PROCESSING AND WEAVING OF DIFFERENT LOCAL MATERIALS ON-LOOM FOR BASKETRY PRODUCTS

By

Osei Joseph

(HND Fash. & Textiles, B.A Industrial Art)

A Project Report submitted to the School of Graduate Studies

Kwame Nkrumah University of Science and Technology, Kumasi in

partial fulfilment of the requirements for the degree of

MASTER OF ARTS IN ART EDUCATION

Faculty of Art

College of Art and Social Sciences

June, 2011

DECLARATION

I hereby declare that this submission is my own work towards the M A 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 other degree of the University, except where due acknowledgement has been made to the text.

Osei Joseph (PG3314209) …… ….....

Signature Date

Certified by:

Mr. K. Adu Baah ……. ……..

(Supervisor's Name) Signature Date

Certified by:

Nana Afia Opoku-Asare, Mrs …… …….

(Head of Department's Name) Signature Date

ABSTRACT

The project sought to introduce new ideas into the basketry industry. Basketry has been practiced long ago in homes and schools in Ghana. It is used for many purposes in the Ghanaian environment such as storage of food items, measuring cereals and other food items, as shopping bags and for carrying items. There has not been much innovation in the basketry production in Ghana as basket makers use the traditional way of producing baskets. In schools, students studying basketry have not demonstrated innovation enough to bring new ideas into basketry production. This may be due to the fact that teachers do not have the knowledge and the skills to introduce students to new ideas in basketry production. The qualitative method of research was employed for the study under which the following methods and data collection instruments were adopted for the study: experimental research method, descriptive research method, research conducted at libraries and field, purposive sampling technique, interview and observation. The research discovered that it is possible to use the ordinary domestic loom to weave basketry structures from natural and man-made materials; that local materials that are flexible in nature found in the environment can be used for interesting basketry products; that there had not been much innovation in equipment or basketry products over the years. In order to enhance creativity and innovation in the basketry industry, the research recommends; that students should try other weave structures other than plain and twill weave such as satin and sateen using processed basketry materials on the man-powered loom; that on-loom basketry should be introduced in the school curriculum and to the occupational basket makers, so that teachers can encourage students to use flexible natural and man-made materials in their environment for basketry production. This in a way can help promote recycling of waste; that basket makers should try to use other materials such as polythene which is found everywhere in Ghana and other fibres which can be found

in their localities for basketry; that basket makers should also make use of equipment or device like the loom to enhance productivity.

ACKNOWLEDGEMENTS

This project would not have been successful without people's contributions and guidance towards the completion of this project.

I wish to thank my supervisor, Mr. K. Adu Baah, for taking his time in reading through this text and providing constructive suggestions to make this project a reality. I also thank Dr. Rudolf Steiner, a lecturer at Integrated Rural Art and Industry Department, KNUST, for his contributions to this project. Thanks also go to Mr. Harward Kofi Ebenezer, at textile department KNUST, for his suggestions on the project, and lastly to Mr. Nyanteh Benerth, a textile master at Agona Senior High School, for his suggestions to this project.

Finally, my sincere thanks go to all whose names were not mentioned but contributed in diverse ways to the success of this project.

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INTRODUCTION

1.1 Overview

This chapter deals with the following topics: background to the study, statement of the problem, objectives of the study, research questions, delimitation, definition of terms and importance of the study.

1.2 Background to the Study

Basketry is practised in almost every part of Ghana. This is probably because basketry materials are widely available and can be obtained at little or no cost. The processing of basketry materials also does not require any complex equipment. The use of the loom for producing basketry products may be a new development in the art of basketry and may encourage the youth in Ghana to enter into basketry production after completing school. This may help to reduce unemployment in Ghana.

On-loom basketry may result in the production of many new products which can have many uses such as car interior decoration, room decoration, and dressing bags. The research would also educate weavers on what the loom can be used for, apart from its use for weaving fabrics.

1.3 Statement of the Problem

Basketry is practised worldwide in almost all cultures. It is a technology that has been with man from time immemorial. In Ghana, basketry is part of the visual art curriculum but it is not being in schools. This is because the concept of basketry is limited to the traditional basket that is used for carrying farm produce. This art has not developed beyond the traditional ways of producing baskets. In the context of contemporary basketry, different

materials can be used to make basketry items, including those produced from mats woven on-loom using weaving as a technique. .

This study was designed to use on-loom techniques to produce basketry items such as bags, curtains, table mats, folders, bed mats, and flying-tie cases from mats woven from a variety of local raw materials.

1.4 Objectives of the Research

1. To identify and describe basketry materials that can be processed for weaving on the loom.
2. To process the identified materials for weaving on the loom.
3. To weave plain and twill weave mats on the loom using the processed materials to Produce sample basketry items.

1.5 Research Questions

1. How can basketry products be made on the loom?
2. What kind of materials can be used for weaving mats on the loom?

1.6 Delimitation

The study was limited to the production of cane, rattan and palm frond basketry items in Sekyere, Okyerekrom and Fumesua in Ashanti Region.

The study was also limited to the use of banana fibres, raffia, sisal fibres, spear grass, flower stalks from guinea grass, polythene strips, and pieces of waste fabrics as weft and acrylic yarn and cotton twine as warp in weaving mats that were made into bags, folders, curtains, table mats, bed mats, chair backs, and flying-tie cases.

1.7 Definition of Terms

Element - Warp and weft.

Stakes - The upright posts in a basket.

Float - Loose yarns on the surface of a woven material.

Yarn count - This measures the degree of fineness in yarns.

Shed - The passage created between the upper and lower sets of yarns for shuttle transverse.

Harnesses / shaft - Sticks which are suspended between the two upright posts of the s broadloom which lower and raise the healds to create a shed.

Loom - A device or equipment for weaving.

Warp - Refers to the spokes.

Weft - The weavers or the strands.

Ends - Warp yarns.

Picks / filling - The term refers to the weft yarns.

Mallet board - A flat wooden board on which fibres are beaten.

Straw - The flower stalk of guinea grass.

1.8 Importance of the Study

1. The study introduces new dimension in basket weaving to basket weavers in Ghana.

2. The study can be adopted into the National Youth Employment Programme module to

train people in basketry production.

3. The study has introduced new artistic basketry products into the local craft industry.

1.9 Organization of the rest of the text

The rest of the chapters contain the following: Chapter Two is the Review of Related Literature; Chapter Three is the Methodology; Chapter Four is the Presentation and Discussion of Findings; and Chapter Five is the Summary, Conclusion and Recommendations.

CHARPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Overview

This chapter discusses theories and views of authors on basketry. The review focuses on the following sub-topics: history of basket, types of basketry, types of basketry materials, alternative basketry materials, techniques in basketry, importance of basketry, weave structures. Also basketry materials and processes used by basket makers in and around Kumasi.

2.1.1 History of basketry

According to Palaski (2008) basket is a word derived from the Greek word *kophinos*, which means a basket woven of plaited branches and twigs. The term basketry refers to woven textiles created manually without a frame or loom (Adovasio, 1977). Rigid and semi-rigid containers, matting, bags, fish traps, hats, and cradles manufactured in this manner are considered forms of basketry (Adovasio, 1977).

The use of baskets is mentioned many times in the Bible. Some examples include Moses being placed beside the river in a basket made of bulrushes (Exodus 2:3; Polaski 2008), and Jesus performing the miracle of feeding the masses with bread and fish and the leftovers picked up in twelve large basket (Matthew 14:20; Polaski 2008). Polaski says during archaeological digs, basket fragments, which date back some 12,000 years, were found in and around Egyptian and Neaderthal excavation sites.

Hill and Gunn (1977) without mentioning specific dates and years, explain that basketry is one of the oldest aboriginal craft and prehistoric technologies in some parts of the world, and it is still a popular craft today. It includes weaving, knotting and entwining things to make baskets, matting and bags. They further say that no two populations have designed styles of basketry that are identical.

According to Wright (1972)' the most famous baskets may well have been the basket made of bulrushes and mud in which the baby Moses was safely kept. Wright (1972) further explains the philosophy of baskets by describing them as the children of the gods and the basis of our earth, according to the ancient Mesopotamians who had the belief that the world began when a wicker raft was placed on the ocean and soil was spread on the raft to make the land masses.

Similarly, Rossbach (1976) mentions that the Indians of Arizona and New Mexico made basket-molded pottery from 5000 to 1000 BC as part of the earliest basket heritage, and it has survived in gravesites. Rossbach (1976) and Polaski (2008) have revealed that the basket was an ancient craft which was used to bury the dead. They indicated that Radiocarbon dating of baskets found in the Middle East show that they are between 10,000 and 12,000 years old. Other baskets found in the Middle East date back over 7,000 years. Historians agree that these ancient baskets are older than any pottery artifacts excavated to date. Most historians also agree that basket weaving is the world's oldest known craft. Archeologists have indicated that the oldest known baskets presently appear to be some unearthed in Faiyum in upper Egypt (Rossbach, 1976).

Baskets began to spread throughout the world as explorers (traders) began to arrive in new lands to trade. Their goods were contained in baskets and as recipients of goods looked over the baskets, they applied the techniques to the materials of their own land. This explains why so many Asian techniques like hexagonal weaves are found in European baskets, and how European techniques were then carried over to the Americas (Hebert, 2001).

From the discussions little history of basketry is known in Africa, for example Egypt is having the oldest baskets unearthed in Faiyum in Egypt Rossbach (1976). Ghanaians have practice basketry for many years but documented history of basketry in Ghana is not available.

2.1.2 Types of Basket

There are many different types of baskets, and each type is used for a different purpose. Some are for decorative purposes, others are for recreational and functional use. Kamisky (2003) explains baskets as mainly containers that hold items.

Decorative baskets may be used simply for decoration or to hold other items. An example might be a small crystal basket which exists simply to give pleasure to the eye. It is also said that a small basket made of straw or woven grapevine may hold antique glass ornaments at Christmas. A decorative basket may be made of straw, rush, vine, wood or fabric among other materials.

Another type of basket is functional. An example of such a basket is known as picnic basket. According to Kamisky (2003), functional baskets often have a double-hinged top so that the contents of the basket can be easily accessed. Some picnic baskets, according to Kamisky, have holders for plates and cutlery.

There is also the gift basket which is presented to loved ones during graduations or birthdays. Fruit baskets and flower baskets are also said to be popular gifts to hospital patients and mothers of newly born babies. The Easter basket is a recreational type of basket usually lined with plastic Easter "grass" and used to hold Easter eggs. Balloon gondolas are one of the recreational baskets woven with strong materials and can hold at least two humans comfortably (Kamisky 2003).

Novellino (2003) says is great variation in the size and shapes of baskets and a general distinction can be drawn between rigid and soft baskets. Rigid baskets are often strengthened at the four corners and have a base support to give stability to the baskets. Baskets for transporting agricultural crops tend to be rigid while those meant for carrying heavy loads are more flexible and expandable.

2.1.3 Types of basketry materials

According to Asante (2005), baskets used for carrying heavy loads require the use of stiff and sturdy materials. A container made to fold flat requires flexible materials and a basket

made for sale and not intended for actual use are especially fine, using thin or delicate materials in its construction.

2.1.4 Plant-based basketry Materials

According to Asante (2005), South Africans and Ghanaians use materials available in their locality such as weeds, cultivated plants, rushes, and roots for basketry. Newman (1974) shares similar the view that basketry materials are everywhere but in different forms. Newman mentions some of the materials as grass, willow reed, rushes, rattan (cane), raffia, banana fibres, bamboo, split palm fronds, papyrus fibres, swamp straw, sisal fibres and some creepers from the forest as basketry materials.

Crampton (1964) also mentions basketry materials as pulp cane, enameled cane, straw plait, twisted sea grass, and rush. McKissick (1988) reveals that around North Carolina and Texas in the USA, sweet grass is mostly used for basket production. Some of the basketry materials mentioned here can also be easily found in the Ghanaian environment.

2.1.5 Alternative Basketry Materials

Basketry materials are said to be flexible in nature and can be found around the environment in which one lives. Imported synthetic materials which are flexible in nature can also be considered as alternative materials for basketry. Such materials include acrylic thread, polyurethane strips and threads of plastic-coated wires (Asante 2005). Barratt (1993) notes that some contemporary basket makers produce aesthetically appealing baskets made of materials such as cardboards which have been cut into strips with a painted and varnished appearance, besides plastic packing tapes, netting, film strip and fabric cut into strips.

2.1.6 Techniques in Basketry

Rosengarten (1987) mentions coiling as one of the basketry techniques which involves sewing or stitching. Rosengarten describes, straw and reed that are wrapped with raffia and stitched together. The base material is spiraled into a coil and wrapped or sewn to form a base with successively wider coils reducing the circumference and creating various shapes.

Newman (1974) also names coiled basketry as another technique in basketry. Newman, does not mention the process of coil basketry but rather explains how to make it liquid-proof by sealing it with pitch. Hebert (2001) rather explains coiled basket as a technique of winding up the fibres like a snake while stitching it every quarter of an inch.

According to Mirja (1993), to create a simple coil basket, one can substitute old clothsline for the warp and yarn for the weft. It is done by coiling the yarn around the clothsline until a small circle is formed. This continues until more layers are formed. To create interest and to vary the design, different materials can be added by substituting them for the weft, and tying them to the spokes.

Walpole (1989) mentions another technique of basketry as 'stake and strand' which uses uprights (stake). These uprights are usually spread out and the weavers are laid upon one another until the whole process is completed. It is always expected that the stake should be stronger than the strand. According to Hill (1977), plaiting or twining is a technique which requires materials which are long, flat, flexible strips like reeds, bamboo, cane, split timber, and bark. The base element is laid in rows and entwined with cordage. The cordage is spiraled around the based rows.

Newman (2005) also explains wickerwork as one of the techniques in basketry which uses materials which are very stiff in nature, for instance, straw, cane, or reed for warp (stake or spokes) and more flexible materials for the weft (weavers). The weavers are passed over and under the stakes.

2.1.7 Classes of basketry weaves

According to Adovasio (1977), for taxonomic purposes, basketry is divided into groups or sub-classes of weaves (twined, plaited, and coiled) based on the manner of construction. Twined basketry is a sub-class of weaves in which active horizontal elements or wefts are moved around passive vertical elements known as warps. Typically, the wefts are paired or tripled. To Adovasio, elements differ in size and material type.

2.1.8 Plaiting

In plaiting, both vertical and horizontal elements are active, passing over and under each other at a more or less fixed angle (Adovasio, 1977). This author describes coiled basketry as a sub-class of weaves in which the active element or stitch is vertical, while the horizontal element or foundation is stationary. Adovasio again mentions two main varieties of plaited basketry as simple and twill plaiting. In simple plaiting, the elements move over each other in single intervals, such as one-over-one-under-one. In this one or more elements act as a unit. Each unit (set of elements) alternates with its contiguous unit in passing over and under the opposing set of elements. Twill plaiting is a type of plaiting in which the elements in one set cross over two or more elements in the other set at staggered intervals.

Macrame, fitching, pairing, randing, upsetting and waling are also mentioned and explained by Amenuke et-al (1991) as techniques in basketry. Macrame is explained as a kind of ornamental lace made by knotting threads or cord in order to form patterns. Fitching is the process of using weavers to work tightly over one -and-under the next alternately. Pairing also is the technique of using two weavers alternately. Randing is another technique in basketry in which the weaver uses only one weaver. The authors say the technique of using three is weavers is named as upsetting. Walpole (1989) share this idea with Amenuke, et-al (1991) in terms of moving weavers over one and under one around stakes. Walpole used the

term “stake and strand” while Amenuke et-al use the term fitching. In effect, most of the techniques use the principle of over-one warp -under one warp as in plain weave.

2.1.9 Importance of Basketry

Basketry products have played a significant role in the history of mankind since ancient times. Emmons (1993) states that closely woven, watertight containers were used to cook food and loosely woven basketry was also used to strain oil from certain kinds of fish. Emmons goes further to say that furnishing materials could be made from basketry products in the form of mats, chests, trunks and cradles. Garments are another important category of basketry. According to Emmons, rain capes can be made using shredded cedar bark which shed water and provide excellent protection from both sun and rain. Cedar bark basket can also be used for making aprons, skirts and hats. Some ceremonies feature basketry products which signify prestige.

Basketry also continues to provide significant incomes for skilled weavers as it is no longer viewed solely as an ethnographic item or souvenir art. As spart of the heritage of nearly every native people, Wright (1972) says baskets are used for gathering dry food, storing food and for serving food items. Liquids are also retained in baskets that have been rendered waterproof. Open baskets are made to function as filters and as sieves and strainers. Some gift baskets are themed for graduation or birthday (Kaminsky, 2003).

Basketry products may also be used for purposes such as decoration, industrial use for keeping waste materials, measuring of cereals, keeping of utensils in the house, preservation of fish and as dust bins for offices (Opoku, personal communication, August 9, 2010).

2.2 Weave Structures

The structure or the patterns of weaves are determined by the manner in which groups of warp yarns are raised or lowered by the harnesses of the loom to permit the insertion of the filling yarns. Weave structures can create varying degrees of durability in a particular woven material, adding to their usefulness and also to their appearance. Corbman (1983) identifies three basic weaves which are very common in the majority of woven materials. Such weave sare plain weave, twill weave and satin weave, with some variations.

2.2.1 The Plain weave

Corbman (1983) explains plain weave as the simplest type of weave structure and consequently inexpensive to produce. On the loom the plain weave requires only two harnesses. Each filling yarn goes across the width of the woven material. On its return, the yarn alternates the pattern of interlacing. If the yarns are close together, the plain weave will have a high yarn count and the material woven would be firm. The appearance of the plain weave may be varied by differences in the closeness of weave, by different thickness of yarn, or by the use of contrasting colours in the warp and filling. Collier (1980) similarly says plain weave is woven on the one up one down principle and the weft yarn passes over one end, under the next, and over the next end. According to Collier, this principle is repeated in the next pick but the position of the ends is reversed so that different warp yarns are seen on the surface of the woven material. Tortora and Collier (1997) explain plain weave as the interlacing of warp and filling yarns in a pattern of over one and under one manner. According to Tortora and Collier (P.22), the plain weave is constructed this way:

> The filling yarn moves over the first warp yarn, under the second, over the third, under the fourth, and so on. In the next row, the third filling yarn goes under the first warp yarn, over the second, under the third and so on. In the third row, the filling moves over the first warp, under the second.

Tortora and Collier (1997) explain that decorative effects can be achieved by using novelty yarns or yarns of different colours. Corbman (1983) and Tortora and Collier (1997) share

similar views on the principles of plain weave which is creating over-one warp and under-one warp yarn principle. Kadolph (2007) also says plain weave is formed by yarns at right angles passing alternately over and under each other.

Like Corbman (1983), Kadolph says the plain weave requires only a two-harness loom. The plain weave may be described as one harness down one harness up. The one up one down describes the position of the harness when forming the shed. In plain weave, all odd-numbered filling yarns have the same interlacing pattern as the first filling yarn, and all even-numbered filling yarns have the same interlacing pattern as the second filling yarn.

2.2.2 Characteristics of the plain weave

Kadolph (2007) mentions some characteristics of plain weave as having no technical face or back due to the weave, many interlacings per square inch, it wrinkles easily and is less absorbent than other weaves. However, Kadolph maintains that interesting effects can be achieved by varying fiber types or by using novelty or textured yarns mentioned by Tortora and Collier (1997), other effects can also be achieved by using yarns of different sizes, high or low-twist yarns, filament or staple yarns and finishes.

2.2.3 Plain Weave Variations

- **Basket Weaves**

According to Tortora and Collier (1997), the basket weave uses two or more warp and more filling yarns side by side as one yarn. The resultant weave is fairly loose. Collier (1980) also explains that plain weave can give variations when two or more adjacent ends are lifted at the same time and two or more picks inserted in the same shed. Another view is also shared by Corbman (1983) on basket weave as a variation of the plain weave, that the weave uses double yarns to produce the design that resembles the familiar pattern of a basket. Corbman

(1983) goes on to say that, for basket weaving, two or more filling yarns with little or no twist are interlaced with a corresponding number of warp yarns. The yarns may be woven in a pattern of 2/2 (two weft yarn over two warp yarn and under two warp yarn) or 3/3 (three weft yarn over three warp yarn) repeatedly. Kadolph (2007) simply explains basket weave as two or more adjacent warps controlled by the same harness and with two or more fillings placed in the same shed.

- **Rib Weaves**

Rib weave is also another plain weave variation apart from the basket weave. Ribbed woven material have an unbalanced weave with many small yarns crossing over a fewer number of larger number of warp yarns than filling yarns, forming a crosswise rib (Tortora and Collier 1997). Rib weave, according to Kadolph (2007), is achieved by increasing the number of warp yarns in a plain-woven material until the count is about twice that of the weft yarns, creating crosswise ridge. Looking at the structure of the rib by Sara, it means that in such woven material, the warp yarns will completely cover the weft yarns resulting in warp-faced material. Rib weave may also be produced in the warp or in the filling by alternating fine yarns with coarse yarns, or single yarns with double yarns (Corbman, 1983).

2.2.4 Twill Weave

The second type of basic weave is the twill weave and is produced when the weft yarns interlace more than one warp yarn but never more than four, the reason being that strength is required in this type of weave. On each successive line, or pick, the filling yarn moves the design one step to the right or to the left, forming a diagonal line (Corbman, 1983). Similarly, Kadolph (2007) also explains twill weave as a process where each warp or filling yarn floats across two or more filling or warp yarns with a progression of interlacing by one to the right or left, forming a distinct diagonal line.

There are a number of types of twill weave. All use the same principle of crossing more than one yarn at a regular, even progression. Description of twills may be made in terms of the pattern of warp yarns crossing filling yarns. The description of twill weave is notated as 2/2, 2/1, 3/2 and many others. The first digit refers to the number of filling yarns crossed over by the warp and the second digit to the number of filling yarns the warp pass under before returning to cross the filling again.

Tortora and Collier (1997) identify types of twill weaves as: even-sided twill, where the yarns cross over and under the same number of yarns and uneven twill, where warp yarns pass over a larger or smaller number of filling yarns than they pass under the warp yarn. Warp-faced twill, according to Tortora and Collier, have a predominance of warp yarns on the surface of the woven material, with patterns of 2/1, 3/1, 3/2. Filling-faced twill is also described by Tortora and Collier as having, predominance of filling yarns on the surface of the material.

Tortora and Collier (1997) has analyse the angles of the twill weave based on the manner in which the yarns interlace and say that when the face of a twill woven material is examined, the diagonal of the wales are seen to move at a more or less steep angle, and the steepness of the angle is dependent on two factors in the construction of the material. Thus the number of warp yarns per inch of the woven material and the number of steps between movements of yarns when they interlace. The more warp yarn in the construction, the steeper the angle of the wale, provided that the number of filling yarns per inch remains the same. When the steepness of the angle is the result of close spacing of warp yarns, the steeper angles may indicate a good strength, and if the angle the wales make with the filling yarn is about 45, the woven material is classified as a regular twill and weaves with higher angles are steep twill, and those with smaller angles classified as reclining twills (Tortora and Collier, 1997).

2.2.5 Characteristics of twill weave

In identifying certain characteristics of the twill weave, kadolph (2007)says that twill woven materials have a technical face and technical back, the technical face being the side of the woven material with the most pronounced wales. This type of weave is more durable and attractive. Again twill woven material have no up and down as they are woven. Because a twill surface has interesting texture and design, printed twills are much less common than printed plain weaves. Twill weaves are often used for sturdy work or durable upholstery because soils and stains are less noticeable on the twill weaves .

2.2.6 Satin Weave

The third type of basic weave is the satin weave which is similar to the twill weave, but generally it may use as many as five to twelve harnesses for its construction. The satin weave may have two faces, warp-face or filling face construction. Warp faced satin weave construction is done such that the warp yarns are seen on the surface of the woven material. For example, in a five-harness example sateen satin construction, the warp passes over four weft yarns and under one weft yarn. The warp always lies on the surface and interlaces only one weft yarn at a time.

Long floats of warp yarns are seen on the surface of the woven material (Corbman, 1983). Tortora and Collier (1987) also explain satin weave similar to Corbman's as a process of allowing yarn to float over a number of yarns from the opposite direction. Interlacing of yarns are made at intervals such as over four weft yarns under one weft yarn when using five harnesses or a five-harness loom.

2.3 Weaving Mechanism

In any type of weaving on the broad loom, four basic mechanisms or operations are involved: shedding, picking, beating-up (battening), taking-up and letting-off (Corbman, 1983). The

shedding mechanism is responsible for raising specific warp yarns by means of the harness or heddle frame, while the picking operation is to insert filling yarns through the shed. The beating up operation pushes the filling yarns firmly in place by means of the reed. The woven material needs to be wound around a beam. The mechanism responsible for such an operation is the take-up and letting-off motion is the release of the warp yarns from the warp beam (Corbman, 1983).

The discussion suggests that most of the authors reviewed have similar principles in constructing the plain and the twill weaves. That is one weft yarn moving over and under one warp yarn. Moreover, to the authors different plain and weave effects can be achieved by using different yarns and different sizes of yarns. Basketry products can also be made in any environment because materials can be found everywhere.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter discusses the various methods adopted by the researcher in searching for the needed information about the project. This includes the research design, library research conducted, field research conducted, sampling technique used, data collection instrument and types of data used. The chapter also discusses the execution of the project.

3.2 Research Design

The researcher used the qualitative technique under which experimental and descriptive research methodologies were employed for the study.

3.2.1 Quasi - Experimental research method

According to Leedy and Ormrod (2005) when quasi-experiment is conducted the researcher has no control over any variables and therefore whatever result that comes out should be considered. This research method was used by the researcher to find out either it is possible or not to use local basketry materials on the loom and the kind of products that can be produced from the loom.

3.2.2 Descriptive research method

The descriptive research method, according to Leedy and Ormrod (2005), helps the researcher to identify particular qualities or features of something which is being observed by the researcher.

The researcher used the descriptive method to describe the tools, various processes for the preparation of materials and procedures for weaving the structures.

3.3 Field Research Conducted

In order for the researcher to know the kind of basketry material to use and products to weave, and to study different weave structures and materials used for weaving on the loom, visits were made to places where basketry and weaving on the loom are carried out. The researcher also spoke to and observed individual basket makers in the Kumasi Metropolis and basket makers at Adum on the Asafo interchange. At this place the researcher identified materials such as rattan, cane and bamboo for basketry at the site and examined the various ways of processing the material for the products. The researcher was shown finished basketry products and their uses.

The researcher interviewed basket makers on the types of materials used for production at the Centre for National Culture in Kumasi. Materials such as cane and rattan as well as processes of production were explained to the researcher. Apart from the basket makers located in the Kumasi Metropolis, the researcher visited individual basket makers located at Okyerekrom, Fumesua and Sekyere in the Sekyere East District in Ashanti about the materials they use for their products.

3.4 Population for the study

The target population for the study was:

1. Only people who have knowledge in basketry and are in the trade were selected.

2. Those who are the users of man-power looms.

3. Those who have knowledge in weave weaving.

Accessible population: Total size = 30

Basketry producers	= 20
Cloth weavers	= 5
Resource persons in textiles/lecturers	= 5

Thirty (30) representing100% of the population was accessible for the study.

3.5 Sampling

Sample in this project is considered as part or portion of the population for study.

Purposive sampling technique was used in the study to select resource persons to interview. These included, basketry producers, cloth weavers and resource persons in textiles and lecturers.

3.6 Data Collection Instruments

The instruments used by the researcher were interview and observation. These instruments were used to obtain the necessary data from respondents concerning basketry materials, preparation of materials for basketry and weaving, weave structures and techniques for basketry production.

3.6.1 Interview

An interview is a technique that the researcher used to collect data which involves questioning individuals or groups of respondents orally (Colrlien, 2003). In this study the unstructured interview technique was used. This was important because apart from

observation, it was another valuable means for the researcher to collect data for the study. Apart from the discussions that were facilitated by the researcher's interview guide, the answers provided by the respondents led to new information that was beneficial to the study.

The researcher conducted the interviews with respondents in all the places visited for the study using digital camera for taking pictures and tape recorder for recording the interview conducted with respondents. To create conducive atmosphere for the study, respondents were given the chance to express themselves in English and Akan languages.

3.6.2 Observation

According to Corlien (2003), observation ''is a technique that involves systematically selecting, watching and recording behaviour and characteristics of living being, objects or phenomena (p.145)''. At the various weaving and basket making centres, the researcher observed different weave structures on the loom and the processes of achieving those weave structures. The materials used on the looms were also identified. At the basket making centres, materials and methods for basketry of different types were also identified. The researcher documented these activities, using the camera and tape recorder.

3.7 Types of Data

1. **Primary data**

The primary data were obtained from basket makers, textiles weavers in and around Kumasi Metropolis. A resource person who is a lecturer in weave structures at the Department of Industrial Art, KNUST, Kumasi was also interviewed for primary data.

2. **Secondary data**

The secondary data were collected from books, publications and periodicals. The information obtained was critically analyzed and the important facts added to the study.

3.8 Library Research Conducted

The following libraries were consulted: The KNUST main library, Library of Faculty of Art, and Department of Art Education library. The researcher also contacted the Forestry Research Institute of Ghana (FORIG) library at Fumesua in Ashanti Region and Ashanti Library at the Centre for National Culture in Kumasi. Information also was sourced from the Internet, books, periodicals and other publications that are related to the research.

3.9 Tools and materials used for the research project

The tools and materials are described in pages 24-28 to show the role each one played in the execution of the sample basketry items.

- Kitchen knife
- Plastic Comb
- Wooden Mallet
- Mallet board
- Plastic bowl
- Gas burner
- Gas bottle
- Hand gloves

These resources were used in relation to the fibres listed in section

Kitchen knife

The knife used in this project Plate 1 was made of plastic and steel. It was 27 cm long with the handle measuring 11cm and the blade 16 cm. It was used for cutting spear grass from the field (Plate 1).

Plate 1 Kitchen knife

Plastic comb

An ordinary plastic hair comb was used to comb Plate 2 the sisal fibers after beating and washing to remove the outer tissues remaining in the fibres as well as shorter fibres that were not needed.

Plate 2 Plastic comb

Beating stick

This was a cylindrical wooden tool measuring 42 cm by 42 cm prepared by the researcher. It was used for beating the layers of the banana trunk after the layers had been removed to tease out the fibers (Plate 3).

Plate 3 Beating stick

Beating board

It is a wooden board with dimension of 30cm by 30cm square. It was used along with the mallet for the preparation of both the banana and the sisal fibres (Plate 4).

Plate 4 Beating board

Plastic bowl

The plastic bowl Plate 5 was used for washing and dying the prepared basketry materials.

Plate 5 Plastic bowl

Hand gloves

The pair of gloves (Plate 6) was used to protect the hands from touching the chemicals in the dyes used to colour banana fibres, kenaf rope, sisal and raffia during dyeing.

Plate 6 Hand gloves

3.10 Equipment used

Gas stove

This was used for heating dyes for dyeing sisal and banana fibres (Plate 20).

Plate 7 Gas stove

Gas bottle

The gas cylinder (Plate 8) supplied liquefied petroleum gas to the gas stove for heating dyes for the hot dyeing operations involved in the research.

Plate 8 Gas cylinder

3.11 Weaving Equipment and Accessories

Equipment

The main equipment used for the project was the broadloom and its accessories which are:

- Reed
- Raddle
- Shuttles
- Reed hook
- Bobbin winder
- Healds
- Warping mill
- Cross sticks / beaming sticks

Broadloom

This equipment Plate 9 was used for weaving the basketry materials.

Plate 9 Broadloom

Reed

This particular type of reed consisted of closely set strips of peelings of raffia fronds (about 15cm each) fitted to two horizontal bars, one at the top and one down. The vertical spaces between the strips take the warp ends. It was used to separate individual warp ends from cris-crossing during weaving and also for beating the weft into the fell of the woven material (Plate 10).

Plate 10 Reed

Raddle

This comb-like structure was used in spreading the warp yarns on the loom to obtain the required width of the woven material (Plate 11).

Plate 11 Raddle

Shuttle

This accessory was used to insert the weft yarns through the shed to facilitate interlacing (Plate 12).

Plate 12 Shuttle

Reed hook

The reed hook was used to draw warp yarns through the dents of the reed (plate 13).

Plate 13 Reed hook

Bobbin winder

This accessory, made of wood, was used for the preparation of the weft yarn which was used as binder in some of the works, especially the twill weaves (Plate 14).

Plate 14 Bobbin winder

Heald

The heald (Plate 15), made of nylon, was used to suspend warp yarns in the harnesses which raise and lower the yarns during weaving.

Plate 15 Heald

Warping mill

This large piece of apparatus, consisting of a skeleton reel, turns freely on its axis like a turnstile. It was used for the preparation of the warp yarns, which needed to lie parallel in the loom to avoid entanglement (Plate 16).

Plate 16 Warping mill

Beaming sticks / cross sticks

The beaming sticks were about 4cm by 90cm long used to tension the warp yarns. The cross sticks were also used to secure the crosses of the warp yarns on the loom (Plate 17).

Plate 17 Beaming sticks

Bobbin

The bobbins used in this research measured 1.5 cm in diameter and a length of 9 cm with a hole inside. The basketry material used as weft such as banana and sisal fibres was wound around it and fixed inside the shuttle for picking (Plate 18).

Plate18 Bobbin

3.12 Materials used for the project

These materials were used for producing mats in plain and twill weave to serve as the basis of the basketry products described in this report and illustrated in pages 50-64s

- Fibers from the trunk of Banana (*Musa sapientum*)
- Raffia yarn
- Sisal and Sisal – like fibers
- Flower stalks of Guinea grass (*Panicum maximum*)
- Spear grass (*Imperata cylindrica*)
- Polythene strips
- Bleaching agent (Omo)
- Pieces of waste fabric

3.13 Procedures adopted for preparation of the materials

Procedures adopted in processing these raw materials are described in the following sections. Much of this data reflects research work done by Baah (2000).

Banana (*Musa sapientum*) **fibres**

There are different varieties of banana. Some have very long stem while the stem of others are quite short. According to Unternehmensberatung (1971), the stem of different varieties can grow up to the height of 2-7m and have a diameter of up to 40cm. When the stem is critically observed, 11-15 closely layered leaf sheaths can be found. The part of the plant which contains the fibers is the trunk. The diameter of the trunk consists of vertical channels and these channels are filled with sap and air.

Fibre extraction

Since the fibres form an integral part of the sheaths, there was the need for the researcher to remove them for use. The layers had to be first separated from the main stem. The extraction of the fibres was done by beating the fibres out of the stem sheath (Plate 19)

Plate 19 Beating a layer of banana trunk

After beating of the layers using the mallet and the mallet board, the fibres were combed using a domestic comb to remove unwanted materials and also to remove shorter fibres (Plate 20).

Plate 20 Combing the banana fibres

Washing was carried out to remove dirt and other particles inherent in the fibres (Plate 21)

Plate 21 Washing the banana fibres

Drying of fibres was the last stage of this manually extracted fibre from the banana stem (plate 22).

Plate 22 Drying of banana fibres

3.14 Flower stalks of Guinea grass (*Panicum maximum*)

Guinea grass is a perennial grass that grows in tussocks. It has long, narrow, leaves. The leaf blade and sheath have soft hairs on the surface. It has a stalk which flowers to produce seeds at the top of the plant. The flower stalks are pulled out and processed for basketry work (Plate

23). Baah (2000) describes the plant as having an inflorescence and flower stalk (see Figure 1). Ghana, guinea grass can be found in all the regions except the Northern, Upper East and Upper West.

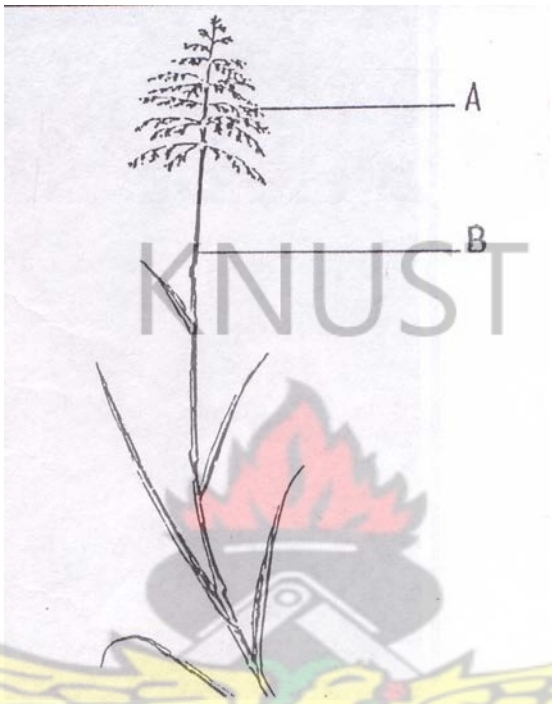


Figure 1 Guinea grass. A- Inflorescence B - Flower stalk

Figure 1 Source: Adu Baah K. (2000)

Plate 23 Guinea grass in their natural environment

Preparation of straw

The fresh stalks are pulled out and dried in the sun for two weeks depending on the condition of the weather. Each of the dried stalks is split into two and placed on the leg and twisted as illustrated in Plate 24.

Plate 24 Twisting of the straw

Flower stalks of guinea grass (*Panicum maximum*)

The flower stalks were split into two using the teeth, and rolled on the leg with the palm of the hand. Due to unhygienic nature of it, Baah (2000) gave an alternative way of splitting the straw by using needle for splitting the flower stalk into two (see Figure 2).

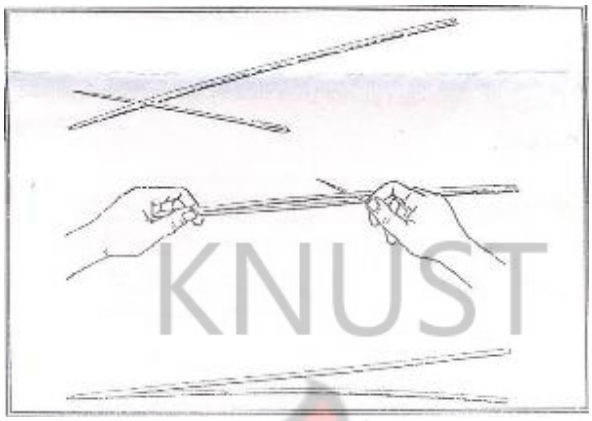


Figure 2 Splitting the stalk of guinea grass

Figure 2 Source: Adu Baah K. (2000)

Baah (2000), again, shares the same idea of preparing straw where it is put on the thigh for twisting (see Figure 3).

Figure 3: Twisting a guinea grass stalk by the traditional method

Source: Adu Baah K. (2000):

Another alternative means which can avoid the use of the thigh is explained in Baah (2000) where he used synthetic rubber pad placed on table for twisting (see Figure 4).

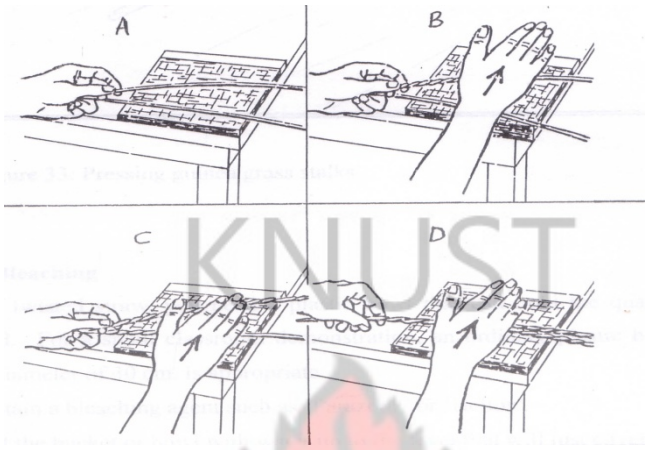


Figure 4: Stages in twisting guinea grass stalk

Continuous twisting using the bare skin of the leg gradually affected the skin. The drying process made the straw a little harder. The hardened property of the twisted straw was used to create interesting floats on the mat surface.

3.15 Sisal fibres

Sisal is one of the materials which can be used for basketry. According to Willson (1971), it is one of the most extensively cultivated hard fibres in the world. It accounts for half the total production of the textiles fibres, and at the same time may be used as basketry material (Willson, 1971). The plant is composed of numerous elongated fusiform fibre cells that taper towards each end of the leaf (Plates 25a, 25b)

Plate 25a Sisal plant (*Agave sisalana*)

Plate 25b Sisal plant (*Agave americana variegata*)

3.16 Extraction of fibres

The leaf of the sisal plant was harvested using a kitchen knife. The leaves were retted in a container to soften the tissues, making it ready for beating. The retted leaves were placed on the mallet board and beaten gently with the mallet in order not to break the fibres (Plate 26).

Plate 26 Beating of the sisal leaves

The mass of fibres was then washed using the detergent *Omo*, which also acts as a bleaching agent to bleach fibres (Plate 27).

Plate 27 Washing of sisal fibres

After beating, washing and drying, the fibres were combed to get rid of unwanted matter and broken fibres, and to get the fibres aligned (Plate 28).

Plate 28 Combing of the sisal fibres

Kenaf rope

Kenaf is one of the bast fibres. The kenaf ropes, bought from the market, were unraveled and dyed with green *suede* dye. The dye was mixed with water and salt and boiled for fifteen (15) minutes. The dyed materials were removed and dried.

Fabric pieces

Pre-experimental work done by the researcher revealed that waste fabric pieces can be used as a basketry material on the loom. The researcher collected different fabric pieces from the tailoring shops and cut them into strips. Afterwards, the strips were given a slight twist to form a coil-like rope and used as weft.

Raffia

Raffia was obtained from the leaflets of the raffia palm. The process of extraction was done by using a traditional method to separate the heavier, green layer of the leaflet and the lighter, creamy yellow layer and peel them apart. The creamy yellow material called *raffia,* was then

dried. In order to give it more aesthetic appeal, the resultant film was dyed with *suede* dye, by the hot dyeing method.

Spear grass (*Imperata cylindrica*)

Ghanaian farmers say this grass is one of the most dominant and harmful weeds because it is very difficult to control (Boadi, personal communication, September 22, 2010). The researcher guessed that the leaves of this grass (Plate 29) can be used to serve a good purpose in basketry. It was processed for mat on the loom.

Plate 29 Spear grass

3.17 Preparation of the leaves of spear grass

The grasses after cutting them from the field were dried under a shed. Drying under the shade helped to maintain the greenish brown colour of the grass (Plate 30).

Plate 30 Dried spear grass

3.18 Dyeing of Materials

Natural plant dyes were used to dye the sisal and banana fibres. The fresh root of the Morinda lucida plant which is known to yield red and yellow dyes (Korankye, 2010) known in Akan as *ngo ne nkyene* was harvested and chopped into pieces and boiled in a sauce pan for thirty (30) minutes to get a good shade of colour red and yellow. Six spoonfuls of common salt was added as a mordant. The sisal and banana fibres were immersed in the hot dye for 30 minutes each. After the fibres had obtained a good shade of natural yellow, the fibres were then removed and dried. The resultant colour was natural yellow.

Another dye, green *suede* was also used to dye the kenaf fibre. The dye was mixed with water and boiled for fifteen (15) minutes. After the fifteen minutes, 3 spoonfuls of common salt was added to the dye to serve as a mordant to fix the colour (personal experience). The fibres were boiled in the dye for another fifteen minutes and then removed and dried.

From the above discussions, any plant which contains fibres can be processed for basketry production as well as any flexible materials which can be controlled on the loom. Basketry producers should use different plant dyes for dying local materials to achieve different colours apart from natural yellow.

3.19 Weaving on the loom

Weaving began with the design of the weave structures as in figure 5-13. Designing in this research refers to the manner in which the warp and weft yarns interlace to form a woven material which can be used to form basketry items. All weave structures were first designed on ruled squares where all vertical columns of squares represent the warp ends, and horizontal rows of squares represent weft yarns or pick as shown in Figure 5.

Figure 5 Design of simple weave

The shaded portions indicate how the weft yarns interlace with the warp yarns to form a woven material. Again from figure 5, the black portion represent the weft yarn whiles the white portion represent the warp yarns. The weft yarns interlace the weft yarns at right angle.

3.20 Warp planning

In planning the warp, the researcher considered the size of the warp material which in effect determined the width of the woven mats. The warp calculation was done by multiplying the reed size by the width of the mat required. The calculations of the warp yarns and its treadling orders were as follows:

Plain weave

Particulars used for weaving plain weave mat

Warp yarn used = Cotton twine

Weft yarn used = Spear grass

Projected width of mat = 40 cm

Reed size = 5 dents per cm

Total warp ends = Width of mat x reed size

= 40 cm x 5

= 200 ends

Heddling order = 1, 2, 3, 4

Treadling order = treadle one (1) and treadle two (2)

This simple plain weave design required only two treadles. The process involved the researcher stepping on treadle one (1) and inserting the weft yarn, removing his foot from the treadle and beating the weft yarn into place with the reed or beater, and then again stepping on treadle two (2) and inserting another weft yarn. The repeated process helped to achieve a plain weave structure. For this design, the first warp yarn cotton had to pass through the first heald eye-let on heddle one, the second warp yarn in heald eye-let on heddle two, the third warp yarn on heald eye-let on heddle three, and finally, the fourth warp yarn on heald eye-let four on heddle four to produce the plain weave structure. Figure 6 illustrates the draft, design and the lifting plan for the plain weave structure, and Plate 31 shows the finished woven mat.

Draft

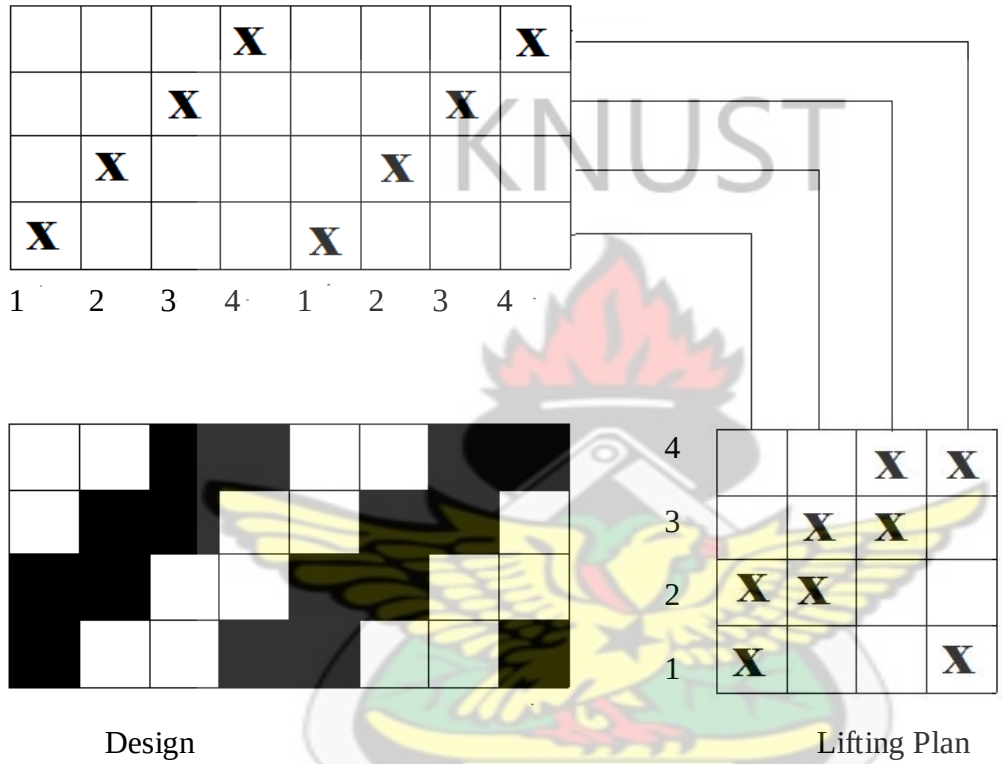


Figure 6 Plain weave draft, design and lifting plan

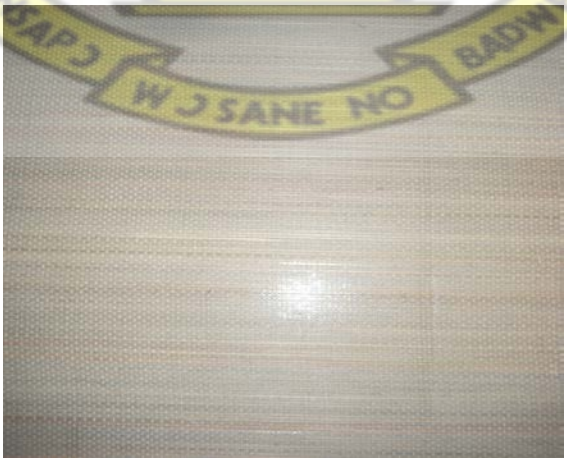


Plate 31 Plain weave mat

3.21 Diamond Twill

Particulars used for weaving diamond twill mat

Warp yarn used = cotton twine

Weft yarn used = Kenaf rope

Width of mat = 40 cm

Reed size = 5 dents per cm.

Total warp ends = width of mat x reed size

= 40 cm x 5

= 200 ends

Heddling order = 1, 2, 3, 4.

Treadling order = Treadle 3, 4, 5, 6. – 16 times

= Treadle 5, 4, 3 -- 16 times

Using heddling order 1,2,3, 4, meant that the researcher had to pick the first warp yarn and insert it in the heald eye on heddle one, and warp yarn two on heddle two respectively. The treadling order above implies that the researcher stepped on the design treadles 3,4,5 and 6 sixteen (16) consecutive times and then weave again in reverse order from design treadles 5,4 and 3 sixteen times. This treadling order produced a diamond twill design (Plate 32) but the same draft, design and lifting plan for the plain weave was used for Figure 7. The treadling order, when reversed produced the diamond effect.

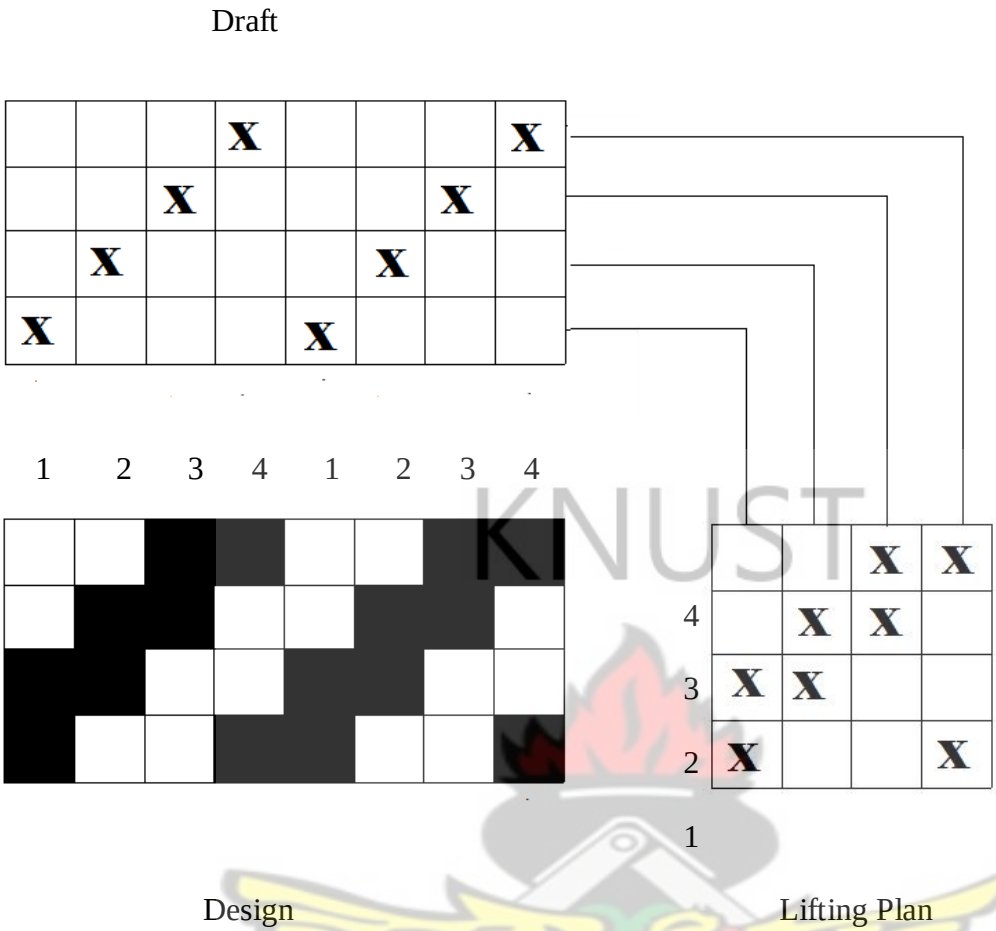


Figure 7 Diamond twill draft, design and lifting plan

Plate 32 Diamond twill weave mat

3.22 Birds eye design

Particulars used for weaving Birds eye mat

Warp yarn used = Cotton twine

Weft yarn used = Guinea grass

Width of mat = 30 cm

Reed size = 5 dents per cm.

Total warp ends = Width of mat x reed size

= 30 cm x 5

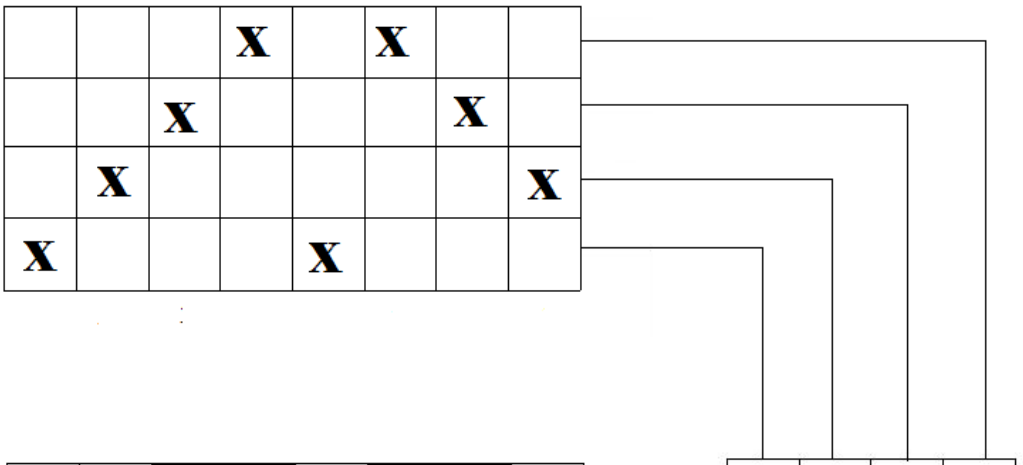
= 150 ends

Heddling order = 1, 2, 3, 4, 1, 4, 3, 2.

Treadling order = Treadle 3, 4, 5, 6. repeat.

The heddling order for the bird's eye design differs from the plain weave and the diamond twill heddling order. After passing the warp yarns through healds 1,2,3 and 4, the subsequent heddling order changes form 1,2,3,4, to 1,4,3,2. The manner at which the stepping was done, was to use the figures 3,4,5 and 6 which represents the treadles. After steping on design treadle six (6), the whole treadling order was repeated. The end product is shown in Plate 48, and its draft, design and the lifting plan is indicated in Figure 8.

Draft



1 2 3 4 1 4 3 2

4

3

2

1

Design Lifting Plan

Figure 8 Bird's eye draft, design and lifting plan

Plate 48 Birds eye weave mat

Due to similarities in heddling and treadling orders the plain and the twill weaves mat woven have similar appearance.

3.23 Plain weave

Particulars used for weaving plain weave mat

Warp yarns used = Acrylic yarns

Weft yarn used = Raffia

Width of mat = 36 cm

Reed size = 5 dents per cm.

Total warp ends = Width of mat x reed size

= 36 cm x 5

= 180 ends

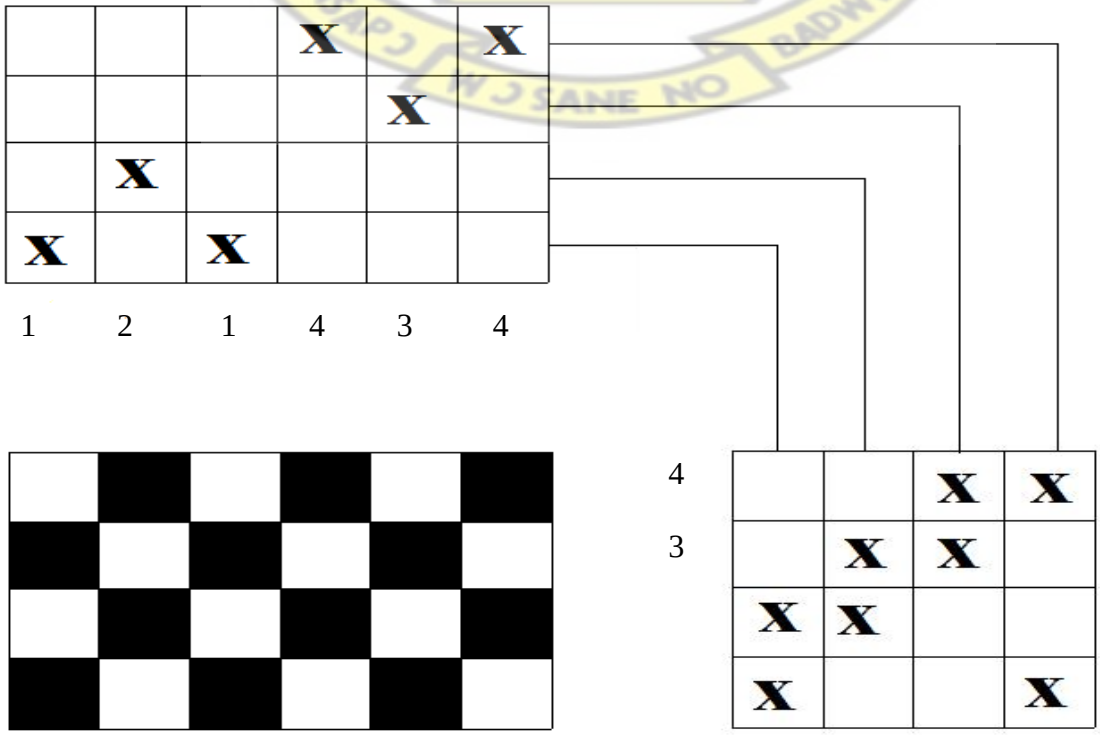
Heddling order = 1, 2, 1, 4, 3, 4.

Treadling order = Treadle one (1)

= Treadle two (2)

The heddling order above is normally used for traditional *Kente Babadua* design but the researcher decided to use it on the broadloom to see the effect. Only plain weave treadles were used. That is, treadles one (1) and two (2). The colour effect was achieved by dyeing some of the raffia used for the weft and coloured acrylic yarns for the warp (Plate 34). After using the draft, design and the lifting plan as in Figure 9, plain weave effect was achieved.

Draft



2

1

Design Lifting Plan

Figure 9 Plain weave draft, design and lifting plan

Plate 34 Plain weave mat

3.24 Reverse twill

Particulars for weaving reverse twill

Warp yarns used = Acrylic yarn

Weft yarn used = Polythene strips

Width of mat = 36 cm

Reed size = 5 dents per cm.

Total warp ends = Width of mat x reed size

= 36 cm x 5

= 180 ends

Heddling order = 1,1, 2,2, 3, 3, 4,4.

Treadling order = T treadle 1

= Teadle 2

= Treadle 3

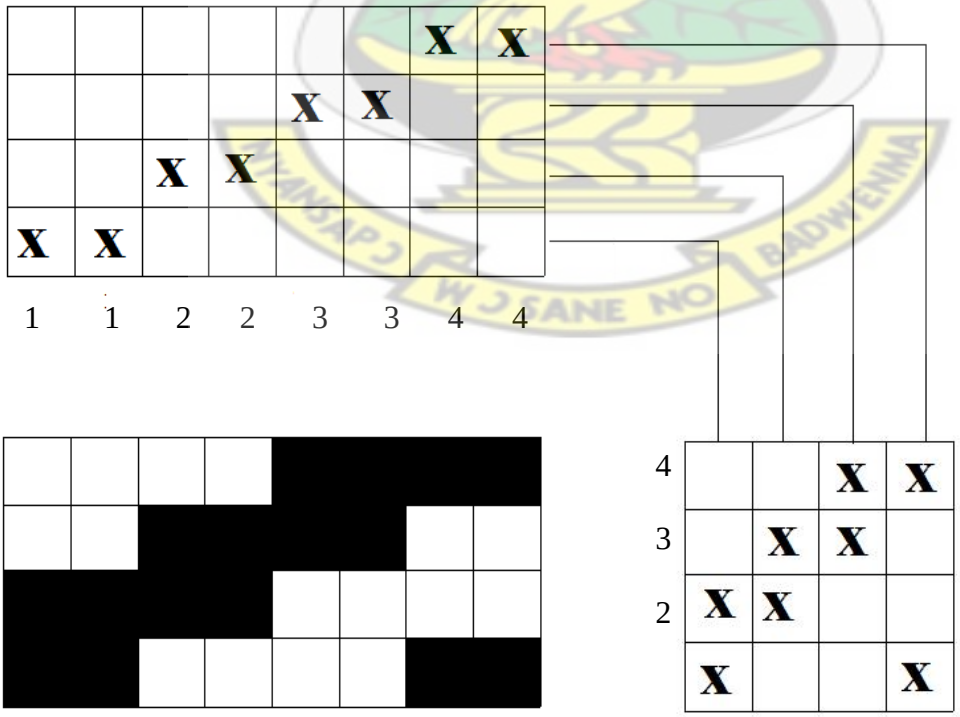
= Treadle 4

= Treadle 5

= Treadle 6

The heddling order above indicates that, the first and second warp yarns were inserted in two (2) healds on heddle one in that order. Headling begun from the centre of the warp to the right and again from center to the left starting from the figure 2,2, 3,3, 4,4 1,1. Six treadles were used. Treadles one (1) and two (2) were used as binder to secure the inserted weft yarns. The rest of the design treadles were used for the twill effect (Plate 35). Figure 10 is the draft, design and lifting plan for Plate 35.

Draft



Design

Lifting Plan

Figure 10 Reverse twill draft, design and lifting plan

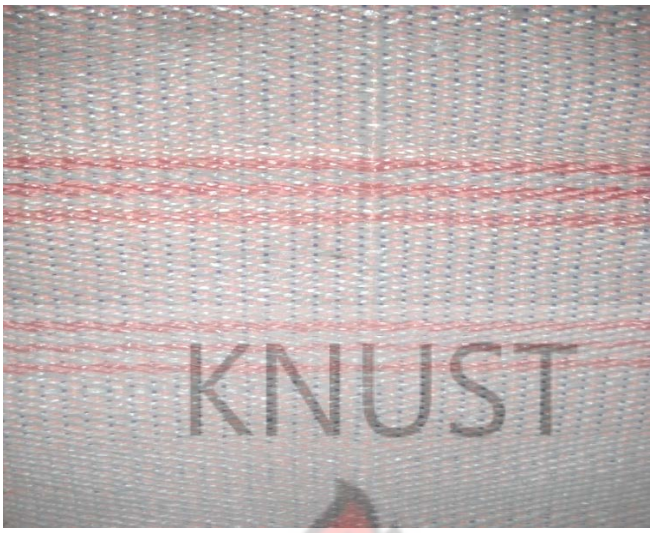


Plate 35 Reverse twill weave mat

3.25 Warp Rib

Particulars used for weaving warp rib mat

Warp yarns used = Acrylic yarn

Weft yarn used = Banana fibres

Width of mat = 36 cm

Reed size = 5 dents per cm.

Total warp ends = Width of mat x reed size

= 36 cm x 5

= 180 ends

Heddling order = 1, 1, 2, 2, 3, 3, 4, 4.

Treadling order = Treadle one (1) - once

= Treadle two (2) – once

Although the same headling order was used for the reverse twill but for the warp rib only two treadles which are normally used for the plain weave were used to achieve the rib effect which follows the direction of the warp (Plate 36). When Treadle one was depressed, one pick was inserted, followed by beat-up, and then Treadle two was depressed and another pick was inserted. Figure 11 in page 60 shows the draft, design and the lifting plan for the warp rib weave shown in Plate 36.

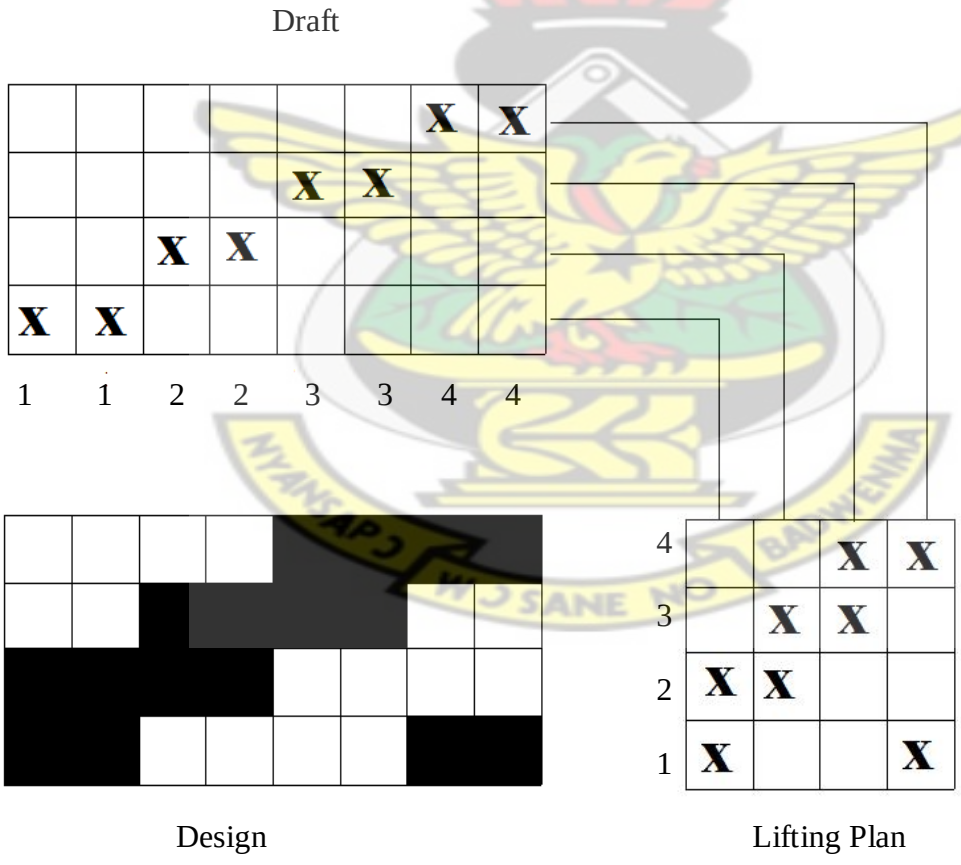


Figure 11 Warp rib draft, design and lifting plan

Plate 36 warp rib weave mat

3.26 Hopsack weave

Particulars used for weaving Hopsack weave mat

Warp yarns used = Acrylic yarn

Weft yarn used = Fabric strips

With of mat = 36cm

Reed size = 5 dents per cm

Total ends = Width of mat x reed size

= 36cm x5

= 180 ends

Heddling order = 1,1, 2,2, 3,3, 4,4,

Treadling order = Treadle one and Treadle two

After heddling with the heddling order above, plain weave treadles were used to achieve the weave. Treadle One was tied to Harness One and three while Treadle Two was tied to Harness Two and Four. When Treadle One was stepped, two picks were inserted at a time

followed by another two picks using Treadle Two. No binder was used. The resultant weave is shown in Plate 52. Figure 12 shows the draft, design and the lifting plan for Plate 52.

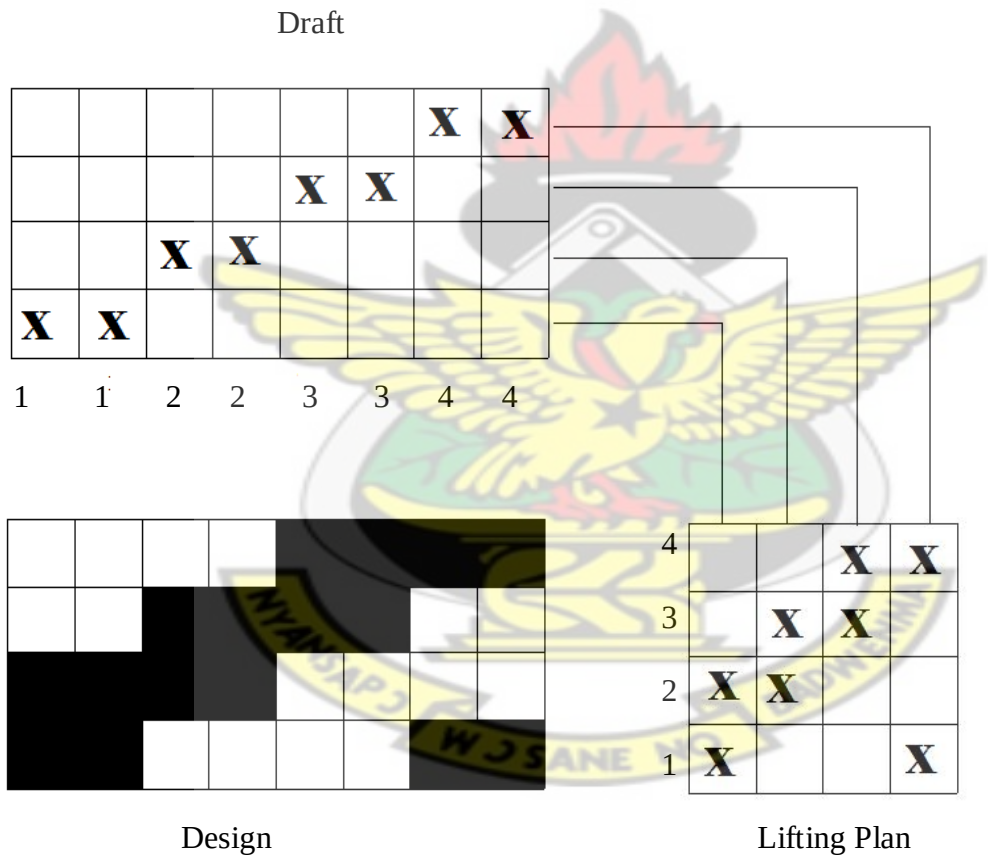


Figure 12 Hopsack weave draft, design and lifting plan

Plate 37 Hopsack weave mat

3.27 Hybrid Overshot (Twill weave)

Particulars used for weaving Hybrid Overshot weave mat

Warp yarns used = Acrylic yarns

Weft yarns used = Sisal fibres

Width of mat = 36 cm

Reed size = 5 dents per cm

Total warp ends = Width of fabric x reed size

= 36 x 5

= 180 ends

Headdling order = 2,3,4,1,2,1,4,1,4,3,4,3,2,3,2, 3,2, 3,4,3,4,1,4,1,2,1,3,2,1

Treadle order = Treadle 3, Treadle 4, Treadle 5, Treadle 4, Treadle 3, Treadle 6 Treadle 3, Treadle 6, Treadle 3, Treadle 4, Treadle 3,Treadle 4, Treadle 5.

Hedling was done from the left hand side of the warp. Heddling start with harnesss two heald two, in that order up to the last number. The whole process was repeated until all the warp

ends were exhausted. The headling order is illustrated in Figure 13. The mat produced is shown in Plate 38.

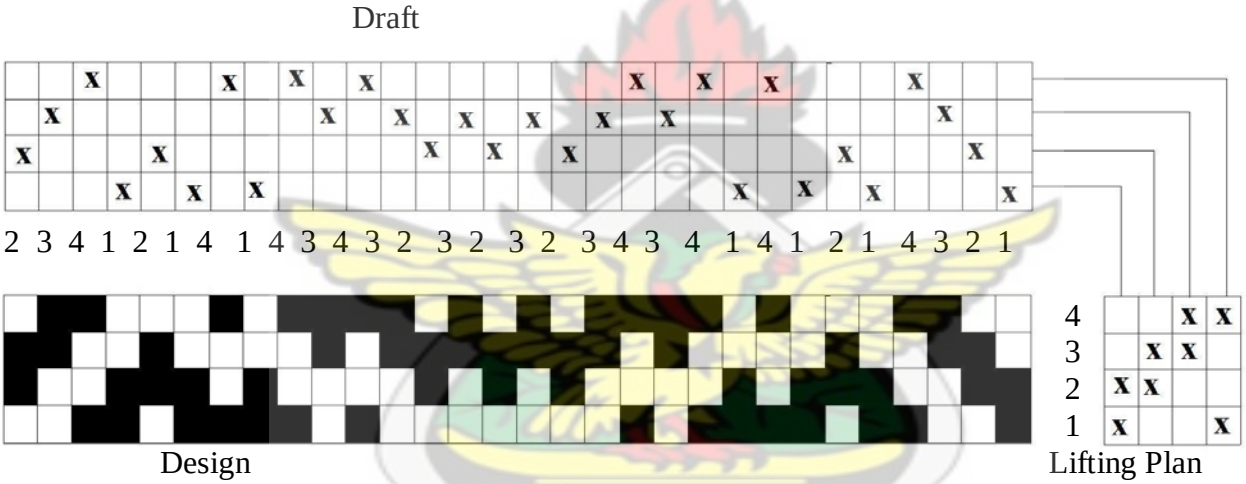


Figure 13 Hybrid Overshot draft, design and lifting plan

Plate 38 Hybrid overshot (Twill weave) mat

3.28 Warping process

The warping process involves the manner in which the warp yarns are put together in a parallel formation on the warping mill. After obtaining the figures for the total number of warp ends needed for each weave structure, the next process was to build up the warp. The researcher started the warping process by tying one end of the yarn for warping to the first peg which is fitted at the bottom of the warp mill between the two upright posts of the mill. The warp yarns were guided by one of the weaver's hands while the other hand turns the warping mill in clockwise direction until the yarns reached the two pegs at the top of the mill which create the crosses in the warp. After creating the crosses, the warping mill is turned anticlockwise to the bottom peg where the milling began. The process was repeated until the required total ends were obtained (Plate 39).

Plate 39 Warping

3.29 Raddling / Beaming

During the process of beaming, the warp yarns were rolled under tension onto the warp beam. Beaming sticks were inserted in the warp to lie over the rolled warp during the rolling to maintain an even spread of warp on the roller and to give tension. The Raddle, a comb-like wooden structure with large dents was fixed firmly to the beater of the loom. The warp yarns were counted and placed in the dents of the raddle based on the total number of warp yarns that was divided by the number of dents in the raddle. The raddling was done to spread the warp yarns evenly on the loom (Plate 40).

The loose end of the warp yarns was tied to a weighted box. The weighted box was then pulled back to give tension to the yarns. The warp beam was dressed to make sure the tension in the individual warp yarns was as even as possible. The warp was then rolled onto the warp beam (Plate 41).

Plate 40 Raddling

Plate 41 Beaming

3.30 Heddling/ Drawing-in process

This process was next to the beaming process where the warp yarns were inserted through the healds in the heddles, using the various heddling orders used for the weave structures. For instance the heddling order for the plain weave, birds eye, rib weave, and hopsack weave were, 1, 2, 3, 4,. 1, 2, 3, 4, 1, 4, 3, 2,. 1,2,1,4,3,4,. 1,1, 2, 2, 3, 3, 4, 4, respectively. These figures were based on the weave structures the researcher wanted to achieve.

The researcher in using a broadloom with four harnesses or shafts had to insert each warp yarn through the eyelet of the healds on the harnesses. The number one (1) represents heald one on harness one (1), number two (2) represents heald two (2) on harness two, number three (3) represents heald three (3) on harness three and number four (4) represents heald four (4) on harness four (Plate 42)

Plate 42 Heddling

3.31 Reeding / Denting

In this process the researcher inserted individual warp yarns through the dents of the reed in strict parallel order with the help of a tool called the reed hook (Plate 43).

Plate 43 Denting

3.32 Tying-up

The tying-up process was in two stages. First the researcher had to tie the warp yarns to apron stick in small bundles. The second stage was to attach the harnesses to the treadles (Plate 44, 45).

Plate 44 Tying-up to apron stick

Plate 45 Attaching harnesses to treadles

The tying-up for the weaves were as follows:

Treadle one to lams 1 and 3

Treadle two to lams 2 and 4

Treadle three to lams 1 and 2

Treadle four to lams 2 and 3

Treadle five to lams 3 and 4

Treadle six to lams 4 and 1

The first two treadles were used for the plain weave and as binders for twill weaves. The rest of the treadles were used for the twill weave.

3.33 Weft preparation

The hopsack weave needed a binder during weaving. Acrylic yarns were used as a binder and were wound around a bobbin (Plate 46) which was then placed in a shuttle for weaving. Other materials used as weft were hand picked (Plate 47).

Plate 46 Weft preparation

Plate 47 Hand picking

3.34 Weaving

During the production of weave structures on the loom, three motions were involved in the process: shedding, picking, and beating-up. Shedding was the process of separating the yarns into an up-and-down formation, so as to create a space through which to pass the weft. In a broadloom, this is done by depressing the treadles individually. Picking was a process used to insert the weft through the shed with shuttle and the hand. The beating-up process was to push the inserted weft yarn to the fell of the woven mat (Plate 48).

Plate 48 Beat-up

Weaving of local materials was difficult because no continuous local material was used as weft. Again the size of the warp was also affected by the length of the weft this was due to the fact that the prepared material could not be wound onto bobbin due to the thickness of the weft material such as kenaf rope, spear grass, and polythene strips.

The final mats produced from the loom had fibre projections on the surface, therefore making the final product look unfinished.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Overview

This chapter discusses the results of the experiment and findings room the field in relation to the objectives and the research questions outlined for the project, taking into account the selected weaves and the materials identified for the project. This chapter also contains the summary of findings.

4.2 Objective 1: To identify and describe basketry materials that can be processed for weaving on the loom.

Both natural plant and man-made basketry materials were identified for the project.

The natural plant materials were grass, rushes, willow reed, rattan, raffia, bamboo,split palm frond, banana trunk fibres, sisal fibres, flower stalk of guinea grass and sweet grass.

The man-made materials include identified were polythene, acrylic thread and fabric.

It was realized that not all of the identified materials could be used on the loom due to the stiff nature of some of them. The selection was based on flexibility and workability on the loom. In this respect, the materials that were found suitable for weaving mats on the loom for basketry products were banana fibres, sisal fibres, flower stalk of guinea grass, raffia, kenaf rope and polythene,

1. In the case of banana fibres, sheath or false stem of the banana plant was found to contain fibres which can be processed and used on the loom to weave structures in a mat form for basketry products. The fibres were highly flexible and could be controlled in ways similar to conventional yarns used for fabric production. It was however, difficult to spin or twist the fibres to obtain long continuous yarns suitable for weaving. The fibres after dyeing showed good dye affinity.

2. Flower stalk from guinea grass (*Panicum maximum*)

Flower stalks obtained from guinea grass were also identified as one of the basketry materials. Guinea grass can be found all over southern Ghana. Although it is not as flexible as the other fibres which were processed and used on the loom, it was able to interlace well with the cotton twine which was used as the warp. It has a natural sepia colour that makes it appropriate to use without the need for prior dyeing.

3. Kenaf rope

Kenaf is one of the sources of bast fibre used for making rope. This material is very common and cheap on the Ghanaian market. The texture of the fibres was found to be rough and hairy. Due to the thick size of the rope it was used to make, the mat that was made out of it was heavy. The weave showed a coarse, diagonal form. The fibre showed a high affinity for dyes.

4. Sisal fibres

Sisal fibres are used as an ornamental plant which can be found around schools and homes. Pre-experimental work which was carried out before the research indicated that it contains fine fibres which could be used for basketry products on the loom. The fibres bleached well after using *Omo* detergent for washing them. They were successfully dyed with plant dye.

5. Fabric strips

Fabric pieces are off-cut materials that tailors and dressmakers throw away. It was identified as a workable material on the loom because of its flexibility. It was also noticed that using different fabric pieces for weaving yielded different colour effects.

6. Spear grass (*Imperata cylindrica*)

This type of grass is quite common in this country. It is available in all seasons, and it is one of the grasses farmers find difficult to control. Since baskets are made to last, the researcher found this material to be viable for the purpose.

7. Raffia

The raffia yarn has moderate tensile strength and is obtained from the raffia palm leaves. The plant normally grows around streams, in swamps and on marsh land.

8. Polythene strips

Pre-experimental work conducted before the start of the actual project gave an indication that polythene strips can interlace well with any warp yarn on the loom. Strips of white and pink polythene materials were picked from the ground and waste bins. They were washed to remove dirt. They were then dried and made ready for use.

4.2.1 Basketry **materials and processes used by Basket makers in and around Kumasi**

Most natives around Kumasi and its environs use oil palm and raffia palm branches for making baskets of different types and sizes. These materials are very common in the localities of the basket makers (Boakye, personal communication, July 9, 2010). The palm branches are prepared and used as the spokes and the raffia palm branches as the weavers.

Plate 49 Splitting the raffia palm branches

Palm fronds are very long compound leaves of the palm plant. Therefore after cutting it down, it needs to be prepared if is to be used for the base of the basket. After splitting the raffia palm branches (Plate 49), it is cut into specific lengths and sizes as determined by the basket maker.

Plate 50 Removal of raffia palm branches inner tissues.

The palm frond contains a bulk of whitish pith inside it. To make the weavers flexible, the basket maker removes the pith.

Plate 51 Weavers (strands)

The strands are prepared by splitting and removing the pithy tissues of the raffia palm. The pithy matter is peeled off progressively until the strands become more flexible and easy to control around the spokes.

Plate 52 Forming the base of the basket.

As shown in Plate 52, the basket maker arranges the prepared palm frond spokes for the base on the kitchen stool in order to keep the base clean from dirt. The weaver goes round the spokes in an over-one and under-one manner.

Plate 53 The process of forming the shape

After getting the circumference of the base, the next stage is to start forming the actual shape of the basket. The basket maker gradually bends the spokes (Plate 53) and goes round it with the weavers.

Plate 54 Plaiting using three weavers

Three weavers are used after getting the shape. The basket maker employs the plaiting (Plate54) technique to strengthen the rim of the basket.

Plate 55 The finished palm frond basket.

At this stage the basket (Plate 55) is ready for use. Plate 55 shows the structure of the weaves.

Other basket weavers within the Kumasi Metropolis also use rattan or willow, cane, bamboo, and plywood for their basketry work (Issah, personal communication, August 9, 2010). The cane is used for tying around the rattan or the willow which is used for framing the works or

the products. Plywood is used for the base of products such as television stand and rattan chair for use in the living room.

Basketry products made with rattan, large and small rattan cane, bamboo and plywood include serving tray, laundry basket, wig stand, and hamper baskets (Opoku, personal communication, August 9, 2010).

Plate 56 Rattan frames and materials.

Large and small rattan canes are the main raw material for another group of baskets made in the Kumasi Metropolis. These materials are used to make frame for living room furniture, television stands and other types of baskets such as those shown in Plates 9, 10, 11, and 12.

Plate 57 Serving tray / television stand

This television stand (Plate 57) and the serving tray are framed with large and small rattan cane. The serving tray is bordered with the plaiting technique at the rim.

Plate 58 Laundry basket.

This laundry basket (Plate 58) is made of only processed large rattan. The black weaving in the middle was done with dyed rattan to give a good aesthetic look to the work. It also shows in detail the structure of the weave one weaver over one stake Plate 58.

Plate 59 Wig stand / serving tray.

This wig stand (Plate 59) shows one of the varieties of basket work produced from large and small rattan cane.

Plate 60 Hamper basket.

Hamper baskets are used to present gifts to people during special occasions such as Christmas and Easter. Hamper baskets shown in Plate 60 are completed with a unique border at the rim to attract customers. The base is made of plywood to give support to the basket.

Plate 61 Laundry basket cover.

Laundry basket (Plate 61) shows in detail the over-one and under-one plain weave. Small rattan cane was used for both the horizontal and vertical elements. Wooden beams were used to provide a frame around which small rattan cane was used to weave the body of the cover.

Plants which contain fibres such as sisal and banana trunk was difficult to spin to achieve continuous yarns for weft insertion. Although little twist was given to sisal and banana fibres no continuous yarn was achieved similar to contemporary yarn. The nature of the local material used also determined the texture and the weight of the mats produced. Materials such as rattan, cane and palm fronds used by basket producers in the study area and their technique for production which is off-loom was different from the on-loom weaving technique.

4.3 Objective 2: To process the identified materials for weaving on the loom

1. Fibres from Banana (*Musa sapientum*)

Sheathes of false stem of banana were beaten, washed and combed to obtain the fibres. The researcher retted some of the sheathes in order to soften them for easy removal of the fibres. Due to the water-proof nature of the sheaths, they resisted water penetration, which was needed to aid fermentation of the tissues surrounding the fine fibres.

Some of the fibres broke when the sheathes were beaten hard. Therefore the remaining were beaten more gently. The fibres were then washed to remove unwanted materials. This resulted in entanglement of some of the fibres. The entangled fibres were combed to align the fibres. During the combing, a lot of fibres were wasted. The fibres were then twisted to make ropes. However, it was not possible to obtain long ropes to use as yarn.

2. Flower stalks of guinea grass (*Panicum maximum*)

The flower stalks were split into two and rolled on the thigh with the palm of the hand. Continuous twisting using the bare skin of the thigh eventually affected the skin. The drying process made the straw a little tougher. The toughened property of the twisted straw was used to create interesting floats on the mat surface.

3. Sisal fibres

Fibre processing was similar to the processing of the banana fibres. Washing of fibres entangled some of the fibres together, and in trying to separate the fibres a lot of short fibres were wasted, because they could not be used for weaving on the loom. Combing was done to achieve parallel arrangement of fibres. The combing process removed broken fibres and unwanted tissues.

4. Polythene strips

It was difficult to cut the polythene strips into regular sizes because of their slippery nature. They resisted dyeing because they repel water. The original colour of white and pink, therefore, was maintained.

5. Raffia

Raffia yarns had a characteristic film-like nature which is creamy in colour. It is highly pliable, making it very easy to control. The dyeing test conducted using swede dye gave good results, therefore improving the aesthetic quality of the work produced out of it.

6. Spear grass (*Imperata cylindrica*)

After the primary processing stage, a natural brown colour was obtained. Forming the woven mat into a container was difficult therefore it was used for making a place mat. The spear grass causes body itching during weaving when it comes into contact with the body.

7. Fabric pieces

They were easily twisted into rope form for weaving. The strips obtained after cutting were very short in length. Some of the fabric pieces were also very difficult to twist into rope form, therefore affecting the picking process.

8. Kenaf rope

The rope which was in a 3-ply form was untwisted to obtain the single plies. During this process it was observed that some loose fibres fell out. It was also observed that the single yarns were weak and easy to break and undo.

After basketry materials have been woven in the form of a mat, some can be formed into three-dimensional shapes like dressing bag, brief case, folder, sandals, shopping bags, and storage containers. Other mats can be used for articles like bed mat, place mat, window curtains, chair backs and car seat cover. Figure 14 shows stages in forming a mat into a container.

In order not to loose more fibres processing of materials like banana trunk and sisal which demand beating should be done more carefully. Some local materials like polythene cannot be dye to get different colours, therefore interesting polythene colours should be use.

4.4 Objective 3: To weave plain and twill weave on the loom using the processed materials.

In weaving plain and twill weavs on the loom using the processed materials, the following was observed:

1. That some of the processed materials like the banana and sisal fibres were wasted because the researcher had to count off a number of fibres and remove them from the lot before picking could take place. The removal of the fibres led to the wastage.

2. Weaving the selected materials on the loom resulted in structures having a rough surface.

3. The outcome of the weave structure of the banana fibres, polythene strips, and sisal fibres on the loom resembled materials woven with contemporary yarns.

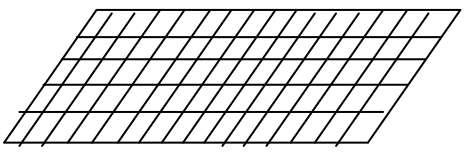
4. Picking was difficult because none of the processed basketry materials for the weft could be rolled onto a bobbin and used with a shuttle which could have aided easy picking.

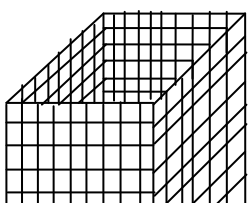
5. Weaving the selected materials on the loom resulted in basketry mats that were heavy.

6. The length of some of the processed materials like pieces of fabric, sisal fibres and straw determined the width of some of the mats. The size of the reed also determined the width of other mats. This was due to the fact that their lengths were very short.

A basket can be woven on the loom depending on the nature of basketry materials used. Baskets on the loom are first woven using some weave structures. The functions or the purpose to which the basket will be put should also be considered. Basketry items on the loom are produced in a mat form and can be form into three-dimensional shapes as in figure 14.

1





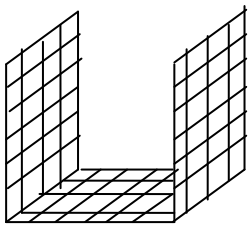
2  3

Figure 14 stages of forming mats into containers.

4.5 Summary of Findings

1. Plain and twill weaves can easily be woven on the man-powered loom using processed basketry materials. Similar heddling orders were used for all the selected weave structures for the project. For example, 1234, 11 22 33 44, 12341432. The same lifting plan was used to raise and lower the warp yarns during weaving to achieve all the structures woven. Again, all odd numbers were lifted at the same time and even numbers the same. A change in the treading order when weaving changed the weave pattern in the case of the twill weaves.

2. Natural and man-made processed basketry materials can be used for basketry products in the form of mats on the loom. Weaving flexible basketry fibre materials resulted in a product similar to fabrics produced with contemporary yarns.

3. It was very difficult processing the fibres from plant like banana and sisal because the fibres had a tendency to break, and it was not possible to obtain long yarns from them. Heavy mats were produced as a result of using coarse basketry material for the weft. A lot of weft material was wasted during processing. Most Ghanaian basket weavers use materials such as rattan and palm fronds.

4. Some basketry materials like banana and sisal fibres (see Plate 25a) which are common and have similar characteristics (Plate 25b) after processing for weaving resulted in materials

having similar characteristics like woven fabric with short floats. Other materials like straw, fabric pieces and polythene strips resulted in long floats and a coarse surface.

5. The research also discovered that the basketry products found in the study areas of this research are different from the on-loom basketry products in terms of materials, size, usage and production technique.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This project research is based on the following objectives:

1. To identify and describe basketry materials that can be processed for weaving on the loom.

2. To process the identified materials for weaving on the loom.

3. To weave plain and twill weaves on the loom using the processed materials.

The project also reveals some findings which are outlined below:

1. Plain and twill weaves can easily be woven on the man-powered loom using processed basketry materials. Similar heddling orders were used for all the selected weave structures for the project for example in a 1234, 11 22 33 44, 12341432 order. The same lifting plan was used to raise and lower the warp yarns during weaving to achieve all the structures woven. Again, all odd numbers were lifted at the same time and even numbers the same. A change in the treading order when weaving changed the weave pattern in the case of the twill weaves.

2. Natural and man-made processed basketry materials can be used for basketry products in the form of mats on the loom. Weaving flexible basketry fibre materials resulted in a product similar to fabrics produced with contemporary yarns.

3. It was very difficult processing some of the fibres such as banana and sisal because the fibres had a tendency to break, and it was not possible to obtain long yarns from them. Heavy mats were produced as a result of using coarse basketry material for the weft. A lot of weft material was wasted during the processing because most Ghanaian basket weavers use materials such as rattan, and palm frond.

4. Some basketry materials like banana and sisal fibres (see Plate 38a) which are common and have similar characteristics (Plate 38b) after processing for weaving resulted in materials having similar characteristics like woven fabric with short floats. Other materials like straw, fabric pieces and polythene strips resulted in long floats and a coarse surface.

5. The research also revealed that the basketry products found in the study areas of this research are different from the on-loom basketry products in terms of materials, size, usage and production technique.

5.2 Conclusions

1. It is possible to use processed basketry materials to produce weave structures on the man-powered loom to produce basketry items. Again in heddling, when odd and even numbers are mixed together, shedding problems will result. Moreover, the treadling order can be changed at any time based on the design to be woven.

2. By weaving natural and man-made processed basketry materials on a loom, large quantities of mats can be produced in a period of time relatively shorter than the time it takes to weave basketry materials by the conventional method.

3. During processing of the basketry materials which were in the form of fibres, care was taken during the beating and combing to minimize the breakage of fibres.

4. The kind of basketry material used determines the weight of the basketry article made.

5. Beating and combing resulted in a lot of waste in some of the materials that required beating and combing.

6. The fine nature of the banana and sisal fibres worked well with plain and twill weave structures. The short floats achieved were as a result of the heddling and the treading orders used.

7. It was observed that basket makers in the study areas of this project still use the indigenous way of producing baskets, and that there has been little innovation in equipment or technology over the years. This led to the resulting observation that

there has not been much innovation in the kind of basketry products seen on the market over the years.

5.3 Recommendations

1. It is therefore recommended that basketry students should try other weave structures other than plain and twill weave such as satin and sateen using processed basketry materials on the man-powered loom. Again students and other basket makers who would like to use the loom for basketry should be creative in changing the treading orders to produce different structures.

2. On-loom basketry should be introduced in the school curriculum and other basket makers, so that teachers can encourage students to use flexible natural and man-made materials in their environment for basketry production. This will help promote recycling.

3. Other forms of retting processes should be experimented on some of the material for fibre extraction to avoid breaking of fibres which result to wastage. Again, care should also be taken in the beating, washing and combing process of fibre processing. Indigenous spinning processes should be encouraged to achieve continuous yarns for weaving on the loom.

4. If lighter mats are needed for the production of certain basketry products such as bags and placed mats, then it is recommended that, finer fibres should be used for weaving. Also if heavy mats are needed, coarse materials are recommended for weaving mats for basketry on the loom.

5. Basket makers should try the use of other materials such as polythene, which is found everywhere and other fibres which can be found in their locality for basketry. This

will bring creativity and variation in product design in the basketry industry. Basket makers should also make use of equipment like the loom to enhance productivity.

6. Fingure-like device should be improvised by the students and basket makers interested in weaving mats on the loom to draw processed materials which cannot be wound on the bobbin through the shed. This may help to avoid difficulty in picking.

REFERENCES

Adovasio, J. M., and Joel, G. (1977). "*Style, Basketry, and Basketmakers*" in James N. Hill and Joel Gunn, eds., The Individual in Prehistory: Studies of Variability in Style in Prehistoric Technologies. New York: Academic Press, 137-153.

Asante, B. (2005). *An introduction to basketry in Africa*. Japan: Graduate School of Asian and African Areas Studies, Kyoto University.

Amenuke, S.K, Dogbe, B.K, Asare, F. D.K, Ayiku, R.K, and Baffoe A. (1991). *General Knowledge in Art for Senior Secondary Schools.* WIM ILE, London: Evans Brothers Ltd.

Adu, B.K.(2000).Instructional Guide to Diverse Materials and Methods for Art Teachers. MPhil thesis KNUST.

Barratt, O. E. (1993). Material and equipment. In *Contemporary Craft: Basket making*, New York: Henry holts and company.

Corlien, M. V., Indra, P. and Ann, B.(2003). *Designing and Conducting Health System Research Projects.* Amsterdam: Kit Publishers, International Development Research Center.

Corbman, B.P. (1983). *Textiles: Fiber to Fabrics.* (Six edition). New York: Bronx Community City University.

Collier, A.M. (1980). *A Hand Book Of Textiles (*Third edition). Bristol: Western Printing Services Ltd.

Crampton, C. (1964). *Cane Work.* (Eighteen edition) Britain: Dryad Press, Leicester.

Emmons, G. T.(1993). *The Basketry of the Tlingit and the Chilkat Blanket.* In American

Indian Basketry Magazine. Vols. I-IV (1980-85).

Hebert, L (2001). Basketry Beginings. In Basket weaving kits and supplies. In www.basketweaving.com. Retrieved on 19/3/2010

Hill, J. N. and Gunn J (eds) (1977). *The Individual in prehistory: studies of variability in style in prehistoric Technologies*. New York.

Industrie-Und Unternehmensberatung GMBH (1975). Pre-Feasibility Study on Processing banana fibres. German Agency for Technical Cooperation (GTZ) Ltd.

Kaminsky (2003). In: www.wisegeek.com. Retrieved 19/3/2010.

Kadolph, S. J. (2007). *Textiles*. (Tenth edition). Upper Saddle River. New Jersey: Pearson Education, Inc.

Korankye, (2010). *Extraction and Application of plant dyes to serve as colourant for food and textiles*: Mphil thesis KNUST.

Leedy, P.D. and Ormrod, J. E. (2005). *Practical Research*: Planning and Design. (Eighth edition). Upper Saddle River New Jersey: Pearson Education International.

MicKissick Museum (1988). *Sweetgrass Basket*. Carolina: University of South Carolina.

Mirja, T. (1993). *Teachers art at walker elementary school*, academics, visual and performing arts. Florida, Fort Lauderdale.

Novellino, D. (2003). *An introduction to basketry in southeast Asia*. Ethnobiology Lab., department of Anthropology.

Polaski, H. (2008). *Short History of Baskets and Basket Making*. In Gift Baskets. An IAC Company.

Ross,B. Ed. (1976). *The New Basketry*. New York: Van Nostrand Reinhold Company.

Rosengartern, D. (1987). *Row upon row*: Sea grass baskets of the South Carolina a lowcounty. University of South Carolina.

Newman, T. R. (1974). *Contemporary African Art and Crafts*. New York: Crown Publishers Inc

Tortora, P. G, and Collier B.J. (1997). *Understanding Textiles*. (Fifth edition). Louisiana: Louisiana State University.

Walpole, L. (1989). *Creative basket making*. UK : William Collins Co., Ltd.

Wilson, P. I. (1971). *Sisal*. Vol. II, Rome: FAO/United Nations Organization, Hard Fibres Research Series, No. 8.

Wright D. (1972), *The Complete Guide to Basket Weaving*. New York: Drake Publishers Inc.

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