scissors.

Step 2: The strips were measured and cut into the required measurements needed for knotting the ladies' bag. They were soaked in clean water for thirty minutes after which they were removed and pounded for fifteen minutes in a mortar with a wooden pestle to loosen up the fibres and make them soft.

Plate 3.55: Soaked leather strips

Step 3: After soaking and pounding the strips, they were tied with raffia. One tablespoonful (4 grammes) of a mixture of blue and black suede dye and six tablespoonfuls (24 grammes) of salt were mixed with warm water in a container and afterwards the cream coloured leather strips were immersed in the dye solution and stirred for five minutes to enable it penetrate the fibres of the leather well. They were left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. The strips were then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched leather strips on the board were put in the shade for it to slowly dry.

Plate 3.56: Tying the leather strips with raffia

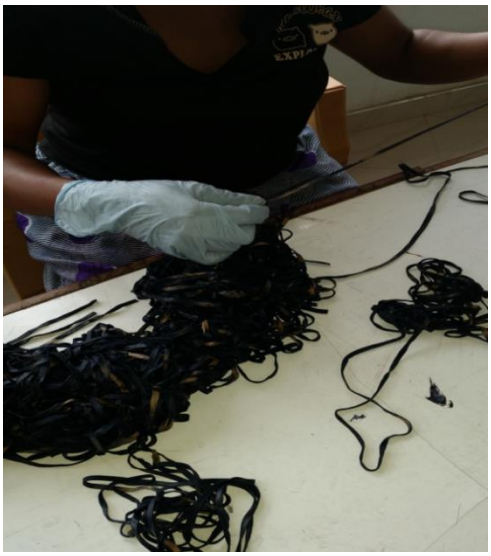


Plate 3.57: Straightening out the strips on the board

Plate 3.58: Strips stretched on board for drying

Step 4. After drying, the strips were burnished one after the other with a smooth surface bottle to soften and also give it a glossy look.

Plate 3.59: Blue-black dyed leather strips

Activity 5.Production of Pink Leather Strips

Here, the researcher used the remaining strips that had not been worked on and dyed it.

Working process involved in the Production of Pink Leather Strips:

Step 1: The strips were cut into required measurement needed for knotting the slippers. They were soaked in clean water for thirty minutes after which they were removed and pounded for fifteen minutes in a mortar with a wooden pestle to loosen up the fibres and make them soft.

Step 2: One tablespoonful (4 grammes) of pink suede dye and six tablespoonfuls(24 grammes) of salt were mixed with warm water in a container and afterwards the leather strips were immersed in the dye solution and stirred for five minutes to enable it penetrate the fibres of the leather well. They were left in the solution for about fifteen minutes and afterwards removed and put in the shade for ten minutes. The strips were then rinsed in clean water to clear the excess dye solution and stretched tautly on a stretcher board. The stretched leather strips on the board was put in the shade for it to slowly dry.

Plate 3.60: Stretched strips on board

Step 3: After drying, the strips were burnished one after the other with a smooth surface bottle to soften and also give it a glossy look.

Plate 3.61: Pink leather strips

3.15 Data Collection for Objective Three

To use leather strips developed from Ghanaian indigenous vegetable tanned leathers in macramé knotting for the production of leather artefacts

The products selected for production with the manipulated leather strips included the following; ladies' dressing bags, purses, pair of ladies sandals and slippers.

Project 1: Making the Orange Purse using Square and Clove Hitch Knots

(a)Design process: The following designs were made to test the use of manipulated leather strips in the production of the orange purse.

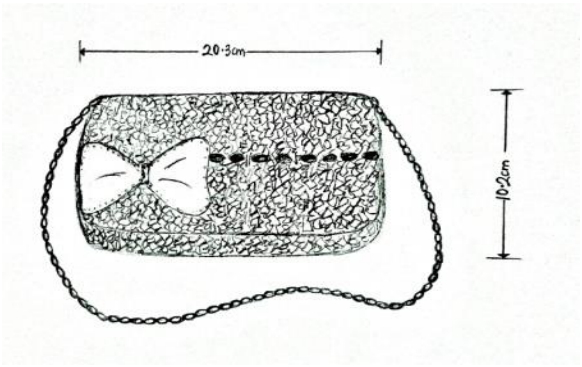


Figure 3.3: Outline of purse.

Figure 3.4: 3-D rendered view of purse

(b) Working Process involved in making the Orange Purse:

Step 1: Twenty- six orange dyed strips with each measuring 305centimetres long were used in tying the knots for the purse.

Step 2: Using the 305centimetres long strips, two strips were folded into two making it four strips in number and tied into a square knot, after which it was set aside, this process was repeated 12 more times. Altogether, 13 square knot units were gotten. The units were tied together with Alternating Square Knots, starting with the third strip on the left. 12 square knots were tied in this row.

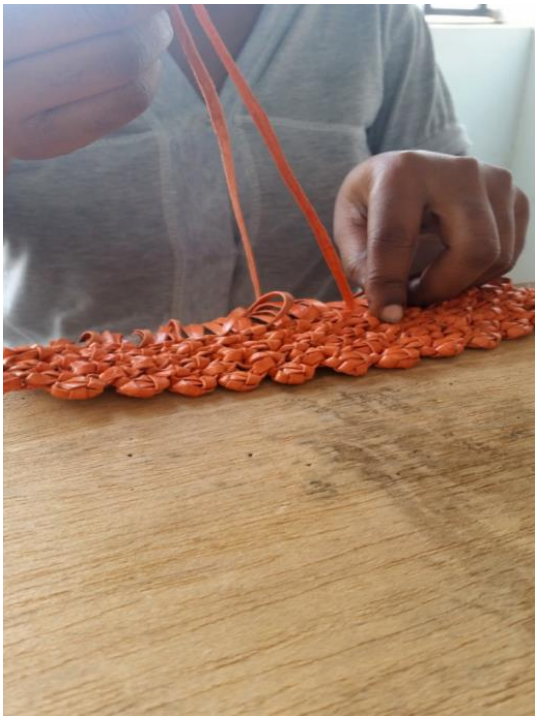


Plate 3.62: Tying of the Alternating Square Knots

Step 3: Rows of 58 Alternating Square Knots were tied in a rectangular format. The tenth row was fixed with beads on the strips outside the filler cords of the square knots, that is, the centre of the 4 strips after which another square knot was tied under each bead.

Step 4: After the 58th row of square knots had been tied, clove hitch was used in tightening the ends of the alternating square knots to prevent it from loosening. However, the left over strips, that is, the fringes were cut leaving an inch and glued to prevent the clove hitch from loosening and fraying.

Step 5: The knotted strips which was in a rectangular form, was folded into three sections, the second and third sections were fastened at the sides together by thonging with some of the strips at the left and right sides, using the first section as a flap.

Step 6: Magnetic button snap was fixed for closing the purse and after which the ends of a golden chain strap was fixed at the right and left sides of the purse. A small piece of orange dyed leather was cut and sewn into a bow tie. The bow tie was fixed and sewn on the outer part of the purse with a thread and beads to decorate.

Plate 3.63: Sewing of bow tie

Step 7: The inner body of the purse was lined with an orange fabric lining.

Finished work- Orange Purse

Plate 3.64:Finished orange purse

Project 2: Making the Orange Pair of Ladies' Sandals using Square Knots

a) Design process: The following designs were made to test the use of manipulated leather strips in the production of orange pair of ladies' sandals.

Figure 3.5: Outline of sandals

Figure 3.6: 3-D rendered view of sandals

b) Working process involved in making Orange Pair of Ladies' Sandals:

Step 1: 16 strips of leather were used, the ankle straps measured 305centimetres each long, the toe to middle straps measured 203centimetres long and the side straps measured 102centimetres each long. The Square knot sinnets were tied and used for the straps to be used for the upper of the sandals. The straps were fastened with rivets.

Plate 3.65: Fastening the straps with rivets Plate 3.67: Upper of the sandals

Step 2: After using a pen to trace the outlines of a template of foot size 36, the inner and outer sole materials of the sandals were cut with the help of a utility knife.

Step 3: The inner sole was marked and punched with the aid of a pen and a punching tool, after which the straps were fixed in the punched holes and shaped in a plastic last. While it was in the last, the shoe maker's glue was smeared at the back of the inner sole. The inside of the back sole was also smeared with shoe maker's glue and left to dry gently for fifteen minutes.

Step 4: After the two glued surfaces had dried, they were pressed together firmly and hammered to secure a strong bond.

Step 5: The edges of the soles were sanded using the sanding machine.

Finished work – Orange Ladies' Pair of Sandals

Plate 3.68: Finished orange ladies' pair of sandals

Project 3: Making the Brownish Black Purse using Half and Clove Hitch Knots

a)Design process: The following designs were made to test the use of manipulated leather strips in the production of ladies' slipper.

Figure 3.7: Outline of purse

Figure 3.8: 3-D rendered view

b) Working Process involved in making Brownish Black Purse:

Step1: 48 brownish black dyed strips with each measuring 203centimetres long were used in tying the knots for the purse.

Step 2: Using the 203centimetres long strips, two strips were folded into two making it four strips in number and tied into a square knot, after which it was set aside, this process was repeated 23 more times. Altogether, 24 square knot units were gotten.

Plate 3.69: Tying of the Square Knots

Step 3: The units were tied together in a circular form with Alternating Square Knots (ASK), taking 2 cords from one square knot section and 2 cords from the next square knot section to tie a square knot. The alternating square knots were tied in rows and in the round to the fourth row.

Step 4: The 5th row was tied in half knots sinnet. The alternating half knots sinnets were tied in a continuous round form until the desired height was reached, that is, from

5th row to the 12th row of the purse. Enough strips were left for tying up the bottom after tying the last row very tight.

Step 5: The purse was turned inside out. Clove hitch knot was tied all round, it was divided into 2, the front and back sides. The purse was put in between the knees with bottom up. With the 2 sides out of the way and dangling on the sides, they were taken one after the other to tie a horizontal line of clove hitch knots.

Step 6: After the clove hitch knots had been tied, the purse was turned with the outside out and bottom was checked to see if the sides had not lopsided.

Step 7: After checking to see whether it had not lopsided, it was turned inside out. The ends were cut leaving 1.3centimetres, and glued to prevent loosening and fraying. It was turned outside out again.

Plate 3.70: Cutting the ends

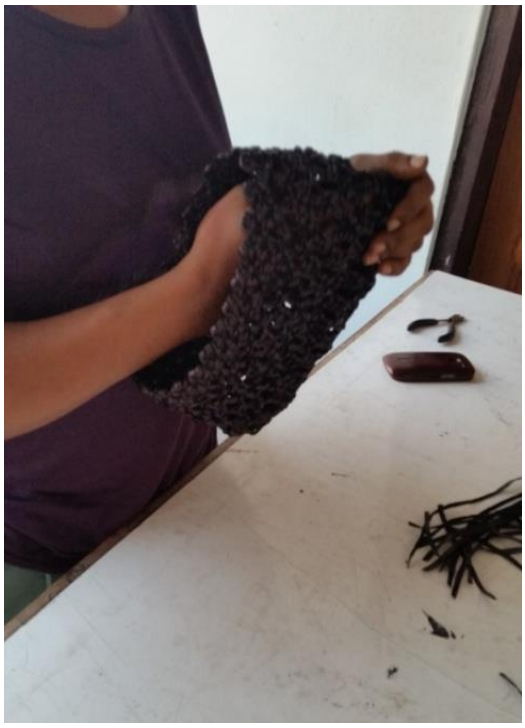


Plate 3.71: Turned outside out purse

Step 8: The flap of the purse was made by cutting leather into the desired shape as designed using a paper pattern, one for the top of the flap and the other for lining. The lining was placed onto the paper pattern piece and the spot where the lining meets the dot on the paper pattern was marked. The magnetic snap with the protruding button was placed at the centre of the lining where the spot was marked. With the prongs meeting the lining, it was carefully marked. A blade was used to slice through the lining on the 2 lines marked. The prongs were fixed into the slits and the magnetic snap was pushed down all the way. On the underside, the plate was placed so the prongs go through the rectangular slits on the plate. Pliers were used in bending the prongs outwards and flattening them to secure it down. The lining and the inside of the top of the flap were glued and made to dry gently after which the surfaces were pressed firmly together by hammering. The edges were then punched and thonged with a leather strip.

Plate 3.72: Making the strap

Step 9: After making the flap, it was stitched to the body and folded over to mark the spot where the magnetic snap meets the body piece. The other magnetic snap was attached in the same way as done earlier in Step 9.

Step 10: The ends of the chain strap were fixed at the left and right sides of the inner body of the purse after which a black lining fabric was sewn with the help of a sewing machine. The sewn lining fabric was attached to the inner body by hand stitching.

Plate 3.73: Sewing the fabric lining

Plate 3.74: Hand stitching the fabric

Finished work- Finished Brownish Black purse

Plate 3.75: Finished brownish black purse

Project 4. Making the Green Purse using Square and Clove Hitch Knots

a) Design processes: The following designs were made to test the use of manipulated leather strips in the production of ladies' green purse.

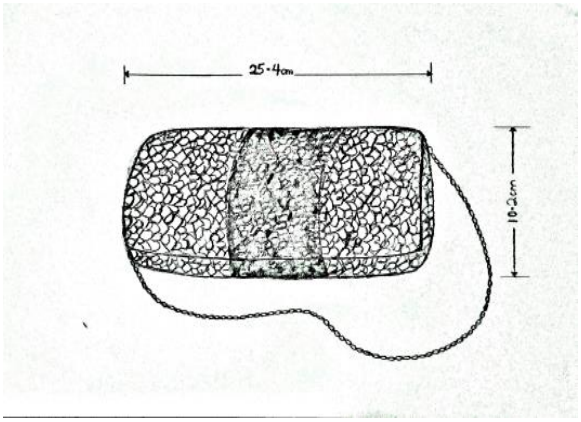


Figure 3.9Outline of purse

Figure 3.10 3-D rendered view

b) Working process involved in making Green Purse:

Step1: 24 green and 6 greenish black dyed strips with each measuring 254centimetres long were used in tying the knots for the purse. Altogether, 30 strips were used.

Step 2: Using the 254 centimetres long strips, two strips were folded into two making it four strips in number and tied into a square knot, after which it was set aside, this process was repeated 14 more times. Altogether, 15 square knot units were gotten. They were divided into 3 sections, first six square knots were green dyed strips, the middle ones which were 3 square knots were the dyed greenish black strips and the last six square knots were also green dyed strips as seen in the design. The units were tied together with Alternating Square knots, starting with the third strip on the left, 14 square knots were tied in this row.

Plate 3.76: Tying the square knots

Plate 3.77: Tying square knots with alternating knots

Step 3: Rows of 45 Alternating Square Knots were tied in a rectangular format. After the 45th row of square knots had been tied, clove hitch was used in tightening the ends of the alternating square knots to prevent it from loosening. However, the left over strips, that is, the fringes were cut leaving an inch and glued to prevent the clove hitch from loosening and fraying.

Plate 3.78: Tying of the clove hitch knots

Step 4: The knotted strips which was in a rectangular form, was folded into three sections, the second and third sections were fastened at the sides together by thonging with some of the strips at the left and right sides, using the first section as a flap.

Step 5: A green fabric lining was sewn with the aid of a sewing machine and magnetic button snaps were fixed at the left and right ends for closure after which it was glued to the inner top of the flap. It was folded over to mark the spots where the magnetic snap meets the body piece and the other magnetic snap was attached in the same way. Another green fabric lining was sewn with the sewing machine and hand stitched in the inner body of the purse. The fabric lining was cut into strips, sewn and hand stitched to the lining of the inner body to hold and keep the golden beaded chain in position.

Finished work – Green Purse

Plate 3.79: Finished green purse

Project 5: Making the Green Pair of Slippers using Twist Knots

a) Design process: The following designs were made to test the use of manipulated leather strips in the production of ladies' green slippers.

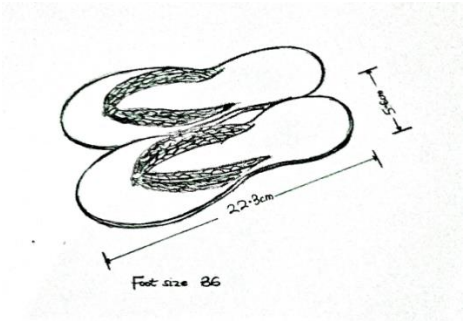


Figure 3.11: Outline of slippers

Figure 3.12: 3-D rendered view

b) Working Process involved in making Green Pair of Slippers:

Step 1: 24 strips with each measuring 60.9centimetres long were used for the knots. The toes to middle foot straps for the upper of the slippers were tied using the twist knots.

Plate 3.80: Tying of the twist knots

Step 2: After using a pen to trace the outlines of a template of foot size 36, the inner and outer sole materials of the sandals were cut with the help of a utility knife.

Step 3: The inner sole was marked and punched with the aid of a pen and a punching tool, after which the straps were fixed in the punched holes and shaped in a plastic last. While it was in the last, the shoe maker's glue was smeared at the back of the inner sole. The inside of the back sole was also smeared with shoe maker's glue and left to dry gently for fifteen minutes.

Plate 3.81: Marking on the inner sole using a pen

Plate 3.82: Drying of the glued sole

Step 4: After the two glued surfaces had dried, they were pressed together firmly and hammered to secure a strong bond.

Step 5: The edges of the soles were sanded using the sanding machine.

Finished work – Green Pair of Ladies' Slippers

Plate 3.83: Finished green pair of ladies' slippers

Project 6: Making Blue-black Tie and Dye Bag using Square Knots, Clove Hitch and Lark's Head Knot.

a) Design Process: The following designs were made to test the use of manipulated leather strips in the production of ladies' bag.

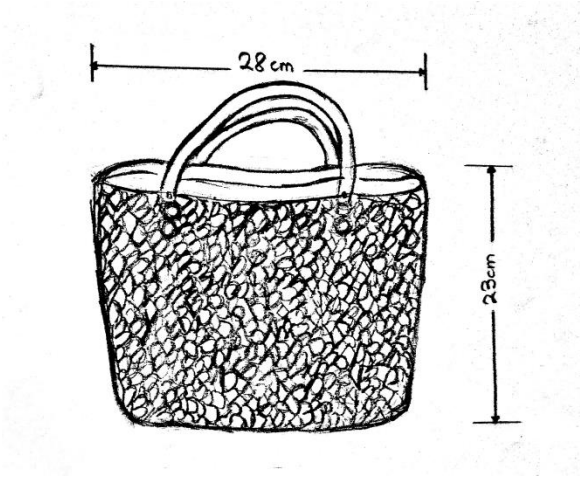


Figure 3.13: Outline of bag

Figure 3.14: 3-D rendered view

b) Working process involved in making Blue-black Tie and Dye Bag:

Step1: Altogether, 84 blue black dyed strips were used. 8 strips were used for the right gusset with each measuring 508centimetres long, 8 strips were used for the left gusset with each measuring 305centimetres long and 34 strips with each measuring 254 centimetres long were used for the middle part of the bag.

Step 2: Using the 213.2centimetres long strips, two strips were folded into two making it four strips in number and tied into a square knot, after which it was set aside, this process was repeated 41 times. Altogether, 42 square knots were gotten.

Step 3: The units were tied together in a circular form with Alternating Square Knots (ASK), taking 2 cords from one square knot section and 2 cords from the next square

knot section to tie a square knot. The alternating square knots were tied in rows and in the round continuously to the 40th row.

Plate 3.84: Tying the knots in the round

Step 4: After reaching the 40th row, the left and right gusset cords were separated, the right gusset cords were extended by tying alternating square knots to the left side, the left side gusset cords were extended a little bit by alternating the square knots to meet the right ends. Both extended right and left sides hanging cords were joined together by tying square knots vertically to form a base.

Step 5: The front and back hanging cords were now passed through the holes at the extreme ends of the base knots. The bag was turned inside out and put in between the knees with the bottom up. The ends were secured with clove hitch.

Step 6: After the clove hitch knots had been tied, the purse was turned with the outside out and bottom was checked to see if the sides had not lopsided.

Step 7: After checking that it had not lopsided, it was turned inside out. The ends were cut leaving an inch, and glued to prevent loosening and fraying. It was turned outside again.

Plate 3.85: Applying glue to the ends

Step 8: Leather strap handles were made for the bag; they were cut 53.3 centimetres long and reinforced with leather by gluing the surfaces and allowing them to dry gently. After drying, the straps were pressed together firmly and hammered to secure a strong bond. The handles were stitched with a blue black nylon cord after punching holes with a punch.

Plate 3.86: Stitching the strap handle

Step 9: The ends of the strap handles were fixed with golden metal rings using rivets, they were knotted with strips using the lark's head and square knots from the outside of bag and secured with clove at the inner part of the bag.

Step 10: A black fabric lining with a zip was sewn with the aid of a sewing machine after which it was attached to the inner body by hand stitching.

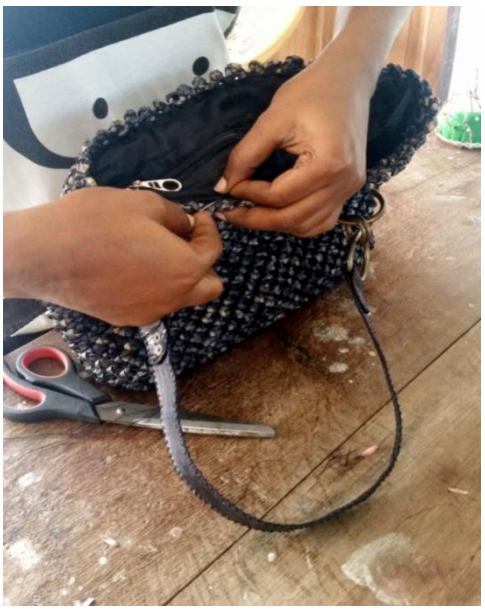


Plate 3.87:Attaching the lining to the inner body by hand stitching

Finished work- Blue- black Tie and Dye Bag

Plate 3.88: Finished blue- black tie and bag

Project 7: Making Pair of Pink Ladies' Slipper using Clove Hitch Knots and Square Knots

a) Design process: The following designs were made to test the use of manipulated leather strips in the production of pair of pink slipper.

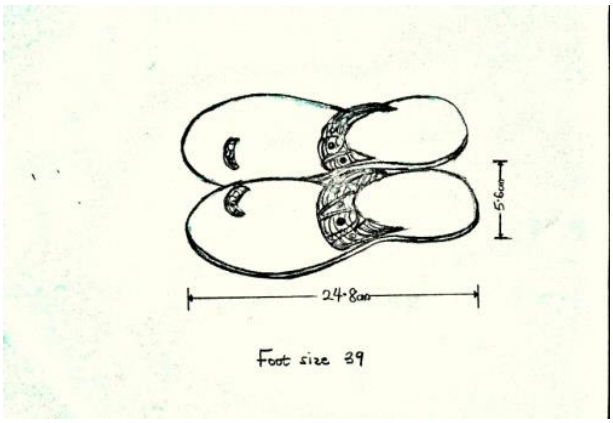


Figure 3.15: Outline of pink pair of slippers

Figure 3.16:3-D rendered view

b) Working process involved in making Pair of Pink Ladies' Slippers:

Step 1: 18 strips of leather were used altogether. For the middle straps, 14 strips which measured 88.9 centimetres each long were used and for the toe straps each measured 41centimetres long. The middle straps were tied using the clove hitch knots and beads. The toe straps were tied using square knot sinnets.

Plate 3.89: Tying of the Clove Hitch knots

Step 2: After using a pen to trace the outlines of a template of foot size 39, the inner and outer sole materials of the sandals were cut with the help of a utility knife.

Step 3: The inner sole was marked and punched with the aid of a pen and a punching tool, after which the straps were fixed in the punched holes and shaped in a plastic last. While it was in the last, the shoe maker's glue was smeared at the back of the inner sole. The inside of the back sole was also smeared with shoe maker's glue and left to dry gently for fifteen minutes.

Plate 3.90: Fixing the straps into the holes Plate 3.91:Gluing the back of the inner sole

Step 4: After the two glued surfaces had dried, they were pressed together firmly and hammered to secure a strong bond.

Plate 3.92: Hammering the slippers

Step 5: The edges of the soles were sanded using the sanding machine.

Finished work – Pink Ladies' Pair of Slippers

Plate 3.93: Finished pink pair of slippers

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Overview

This chapter comprises the findings, discussion of results from interviews and observations. The data gathered from the field have been assembled and presented in this chapter.

4.2 Discussion of Results for Objective One

To identify the characteristics of materials and techniques used in macramé knotting.

The data recorded indicates that the characteristics of the macramé materials are exhibited in the Ghanaian indigenous vegetable tanned leather hence making it viable for use in macramé art. The characteristics included construction, composition, thickness, flexibility, strength and texture. *See plates 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7.*

4.2.1 Characteristics of Materials used in Macramé Knotting

Table 4.1 Types of macramé materials and their characteristics

TYPE OF MACRAME MATERIAL	CHARACTERISTICS
Rayon Cord 	Synthetic material, Braided form, 4mm thickness, High flexibility, High strength, Smooth texture.

Leatherette Strip 	Synthetic material, Cut form, 8mm thickness, Low flexibility, Low strength, Smooth texture.
Leatherette Cord 	Synthetic material, 5mm thickness, Low flexibility, Medium strength, Smooth texture.
Nylon Rope 	Synthetic material, Twisted form, 5mm thickness, Low flexibility, High strength, Smooth texture.
Fine Nylon Cord 	Synthetic material, Twisted form, 2mm thickness, Medium flexibility, High strength, Smooth texture.

Jute 	Natural material, Twisted form, 4mm thickness, Medium flexibility, Low strength, Rough texture.
Raffia 	Natural material, Low flexibility, Medium strength, Smooth texture.

(Source: Assessment conducted by the researcher, July 2015)

4.2.2 Characteristics of Techniques used in Macramé Knotting

The researcher found out that the knots were mostly tied in two opposite directions. Some knots were found to be flat and others were round. A technique like the square knot made an intricate design when used in macramé knotting.

1. Square Knot

With square knots, two folded cords are secured on a working surface and numbered from 1 to 4. The left working cord (1) is moved over the filler cords (2 and 3) heading right and then passed under the right working cord (4). The right working cord (4) is moved under the two filler cords and over cord 1 as it is pulled out on the left. Both ends are pulled to tighten the knot with the filler cords held firmly, thus,the first half of the knot is finished. The second half is tied in the opposite direction; the cord is moved on the right (1) over the filler cords and under the left working cords. Cord (4) under the filler cords and over working cord (1) on the right are moved. The second half of

the knot is tied to form a square knot. Square knots tied on alternating cords make an intricate design. A tightly knotted knot gives a woven like texture and a loosely knotted knot gives a lacelike pattern and texture.

Plate 4.8: Square knot

2. Clove Hitch

With clove Hitch, 2 working cords or more are secured to a working surface, after folding them in half in a vertical manner. A separated cord which becomes the holding cord is placed on top of the vertical cords. It is placed horizontally, has plenty of tension and made straight as possible. The first working cord on the left is moved over the holding cord and then under it. As it is pulled down, it is passed over the portion of the working cord at the bottom. This makes a single half hitch. A second half hitch is pulled tightly by pulling the end slightly to the right.

Plate 4.9: Clove hitch

3. Lark's Head Knot

This knot is mostly used as a mounting knot. It is used in attaching one cord to another, or onto a ring, dowel or handle. One holding cord is secured on a working surface horizontally; another cord is folded and placed under the holding cords. The folded area is put at the bottom and the ends at the top. Both ends are brought over the holding cords, heading downward; they are then passed under the folding area and pulled firmly. When tightened, the lark's head knot has a horizontal segment made by the fold, resting just below the holding cords.

Plate 4.10: Lark’s head knot

4. Half Knot Spiral

This knot is made with Half Knots, which is half of a Square Knot. If knotted in a continuous form it forms a twisted sinnet. Two cords are folded in half and secured onto a working surface with the working cords positioned at the right and left of the two filler cords in the centre. The right working cord is moved to the left, over the filler cords and under the left working cord. The left working cord is moved to the right, under the filler cords, and over the right working cord.

Plate 4.11: Half knot spiral sinnet

5. Josephine Knot

Four working cords are mounted on a working surface; a loop is made with the left cords by placing the working end under the beginning end. The right cords are placed on top of the loop that was formed with the left cords. The ends of the right cords are brought under the ends of the left cords. The right cords are then woven over and under the other cords going from upper left to right by bringing the right cords around and over the first pair over the third pair and under the last pair. The ends are pulled to make loops even and also tightened to desired knot.

Plate 4.12: Josephine knot

6. Overhand Knot

This knot is used to anchor cords at the beginning of macramé projects and finishing a knot. With this knot, the cord is held in both hands and a loop is made, crossing the left end over the right. The right end is passed through the loop from the top. The ends are pulled to tighten the knot.

Plate 4.13: Overhand knot

7. Twist Knot

This knot creates a rounded braid. In knotting, the left strand is picked and brought behind the next two strands and back in between those two strands. The right strand is picked up and brought behind the adjacent two strands and back in between the two. This sequence is repeated until the desired length is achieved. A different knot such as square knot is used to secure the braid.

Plate 4.14: Twist knot

8. Wrap Knot

This knot is easy. The number of ends to be wrapped depends on the thickness of rope required. The thicker the rope the more ends that have to be used. Four ends of 1mm thick yarn would give a normal rope of a finger thickness. With the 4 ends, one end is taken out of the lot and plaited or wrapped round the other three making sure that each wrap forms a ring round the three. At the end of the required length the end is sealed with a strong adhesive then cut off. The end can also be melted to prevent it from loosening.

Plate 4.15: Wrap knot

9. Chinese Crown Knot

This type of knot is used for making ropes and handles. It is not knotted flat. Four ends are required to make this knot. In making this knot; the four ends are turned upside down to keep them in place. In a manner of covering a box the ends are numbered 1 to 4. Cord 1 is picked and looped over cord 2, then end 2 is picked and looped over 3, then 3 is looped over 4, the 4th end is picked finally and passed through the 1st loop. The 4 ends are then pulled tight.

Plate 4.16: Chinese crown knot

10. Three Ply Braid

This is tied using three strands, thus, one on the left, middle and right. The left strand is picked and placed over the middle strand. Then the right strand is picked and placed over the middle strand.

Plate 4.17: Three ply braid

4.3 Discussion of Results for Objective Two

To manipulate Ghanaian indigenous vegetable tanned leather for the production of suitable leather strips for use in macramé art.

4.3.1 Results Assessment of Leather Cutting Techniques

It was found out that the spiral cutting technique gave a lengthy strip other than the straight cutting technique. This suggests that the spiral cutting technique is the best method of constructing leather for use in macramé knotting.

4.3.2 Results Assessment of Leather Softening Methods

i. Disc-Shaped Drawing Technique

The disc- shaped drawing technique gave the goat and sheep leather strips a rounded effect but had medium flexibility.

ii. Pounding to Soften Technique

The goat leather strip became flexible and soft after pounding it in its raw state without the application of liquid substance. The sheep also became very soft and flexible but had evidence of tearing.

The oil infused goat leather strip became soft after pounding and the sheep leather strip also became very soft although it had evidence of tearing.

4.3.3 Results of Leather Flexibility Assessment

The bending and pulling of the goat leather showed few wrinkles but had no evidence of tearing or damage. The bending and pulling of the sheep leather strips showed few wrinkles and had evidence of tearing.

This suggests that in terms of flexibility, goat leathers suit best for use in macramé knotting.

4.3.4 Results of Leather Strength Assessment

The sheep leather broke apart when applied with force other than the goat strips. However, the goat leather strip is stronger than the sheep leather strip. This suggests that the goat leather is strong enough for use in macramé knotting.

4.3.5 Results of Leather Texture Assessment

The appearance of the leather strips were looked at and felt with the hands. The researcher found out that both local sheep and goat leathers had smooth textures. This suggests that the goat and sheep leather have smooth textures.

4.3.6 Results of Leather Thickness Assessment

It was found that the narrow the width, the lighter it was and the wider the width the heavier it was. Wide leather strips give heavy strips and narrow leather strips give light strips. This suggests that wide leather strips give heavy thickness and narrow strips give light thickness.

Wright (2014) is of the view that materials that resist folding (like thick leather) are not considered to be very flexible, however this confirms that leather strips ranging from 6mm to 10mm give heavy and thick strips, hence making it less flexible.

From the tests conducted, goat leather suits best for use in macramé knotting.

4.4 Discussion of Results for Objective Three

To use leather strips developed from Ghanaian indigenous vegetable tanned leathers in macramé knotting for the production of leather artefacts.

Wright (2014) says that to tie macramé knots, the material needs to be able to be twisted and folded easily. However, the researcher found out that the local goat leather strip was able to twist and fold easily in the knotting. It held the knots well and also showed in detail the structure of the knots used in producing the artefacts.

The leather artefacts produced were tested for the following qualities:

a) Attractiveness

b) Durability

c) Fitness for purpose

4.4.1 Attractiveness

The researcher found out that the burnished plain and decorated dyed strips gave the artefacts produced an aesthetic and glossy look which made them very attractive and appealing to the eyes.*See plates 4.18, 4.19, 4.20, 4.21, 4.22, 4.23, 4.24 and 4.25.*

Plate 4.18: Orange purse

Plate 4.19: Brownish black purse

Plate 4.20 Orange ladies' sandals

Plate 4.21 Pink ladies' slippers

Plate4.23 Green purse

Plate 4.24 Green ladies' slippers

Plate 4.25 Blue- Black hand bag

Plate 4.26 Pink hand bag

4.4.2 Durability

The goat strips made the artefacts durable since the strips used were strong enough and had no damages, wear or tear.

4.4.3 Fitness for Purpose

The fashionable ladies' bags, purses, slippers and sandals produced had feminine appearances that came in different styles, shapes and sizes. The ladies' bags and purses serve as containers that can be used to hold personal items. Also, the ladies' pair of sandals and slippers serve as items that can be worn to match any ladies outfit.The items produced were very easyand comfortable to carry.

The choice of designs and whole frame of the work made it possible for the artefacts to be functional and decorative which fits its purpose.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter discusses summary of the research conducted, the conclusions drawn and recommendations from the findings.

Summary

This research found macramé art which is a means of knotting to create artefacts, as a technique with which the Ghanaian indigenous vegetable tanned leather can play a major role on the bases of manipulating it to attain strips that can be knotted in macramé art. For this reason, the researcher adopted the following specific objectives:

1. To identify the characteristics of materials and techniques used in macramé knotting.
2. To manipulate Ghanaian indigenous vegetable tanned leather for the production of strips suitable for use in macramé art.
3. To use leather strips developed from Ghanaian indigenous vegetable tanned leathers in macramé knotting for the production of leather artefacts.

To achieve these objectives, the researcher visited some places in Kumasi where macramé artefacts are produced to see the materials, tools and techniques used; their characteristics were identified and examined. The researcher reviewed available literature, observed and conducted interviews.

The researcher manipulated the indigenous vegetable tanned leather for the production of leather strips suitable for use in macramé art through secondary treatment process, practical measures were also taken to manipulate the selected leathers (goat and sheep)for use in the research by physically examining them with the view of finding

out their reliability for macramé knotting, finishing techniques were applied on the strips and finally suitable strips were produced and used for the creation of leather artefacts. It was observed during the research that the manipulation of the indigenous vegetable tanned leather in the production of strips for use in macramé knotting was successfully carried out through the parameters of cutting goat leather into strips with widths ranging from 3mm to 5mm; pounding leather strips, suede dyeing of pounded strips and burnishing, pounding oil infused leather strips and suede dyeing of pounded oil infused leather strips and burnishing**.** The durability of the work was determined by the technical handling of leather through selection and application of appropriate secondary treatment processes, the resulting outcome provided functional applied leather artefacts in the form of ladies' bag, purse and slippers.

Conclusions

1. It was observed that the macramé and leather artisans in the study areas hardly used the local materials such as jute, raffia and leather; they preferred using the foreign materials in producing artefacts. However, this has revealed that the unexploited locally obtainable materials must be studied to explore and tap their potentials in art and technology.
2. The study has shown that the Ghanaian indigenous vegetable tanned leather can be manipulated in the production of strips for use in macramé art.
3. The study has shown that the spiral cutting technique is the best method of constructing leather strips for use in macramé art.
4. The study has shown that pounding of leather in its raw state and pounding of oil infused leather are best ways of softening strips suitable for use in macramé art.

5. The study has shown that local goat leather strips are the best for knotting due to its strength, ability to twist and fold easily, ability to hold knots and ability to show details of knots structures.

Recommendations

The researcher recommends the following:

1. Macramé and leather artisans should explore the unexploited locally obtainable materials and tap their potentials in art and technology.
2. The Ghanaian indigenous vegetable tanned leather should be manipulated in the production of leather strips for the production of artefacts in macramé art.
3. The best cutting method which is the spiral cutting technique should be employed in the construction of leather strips for use in macramé art.
4. The pounding of leather in its raw state and pounding of oil infused leather should be applied in softening strips suitable for use in macramé art.
5. The goat leather strip should be used in macramé knotting due to its strength, ability to twist, fold and hold knots when used in producing leather artefacts.

REFERENCES

Acajou Crafts (2008).*Free Macramé Patterns.* Retrieved on November 16, 2014 from http://www.free-macrame-patterns.com

Adu- Asabere, A. (2011) *Development of Criteria for Assessing the Quality of Skins and Hides for Indigenous Leather Production in the Kumasi Metropolis*. KNUST. Kumasi: M.AThesis, Department of General Art Studies.

Amberg, B. (2015). *Vegetable Tanned Leather – Need To Know.* Retrieved on May 18, 2015 from http://www.billamberg.com/vegetable-tanned-leather-need-to-know/

Asubonteng, K. (2010) *Improving the Quality of Ghanaian Indigenous Leatherwork; Alternative Strategies.*KNUST. Kumasi: PhD Dissertation, Department of General Art Studies.

Baskett, M. (1999).*Making Beautiful Hemp and Bead Jewelry.*Sterling Publishing Co., Inc.387 Park Avenue South, New York, N.Y.10016.

BLC Leather Technology Centre Ltd. (2007), *The Story of leather*. Retrieved on April 29, 2015 from http://www.all-about-leather.co.uk/what-is-leather/where-does-leather-come-from.htm

Boahin, J. O. B. (2005). *Principles and Techniques of Leatherwork for Schools and Colleges,*KNUST, Kumasi: University Printing Press.

Boahin, J. O. B. (2008). *Technical Problems and Solutions in the Indigenous Leather Industry: Implications for Art Education in Ghana.* KNUST, Kumasi:PhD Dissertation, Department of General Art Studies.

Bogopane, L.P. (2013). *A Critical Review of Pertinent Qualitative Research Processes, Approaches, and Tools in Social Sciences.* J SocSci, 35(3), 217-229.

Brown, D.M. (2002). *The Miracle of Macrame*. The Libertarian Enterprise Number 171, April 29.

Burns, N. & Grove, S.K., 2001, *Essentials of Nursing Research Practice*, W.B Saunders, USA.

Burns, N. & Grove, S.K. (2003).*Understanding Nursing Research.* Philadelphia: WB Saunder

Churchill, J. (1983). *The Complete Book of Tanning Skins and Furs.*Stackpole Books, 5067 Ritter Road, Mechanicsburg, PA 17055.

Cruz, R. (2014). *Micro Macramé Basics & Beyond: Knotted Jewelry with Beads*. Kalmback Books, 21027 Crossroads Circle.Waukesha, Wisconsin 53186, U.S.A.

Dangima, M. (2015), Ghanaian indigenous vegetable tanning, Asawase, Kumasi, (Oral interview), June 23, 2015.

Davies, P. (2006). Interview. In V.Jupp (Ed.), The SAGE Dictionary of Social Research Methods. (pp.158-159). London, England: SAGE Publications, Ltd.

Dumont, K. (2000), The New Macramé: Contemporary Knotted Jewelry., Lark Books, a division of Sterling Publishing Co. Inc., 387 Park Avenue South, New York, N.Y.10016.

Firmin, M. (2008).Unstructuredinterview.InL.Given (Ed.), *The SAGE encyclopedia of qualitative research methods.* (p. 908). Thousand Oaks, CA: SAGE Publications, Inc. doi: http://dx.doi.org/10.4135/9781412963909.n475

George,M.W.(2008). *The Elements of Library Research: What Every Students Needs to Know.*Princeton University Press, 41 William Street, Princeton, New Jersey 08540.

Grenier, S. (2014).*Hello! Macrame: Totally Cute Designs for Home Décor and More (Design Originals).*Pepperell Braiding Co., Published by Design Originals, Inc.

Hair, J.F., Babin, B., Money, A.H., &Samouel, P. (2003).*Essentials of Business Research Methods*. Hoboken, NJ: Wiley.

Jarnagin, D. (1997; 2006). *Vegetable Tanned Leather.*Retrieved on May 18, 2015 from http://www.jarnaginco.com/Vegetable tanned leather.pdf

Key, J. P. (1997). *Research design in occupational education.*Oklahoma State University.

Kumekpor, T.K.B. (2002). Research Methods and Techniques of Social Research. Accra: SonLife Press & Service: 137-138

Leedy, P.D. &Ormrod, J.E. 2005, *Practical Research: Planning and Design*, 8th edn, Pearson, Upper Saddle River.

Leather Resource (2008).History of Leather. Retrieved on May 8,2015 from http://www.leatherresource.com/history.html

Leedy, P.D. (1997). Practical research: Planning and design (6th ed.). Upper Saddle River, NJ: Prentice-Hall, Inc., p. 232-233.

Marchen Art Studio (2013). *Macramé Pattern Book.*St. Martin's Press, 175 Fifth Avenue, New York, N. Y. 10010.

Mate, M. (2009). Development of Selected Unconventional Fabric Construction Techniques.KNUST.Kumasi: Unpublished Mphil. Thesis, Department of Art Education.

Merriam, S.B. (1988). *Case Study Research in Education: A Qualitative Approach.* San Francisco: Jossey Bass.

Michael, V. (2006).*The leatherworking Handbook: A Practical Illustrated Sourcebook and Tchniques and Projects.*Cassell illustrated, a division of Octopus Publishing Group Limited, 2-4 Heron Quays, Lon E14 4JP.

Michel, A. (2014), *Skin deep: An outline of the structure of different skins and how it influences behaviour in use. A practitioner's guide.*In : Harris, S. &Veldmeijer, A. J., (Eds.) *Why Leather?The Material and Cultural Dimensions of Leather*. – Sidestone press, Leiden.

Milligan, C. (2009). *Mod Knots: Creating Jewelry and Accessories with Macramé.* Northlightbooks, an imprint of F+W Publications, Inc. 4700 East Galbraith Road, Cincinnati, Ohio 45236 (800) 289-0963.

Mouton, J. (2001).*How to Succeed in your Master's and Doctoral Studies*: A South African Guide and Resource Book. Pretoria: Van Schaik

Oteng, A.A (2011). The Construction of a Gas- Fired Kiln using Low- density bricks composed from Mfensi Clay for Schools. KNUST, Kumasi: M.A. Thesis, Department of General Art Studies.

Reed, R. (1972), Ancient Skins, Parchments and Leathers *(Studies in archaeological science*). Seminar Press, London.

RibaiLlado , M. T ,& PascualiMiro, Eva. (2008). *The Art and Craft of Leather: Leatherworking tools and techniques explained in detail.* 250 Wireless Boulevard Hauppauge, New York 11788.

Simply Leather (Wales) Ltd. (2006).*History of Leather.* Retrieved on May 5, 2015 from http://www.simplyleather.co.uk/acatalog/HistoryofLeather.html

Saunders,M., Lewis,P., and Thornhill, A.(2009). *Research methods for business students* (3rd edition) London: Pearson Education Limited.

Thomson, R. (2006b). *The Nature and Properties of Leather*.In: Kite, M. & Thomson R., (Eds.) *Conservation of Leather and RelatedMaterials*. - London, Routledge.

Wright, A. (2014). *Free Macramé Patterns.*Acajou Crafts, 613 Boothe Road, Hardy, AR 72542.

APPENDICES

APPENDIX A: INTERVIEW GUIDE PREPARED FOR LEATHER EXPERTS

Objective**:** To acquire data on Ghanaian indigenous vegetable tanned leather.

1. What is Ghanaian indigenous vegetable tanned leather?
2. What are the characteristics of Ghanaian indigenous vegetable tanned leather?
3. What techniques do your students use in producing their works?
4. Can Ghanaian indigenous vegetable tanned leather be used in macramé knotting?

APPENDIX B: INTERVIEW GUIDE PREPARED FOR FIBRE AND FABRICS EXPERTS

Objective: To acquire data on macramé art.

1. What is macramé art?
2. What are the types of macramé art?
3. What types of materials and techniques are used in macramé knotting?
4. What are the characteristics of macramé materials and techniques?
5. What knotting techniques do your students use in producing their works?

APPENDIX C: INTERVIEW GUIDE PREPARED FOR MACRAME ARTISANS

Objective: To acquire data on macramé materials and its availability and to acquire data on the techniques used in the production of artefacts.

1. What types of macramé materials do you use?
2. Where do you get the source of macramé materials from?

3. What are some of macramé artefacts you have produced?
4. What techniques do you employ in your works?

APPENDIX D: OBSERVATION GUIDE

Objective: To observe the activities involved in macramé art

1. Materials and techniques used in macramé knotting.
2. The characteristics of materials and techniques used.
3. Types of artefacts produced.