Training Manual for Bamboo Craft

Module II:

Weaving &Woven Products

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Preface

Bamboo is an ancient woody grass widely distributed in tropical, subtropical and mild temperate zones. Traditionally seen as the “poor man’s tree”, in recent years bamboo has risen to a high-tech, industrial raw material and substitute for wood. Although the commercialization of planted bamboo has been slow, it is becoming an increasingly important economic asset in poverty eradication, economic and environmental development (FAO, 2005).

Bamboo is a group of perennial evergreens in the true grass family Poaceae and includes the largest members of the grass family. There are more than 70 genera of bamboo divided into about 1,450 species, of which only around 50 species are routinely cultivated (Hunter, 2003). Native bamboo grows in many parts of the world, including East Asia, Sub-Saharan Africa and the Americas. Bamboo is not limited to tropical climates, with some species able to withstand frost and survive in Northern Europe. It is an extremely fast-growing plant, with some species obtaining growth surges of 100cm per 24 hour period. Most bamboo species grow to their full height within a single growing season. Over the following seasons the walls of each culm (or stem) dry and harden, reaching maturity within 3 to 5 years.

Bamboo has traditionally been used for basic construction and scaffolding, woven mats, basketry, incense sticks, and a wide variety of other handcrafted items. The utilization and trade of bamboo sector is dominated by a large informal sector comprising farmers, artisans, and family-owned cottage industries located in remote villages. Bamboo has been used as the primary raw material of the pulp and paper industry of North East India for many years. It is increasingly being exploited as a wood substitute for a range of industrial products including particleboard, bamboo mat boards, and bamboo mat corrugated sheets. Bamboo is cultivated in a small scale in homesteads but most of the material that is processed into finished products is extracted from state owned forests.

How to use the manuals

In order to promote vocational skill development through the use of technology enhanced learning, and open educational resources, training contents have been developed for training artisans / workers to enhance the quality and introduce new line of products with higher value addition that has acceptance in high-end markets.

Module 2 is designed to provide a pictorial step-by-step elaboration on the various applications of bamboo to create diverse products. It provides information regarding weaving techniques to make unique products such as table mats, lamp shades, baskets, bins etc. This manual can be used as a reference material for trainers, trainees and artisans who are learning to work with bamboo. An audio-visual guide has also been developed for the manual in order to enhance understanding. It is advisable to use both resources to derive the most of the manual.

Contents

1. Bamboo for Weaving

Bamboo has been rightly called as 'wondergrass' due to its multifarious uses. No other plant material can provide a strong competition to bamboo due to its excellent properties and attributes which make it suitable for numerous end products/ purposes. Although bamboo is very strong and hard in its natural form, however when converted into a thin sliver, it can be very flexible owing to its strong fiber property. This special property has been exploited by the users from all over the world for many centuries. It requires special skills for bamboo-weaving that has opened multitude of employment generation activities.

Figure 1: Reed Bamboos are appropriate for weaving

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Although all the bamboo species can be used for weaving basket and mats, however some of them are very hard and some make very brittle slivers. Thin wall, longer nodes, smaller diameter bamboos can make better quality slivers for weaving. Mostly freshly harvested thin walled, long internode type bamboos are good for weaving.

Figure 2: Raw material for weaving

The reed bamboo varieties are used mostly for making mats and baskets in Kerala and in North East part of India. The baskets made from thin flexible slivers are very sturdy.

Since times immemorial, bamboo has been woven to make various products like carry baskets, storages, containers, mats, fences, bridges etc. People have been weaving bamboo to make various products according to their requirements.

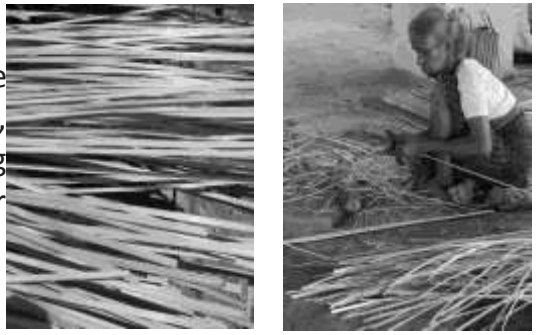


Figure 3: Bamboo slivers being made for weaving

The baskets are prepared for various purposes, some for daily use and others for some particular use only. The diversity in the size, shape, weaving structure and pattern enables these baskets to have a wide range of applications.

Figure 4: Finishing work being carried on the baskets

Figure 5: Bamboo slivers ready for weaving

Figure 6: Bamboo weaving

As per the regional requirements and the materials to be carried, the designs for baskets are made. These weaving techniques are time tested and can be reintroduced in a new way to the modern living. Today, baskets are used extensively in packaging and transportation of various fruits and vegetable, and used as storages and containers in modern living. Thus, modifying the shapes and forms with appropriate sizes can make these baskets more relevant for modern day requirements.

Figure 7: Ready for sale woven baskets

Figure 8: Various traditional baskets

Some of the baskets have very simple designs and others are very intricate and require high amount of skill to practice it. Weaving is done in a large scale for construction of certain parts of houses like wall structure, partitions, etc.and also used in preparing, gates and bridges due to its sturdy characteristics. These are often made with thick slivers to make the mat stronger for acting as a protection from wild animals. Various types of weaving patterns are also practiced for making house walls and fences. The houses and fences in North Eastern part of India are commonly made by these techniques. Some selected species are used for these because of its natural insect repellent properties and its physical properties. This book is a manual for weavers on the correct process of weaving

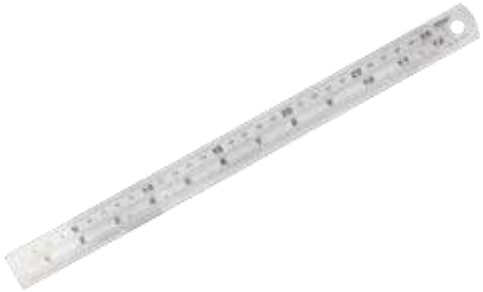
2. Tools &Raw Materials

There are various tools used for working with bamboo specially for making thin slivers. The most important tool used is knife while other supporting tools are described below. Many of these are required for various purposes related to making products out of a mat or a basket etc. The process of weaving begins from measuring to cutting, splitting, drilling, bending, grinding etc. Many of the processes are not mechanized and manual tools are needed for handcrafting in some stages of the production process. The tools needed for manufacturing bamboo woven products are shown and listed below.

Tool 1: Measuring Tape

Tool 2: Cutting Pliers

Tool 3: Calipers



Tool 4: Steel Ruler

Tool 5: Knife

Tool 6: Hand Saw

Tool 7: Angle scale

Tool 8: Power Drill

Tool 9: Compass

Tool 10: Hand Sander

Tool 11: Jig Saw

Tool 12: Hot Air Gun

3. Raw Material Preparation

Once the bamboo is harvested, it is necessary to remove all the branches of the culm with the help of a knife **(Tool 5).** The outer layer of the skin of the culm should be protected very well to avoid scratching them. Cutting the culm into short sections that are easy to carry is an essential step in order to prevent the internodes from cracking or being damaged during transport. This can be done with the help of a handsaw **(Tool 6).** When cut into short sections, the material can be packed and bundled in order to maintain their good quality for processing.

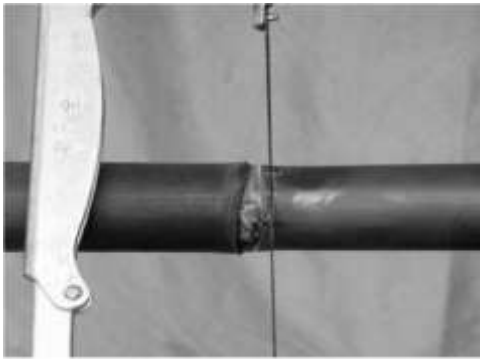


Figure 9: Cutting the culm into sections

To separate bamboo culms, it is necessary to place the saw 0.5 cm away from the node and cut parallel to the node as depicted in Figure 9. A straight cross-section will enable one to see the actual thickness of the culm wall. For preserving bamboos, it needs to be soaked in water for 15 to 30 days. Soaking makes the culms more subtle and increases their resistance to cracking when dried. Soaking in water does not provide any defense against fungal or pest attacks. However, their resistance to them can be increased by adding boric acid to the water in the pool using a proportion of 1:600. After the soaking process, allow the bamboos to air dry in a shaded area. It is important to remember that the bamboo may crack if the dyeing process is too rapid. Thus, it is necessary to protect the culms from heat and direct sunshine while they are drying.

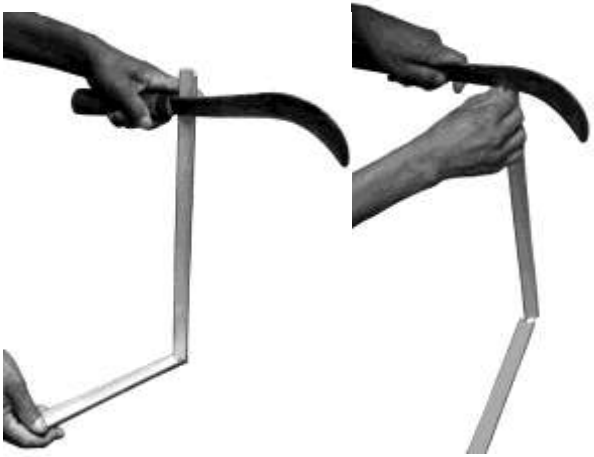
Figure 10: A preservation pool for bamboo culms

The images shown below are the basic steps that need to be followed for making the thin or thick slivers for making baskets or woven mat based products.

Step 1: Cut the bamboo to the required size with the help of a hacksaw/handsaw

Step 2: Remove the skin with knife as shown in the figure.

Step 3: Split the bamboo into two halves



Step 4: Split this further to smaller width as required

Step 5: Split bamboo further for uniform width

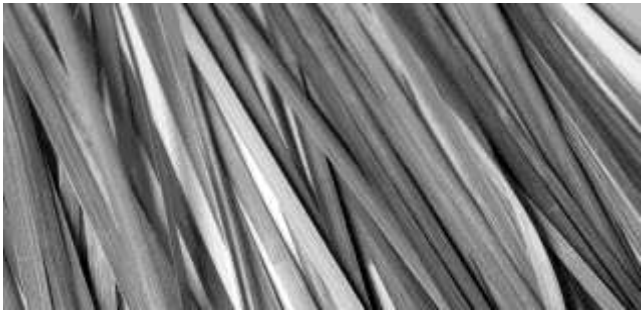
Step 6: Split the bamboo parallely between the outer layer and the inner layer as shown in the image.

Step 7: Bend the bamboo a little as sown in the image to control the split

Step 8: Keep the thin sliver between the knife and a wooden plank as shown and pull the sliver to clean it further

Step 9: Make sure the splits are uniform in size

Step 10: Selection of splits of the same size



Step 11: Make sure the splits are uniform in its size.

Step 12: Processed splits are stored

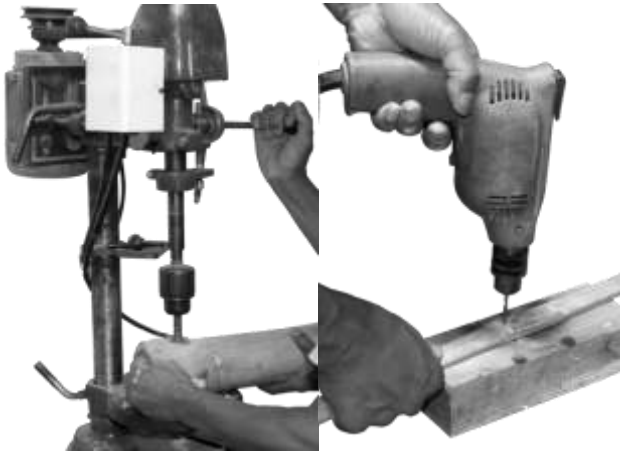
4. General Process

Treatment of Bamboo

Splitting

Cutting

Sanding



Drilling

Finishing

5. Dyeing Process

Color of the culm

Identifying the age of bamboo culms by their colour is possible with new and young culms, but is increasingly difficult for older culms. Most of the bamboo when it is young has a distinctive sheen, which is typical for green, yellow and black bamboo varieties. Bamboos with green culms generally have a dark green colour when they are 1 year old, but as the culms age, their colour gradually fades and becomes murky. Thus, for aesthetic beauty, bamboos are dyed into vibrant colours. Dyeing is a simple process that adds colour to any cellulose material like cotton, jute, bamboo, or any other natural fibre. There are two types of dyes, one is the natural dye which is made from the flowers, leaves, barks, minerals etc. while the other is the chemical dye. Since bamboo is a natural and cellulose material and has an off white colour, it can absorb colour well and enhance the beauty of it. Preferably green or non dried bamboos in sliver form are good for better absorption of dyes.

Step 1: Boil the water in a steel tub

Step 2: Select the dyes/ colours required

Step 3: Add salt in the boiled water.

Step 4: Add dyes in the boiled water.

Step 5: Stir it well while it boils.

Step 6: Dip and place the coiled slivers in it.

Step 7: Boil the solution with slivers in it.

Step 8: Remove the slivers from dye after 15-20 min.

Step 9: Wash it properly before using it

Once good quantity of the slivers are made, it can be dyed in various colours and preserved well and can be utilised whenever needed.

6. Weaving Techniques

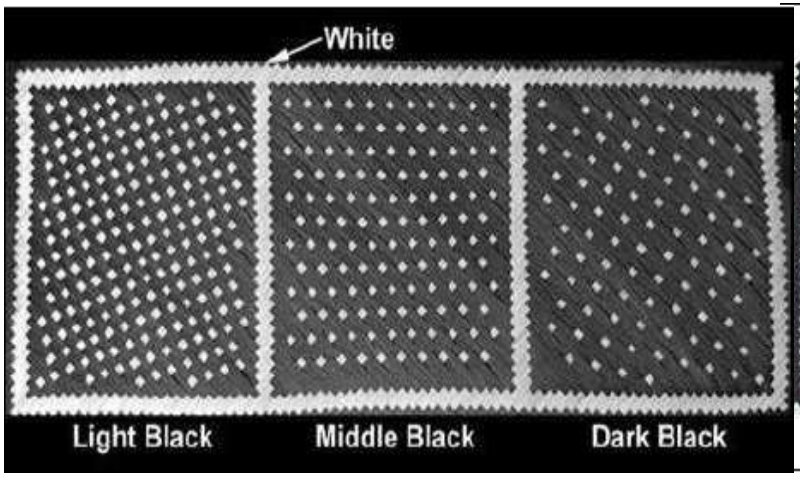
Basic Terminology: Warp and Weft

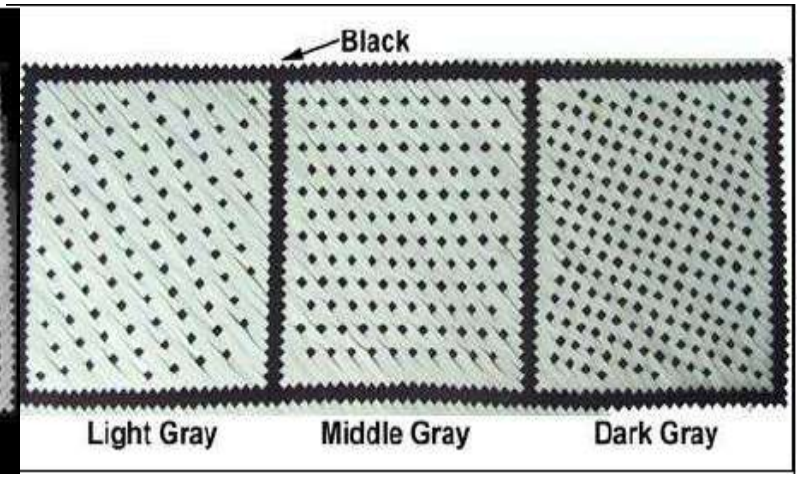
Warp and weft are two basic terms used for weaving in general.

- Warp is the set of parallel bamboo strips that provide a basis for weaving patterns. In plane bamboo weaving, the warp strips are positioned vertically on the workbench
- The weft is made up of the bamboo strips that are inserted perpendicularly under and over the warp to create a design. In plane bamboo weaving the weft strips are positioned horizontally on the workbench.

Color of Woven Bamboo Patterns

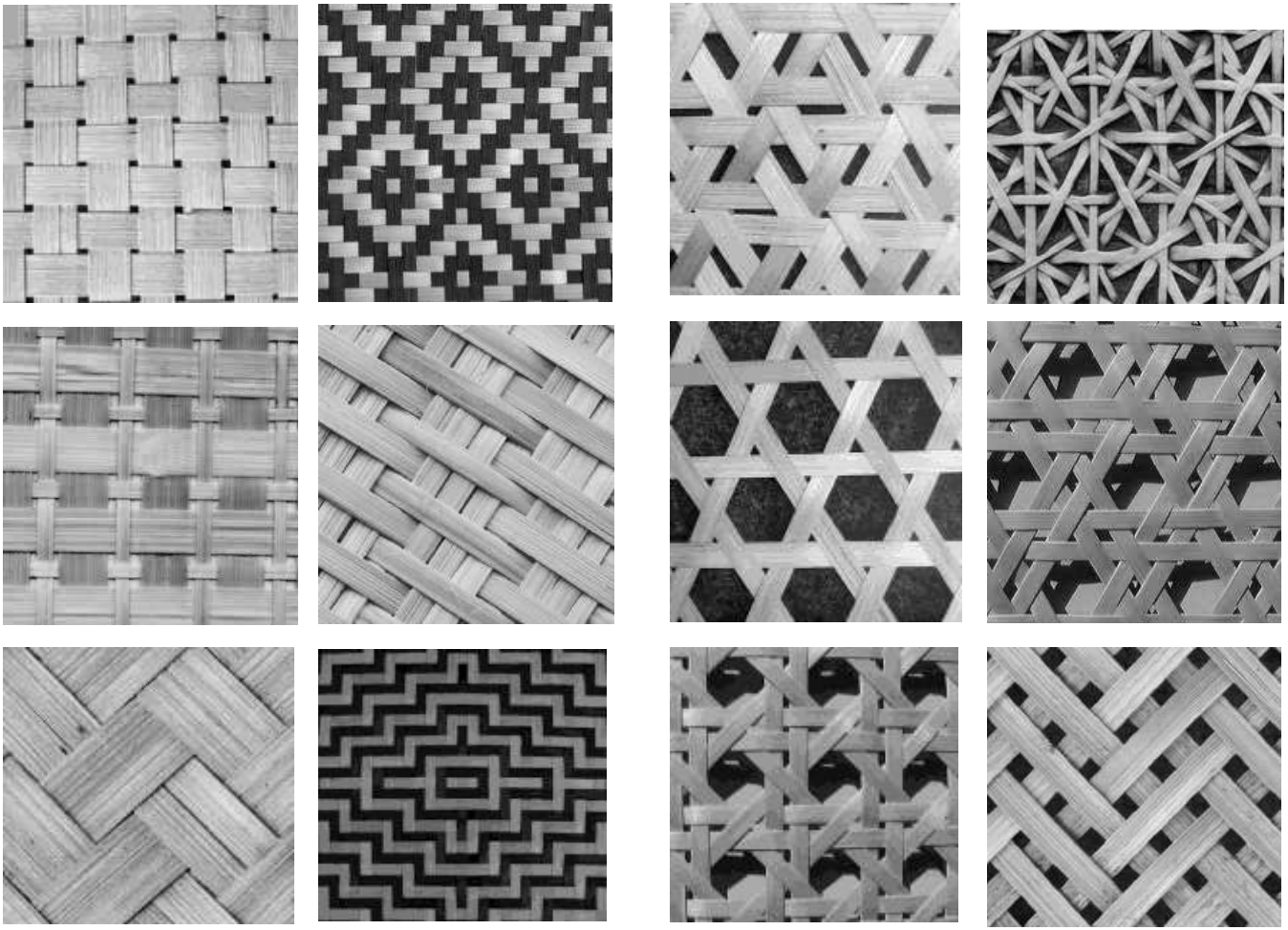
Weaving dots into patterns is the basic technique for plane bamboo weaving. This weaving technique involves combining 2 colours (light and dark) of bamboo strips along the warp and weft of the bamboo strips. There are 8 colour shades used in the dot pattern weaving: (1) Black (2)Light gray (3)Middle gray (4) Dark gray (5) White (6) Light Black (7) Middle black and (8) Dark black. These colors are illustrated in the 2 bamboo woven products below



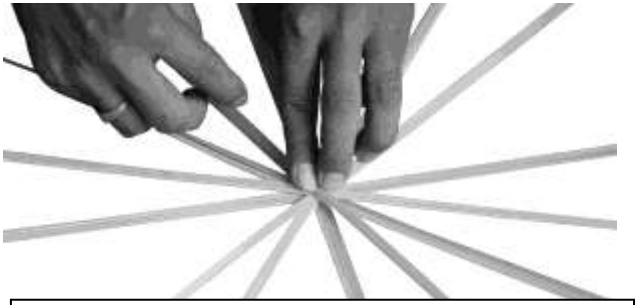


There are 5 common weaving methods, namely, vertical weaving method, multi angle weaving method, round weaving method, cross weaving method and other. Each of these 5 weaving methods have their unique weaving patterns. Also, with years of practice, craftsmen have developed their own methods and techniques of weaving too.

Various Mat Weaving Patterns



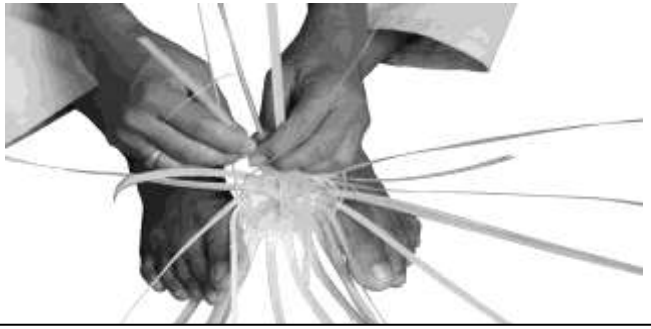
6.1 Basket Weaving



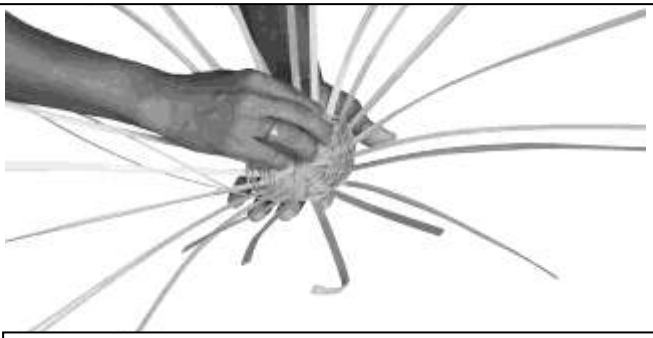
Step 1: Use broad slivers and arrange as shown

Step 2: Take two narrow slivers and weave them in an up and down pattern, passing through the broad sliver arrangement in a circular fashion

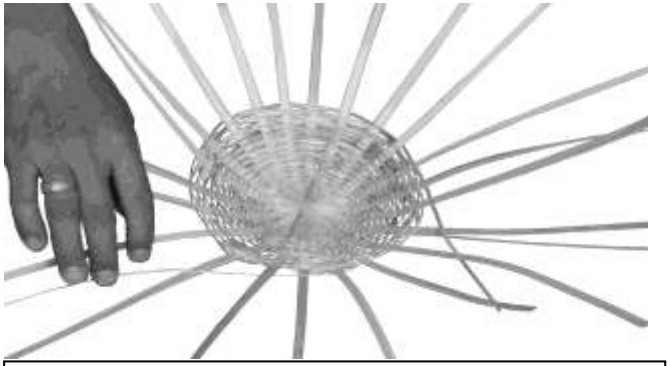
Step 3: Continue weaving up and down as shown.



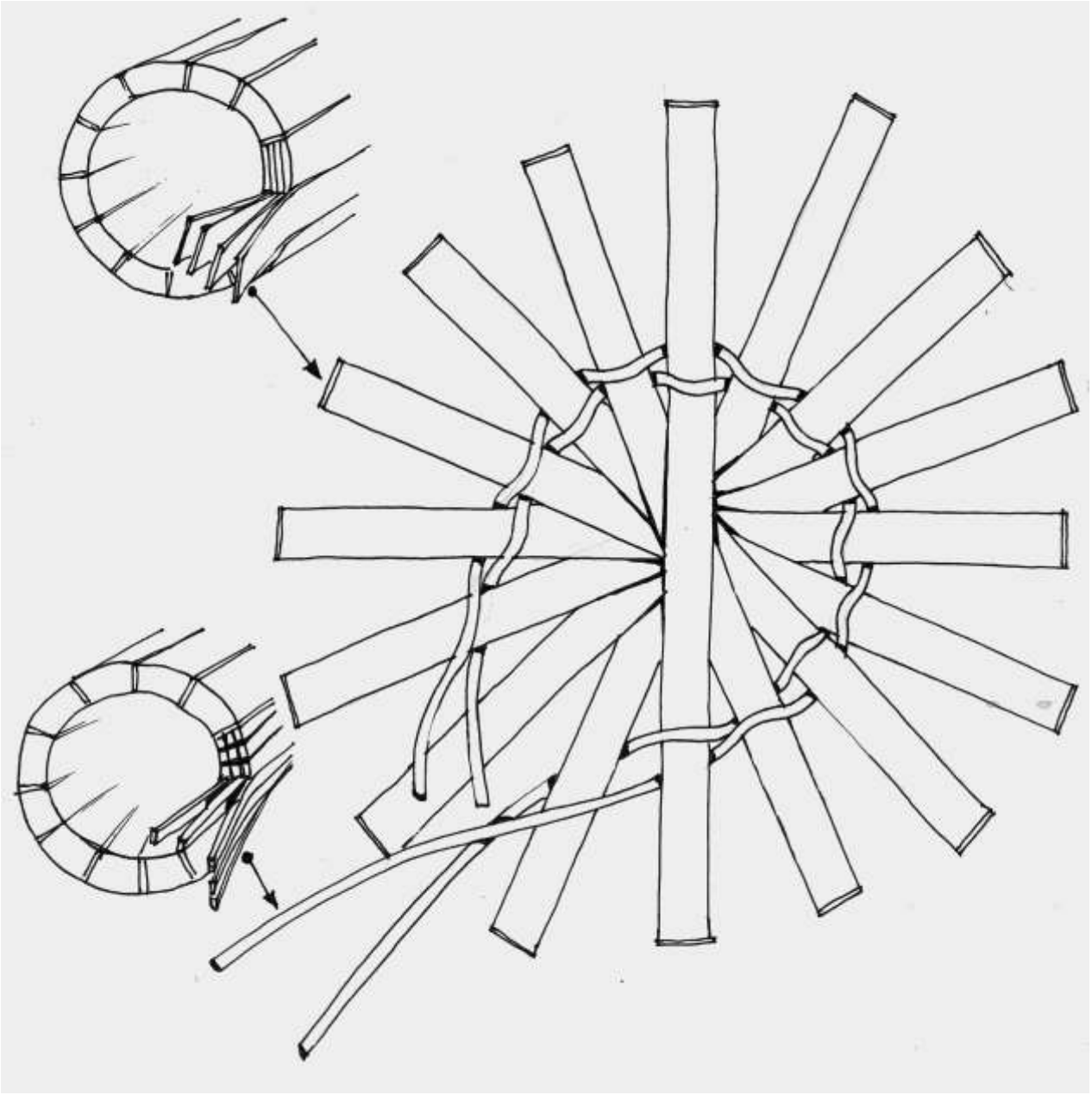
Step 4: Slowly start building a 'bowl' shape by pushing the weaved circular section below and bending the broad sliver to make it a gradual vertical curve



Step 5: The 'bowl' shape can be slowly made by pushing the weaved section below with your fingers



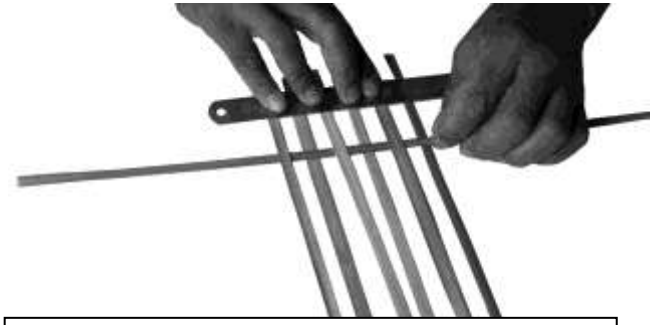
Step 6: Continue the weaving until desired height. Color sliver can be used too according to choice



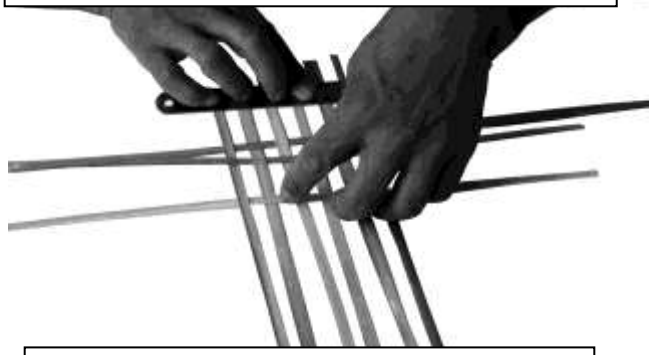
Details of basket weaving structure.

6.2 Mat Weaving1

Step 1: With the help of a scale, the slivers can be placed at equal intervals

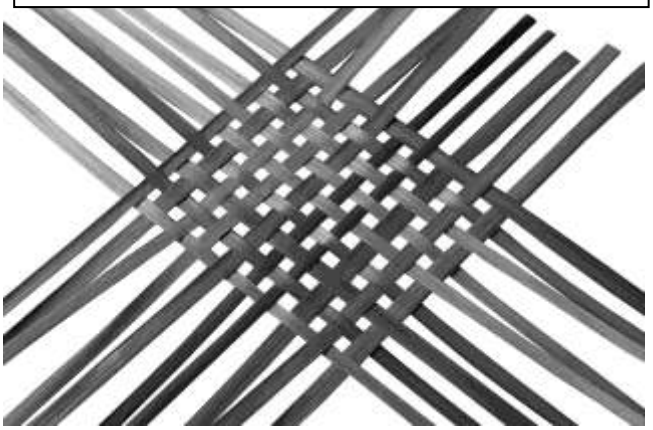


Step 2: At right angles, insert a sliver in an up and down manner



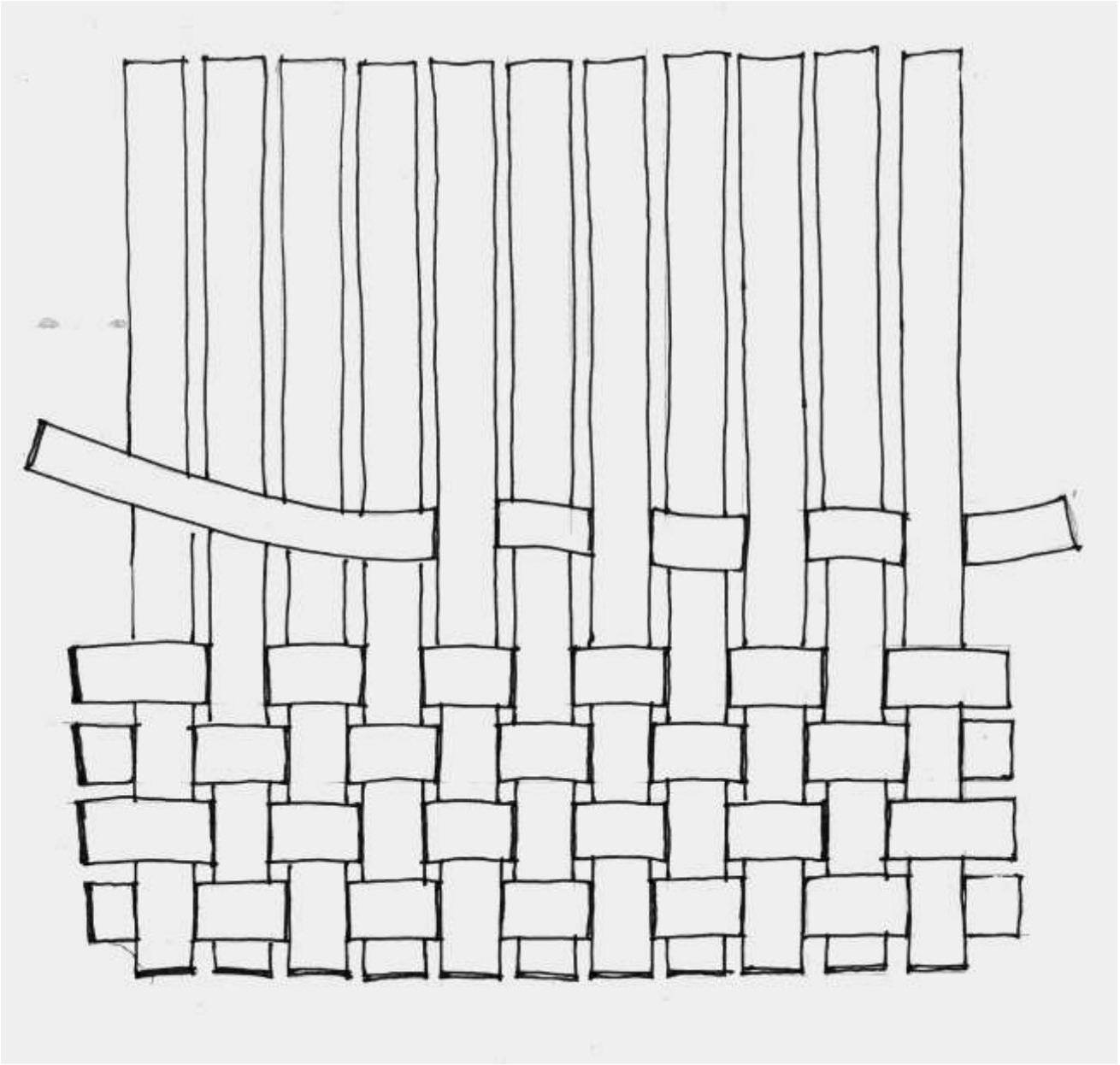
Step 3: Keep inserting more slivers at right angles in the same manner

Step 4: Both the sets of slivers are placed at equal intervals (depending on the pattern/design of the weave)



Step 5: The slivers can be added according to the desired size of the mat

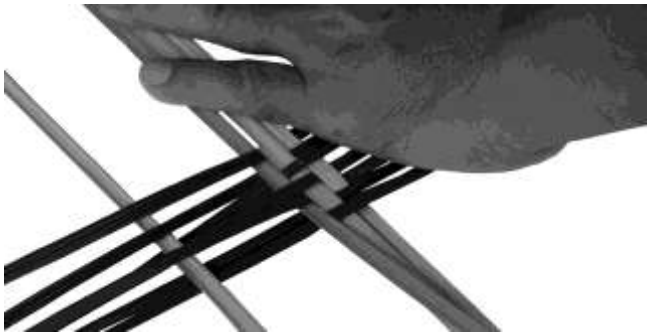
The mat can be made to any size and in any colour combinations.



Method of weaving a simple mat.

6.3 Mat Weaving2

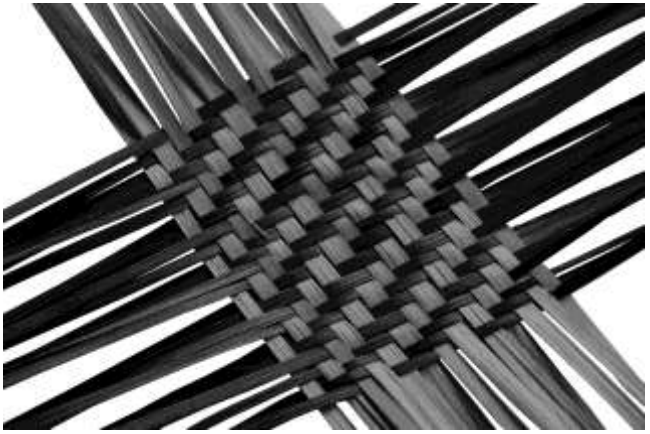
Step 1



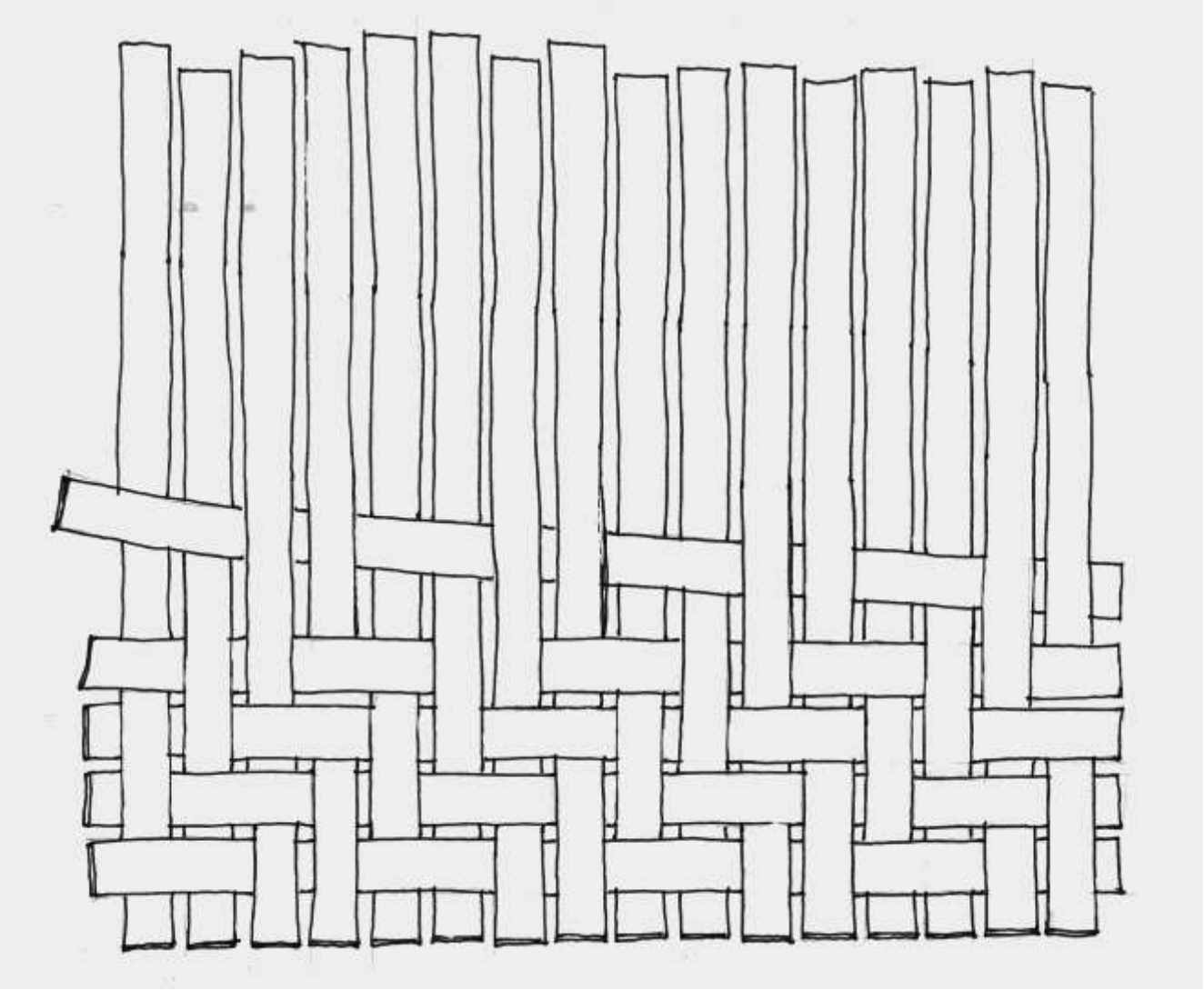
Step 2

Step 3

Step 4



Step 5

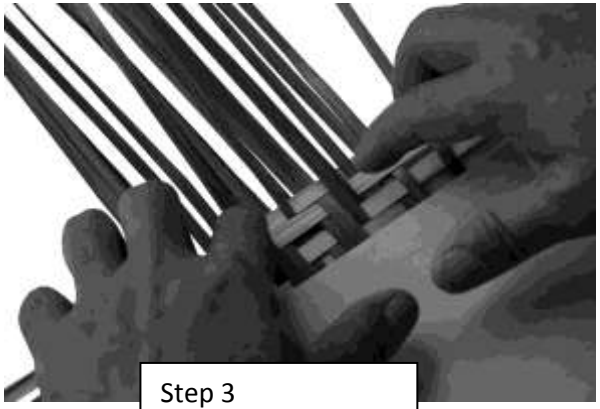


Cross weaving pattern

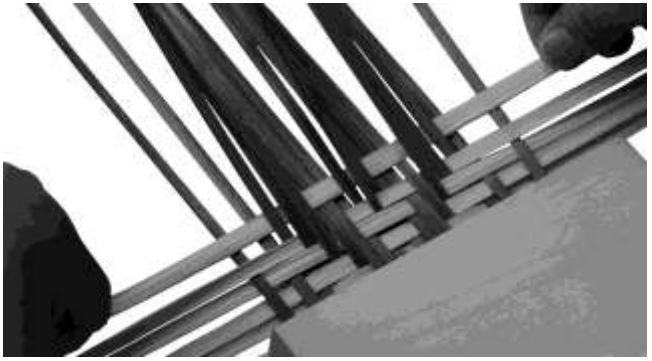
6.4 Mat Weaving3

Step 1

Step 2

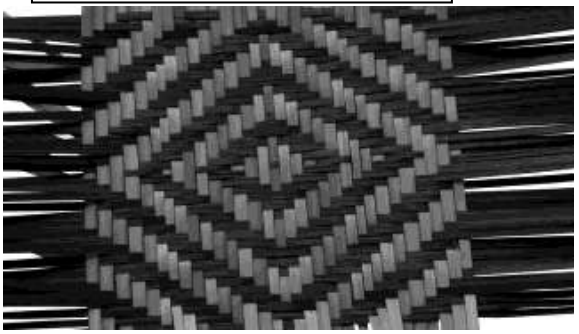


Step 3



Step 4

Step 5

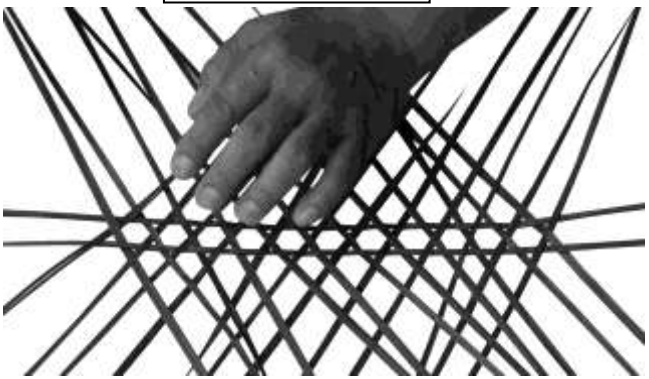


Step 6

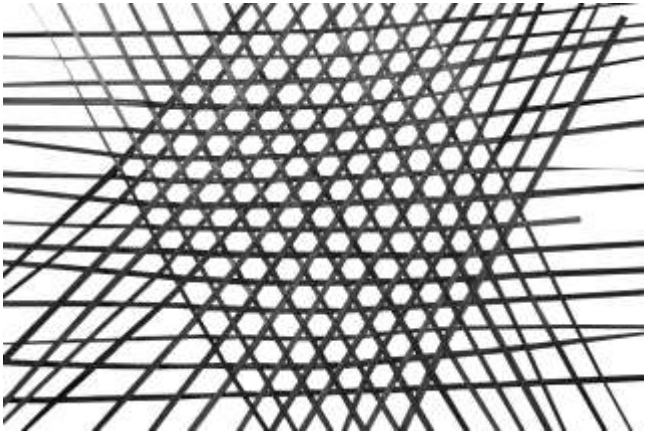
6.5 Mat Weaving4

Step 1

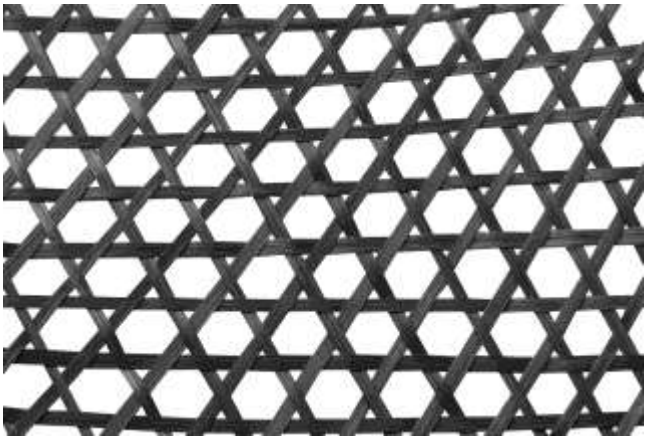
Step 2



Step 3



Step 4

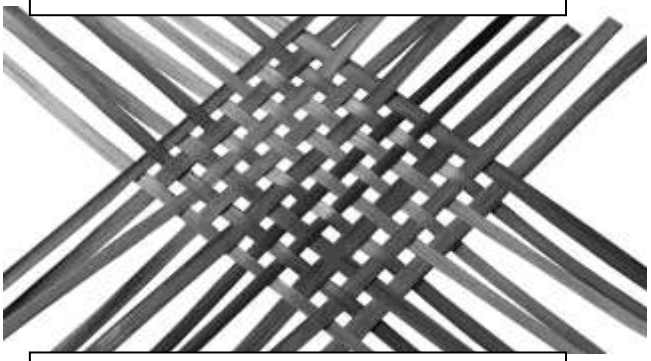


Step 5

7. Product Making

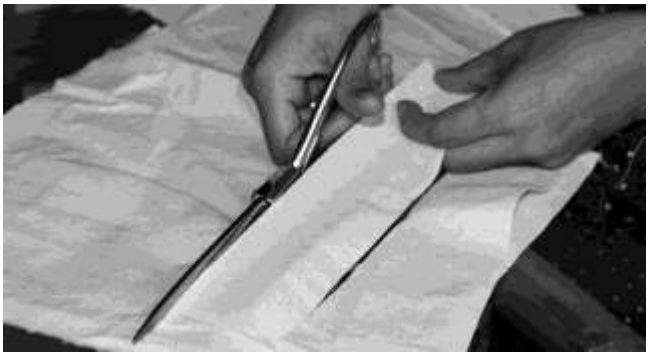
7.1 Table Mat Making

Step 1: Weave a mat in a cross-weaving pattern as shown in the previous section

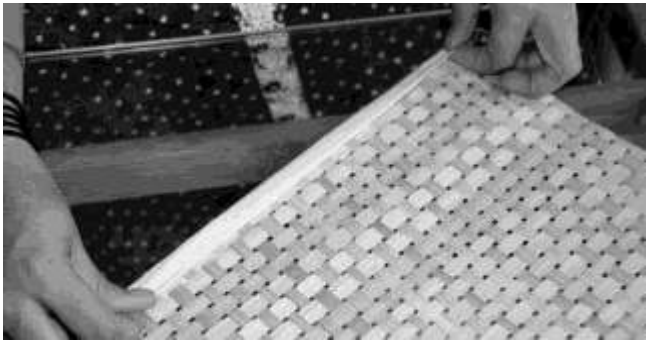


Step 2: Weave the mat till the required size

Step 3: Measure and mark the length of the mat on a fabric

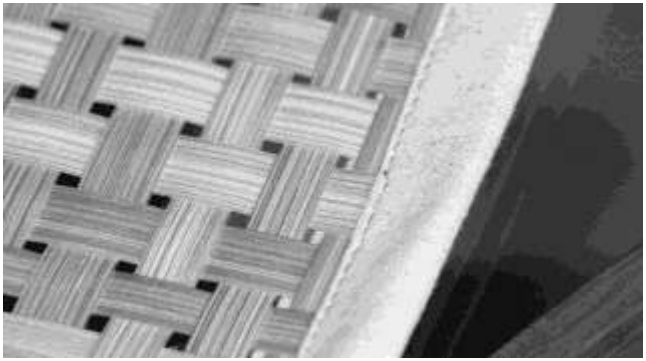


Step 4: Cut the fabric as marked



Step 5: Fold the cloth on the edge of bamboo mat

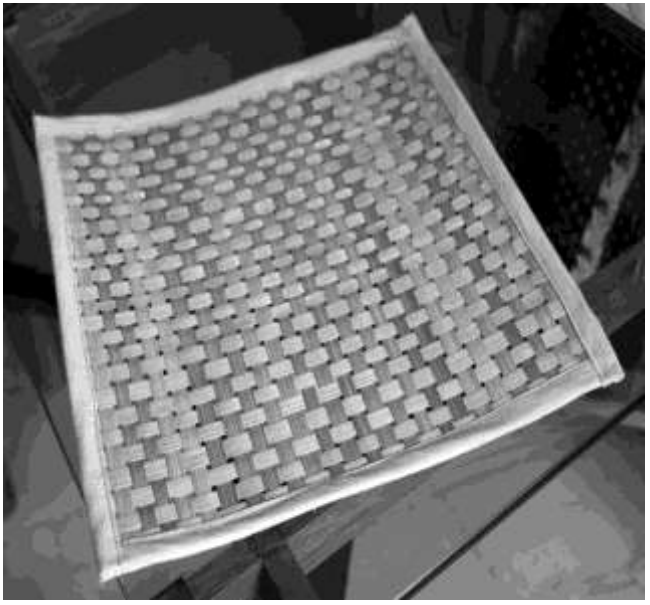
Step 6: Stitch the cloth to the edge of bamboo mat



Step 7: Stitch it as shown in the picture

Step 8: Stitch other sides of the mat similarly

Step 9: Cut the excess fabric



The final table mat.

7.2 Dust Bin Making

Dust bins are one of the most common products used in every household, offices, schools colleges, hospitals and all public places. Generally dustbins are made of plastic, steel, plywood and other materials in different sizes and forms. Plastics have been a major component in dustbins which are later disposed as garbage and pose a threat to the environment.

Bamboo is an environment-friendly and sustainable alternative for dustbins. Dustbins can have a huge market demand if the government offices replace all the plastic bins with the bamboo ones. This would generate livelihood opportunities for thousands of artisans across the country. Also, this skill can be learned very fast and doesn't require much time for skill development.

In this module an outline is given on how to make dustbins in a simple way. Here a circular shaped dustbin has been shown, however one can make it in various shapes like square, rectangle, triangle, hexagonal etc according to the requirement and the sizes.

Step 1: Make thick bamboo splits of 50 cm length from thin walled bamboos and mark 15 cm from one end.

Step 2: Heat the bamboo strips with the help of a heatgun and bend them in an angle as shown in the picture

Step 3: Measure the excess length of the splits.

Step 4: Prepare the notch at the bottom end of the split by cutting both sides with hack saw

Step 5: Notch can be further sharpened with the help of a cutter

Step 6: Round the corners of notch using the knife

Step 7: Cut a circle from 15 mm ply wood, in 20 cm dia.

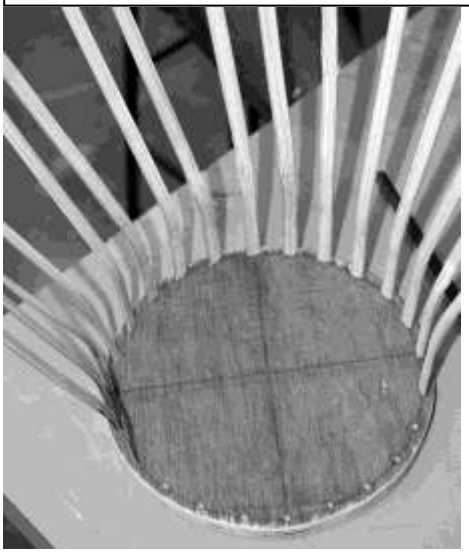
Step 8: Clean the edges using a sander or a file.

Step 9: Use sand paper to smoothen the edges.

Step 10: Divide the edges in 20 parts and mark the points.

Step 11: Drill on the marking using 3-4 mm dia. drill

Step 12: Insert the prepared splits to the drilled holes at the base

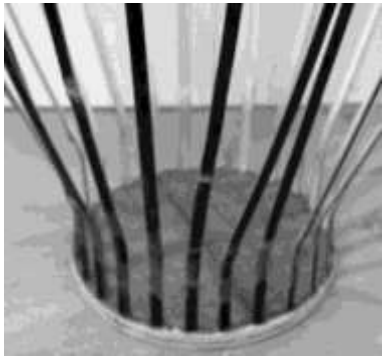


Step 13: The sticks need to be arranged properly with equal distance. The bent part needs to be aligned well (the shape of the bend can be explored in various shapes).

Any normal basket made in this shape can be used as a dustbin. In this kind of basket, plywood at the bottom is used as a base to provide it stability and prevent it from toppling over. This process is very simple, convenient and doesn't require much time.

Step 14: Fix it tightly to the base.

Step 15: Apply adhesives to the inserted splits



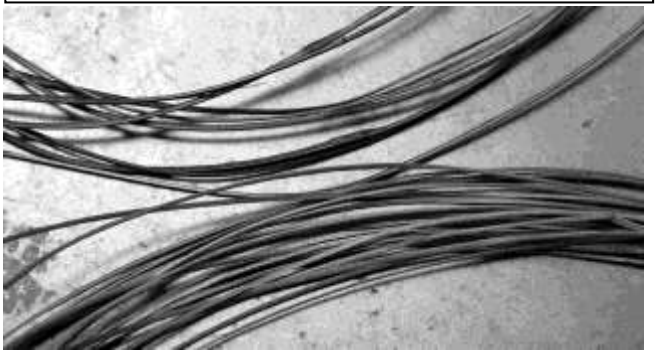
Step 16: Base is ready for weaving.

Step 17: Start weaving with thin split .

Step 18: Finish one level and start the next one.

Step 19: Continue the weaving.

Step 20: Weave up to around 10 cm.



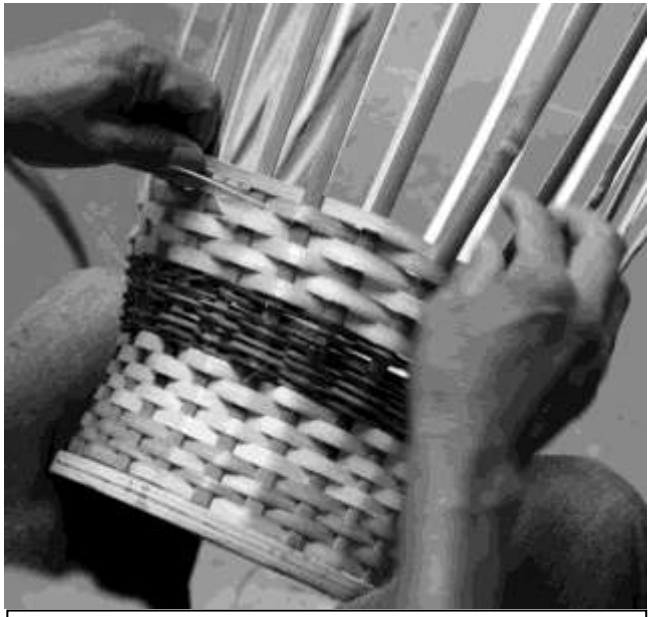
Step 21: Then use coloured thin splits

The shape and form of the dust bins can be customised according to the taste of the user. It could be a simple cylindrical shape or bucket shape or bottom can be a square and top ends up in a circle. All these shapes can be explored by individual artisans according to their imaginations.

Step 22: This has to be done with two splits one up and another down passing through the vertical sticks.

Step 23: Step 23: Continue this weaving till about 6-8 cm.

Also, various colour combinations can be explored on the dustbin.



Step 24: After that again use the flat slivers.

Step 25: Weave this till 15 cm.

Step 26: Again weave with coloured narrow slivers.

Step 27: Add another colour up to the top

Step 28: Use thick sliver, one inside and one out

Step 29: Bend it together and tie it with thin copper wire

Step 30: Use adhesive to stick the inside and outside rim.

Step 31: Cut the extra length of the sticks on the edges

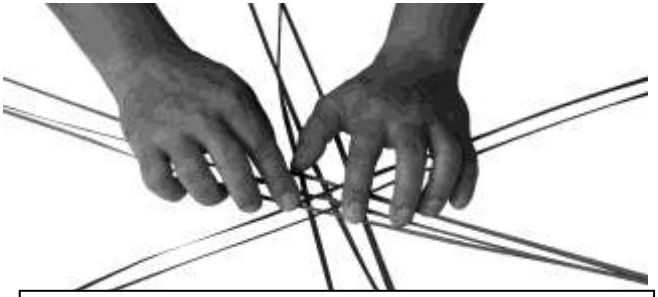
Final dustbin

7.3 Lampshade Making- I

The lamp shades made using various materials are very common in today's market. Bamboo has also been one of the prime material used for making lamp shades. Various weaves learned in the previous chapter can be used to make various types of lamp shade. The flat mat or weaving around a cylindrical or square object etc can create various shaped lamp shades.

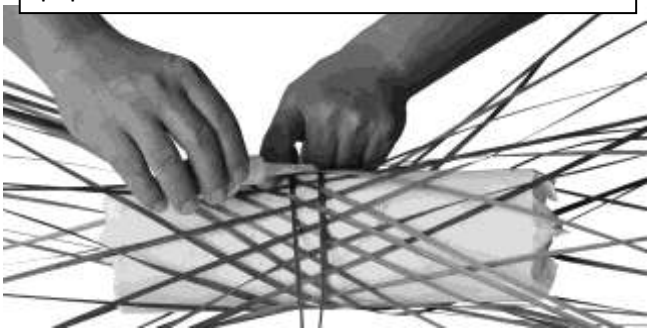
Here we are exploring the technique of hexagonal weaving on a cylinder to make a lamp shade. One needs to take a cylindrical object of any diameter according to the size of lamp shade required. Make thin slivers of around 3-4mm width and dyed in one colour and use natural shade as combination with the colour.

Step 1: Weave the slivers in such a manner that they create a hexagon in the centre

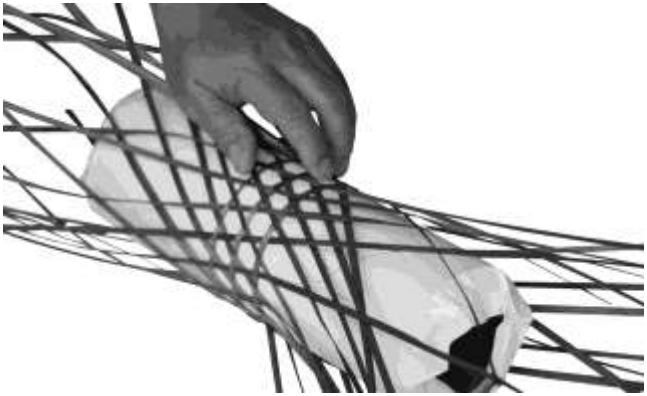


Step 2: Keep adding the slivers on all the sides of hexagon by inter locking the slivers up and down.

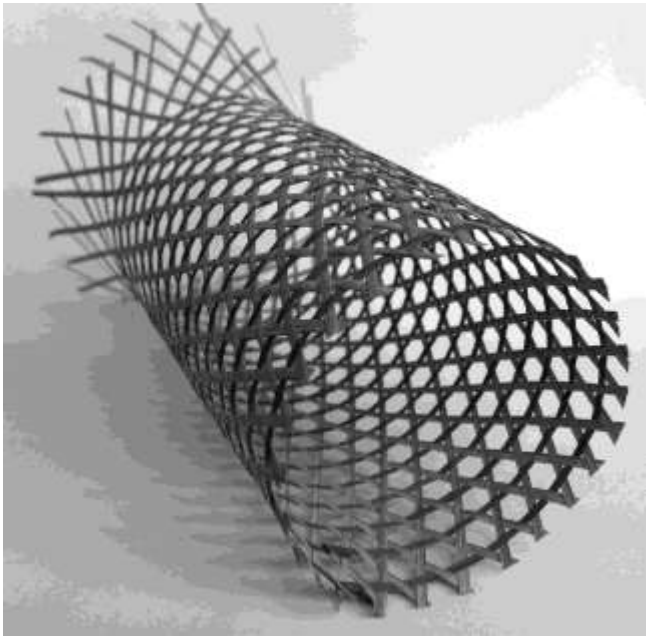
Step 3: Cover a cylinder shaped object with a paper.



Step 4: Place the mat on the cylinder and start weaving around it.



Step 5: Continue the weaving around the cylinder



Step 6: Once the weaving is complete, remove the cylinder and trim the edges of the woven cylindrical shape made of bamboo slivers. Use adhesive to stick the trimmed edges.

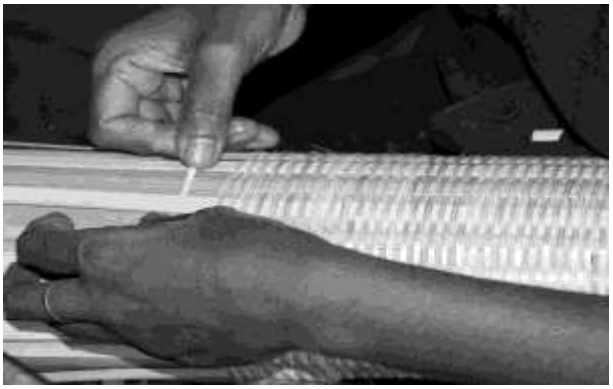
Step 7: Use thicker sliver inside and outside and bend

Step 8: Apply adhesive on both the inside and outside rims

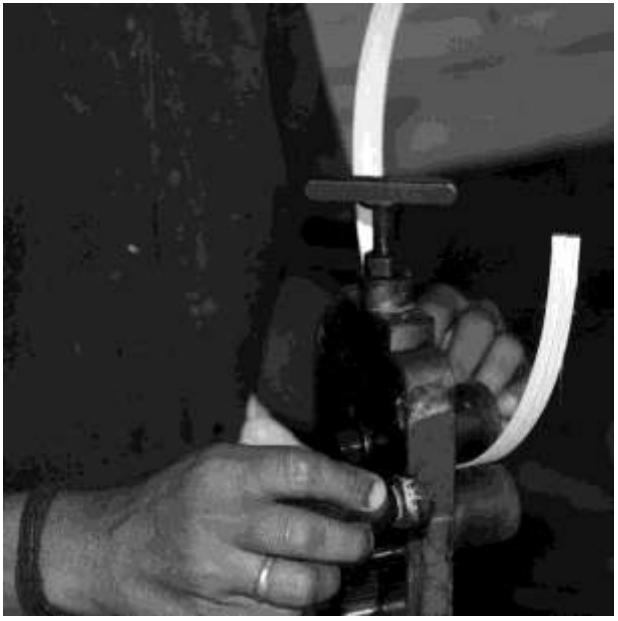
The final lamp shade

7.4 Lampshade Making- II

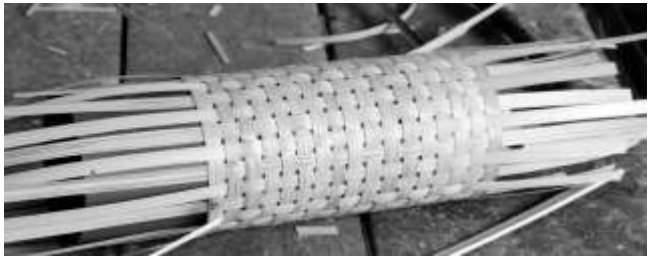
Making thin slivers for lamp shades



Lamp shade made out of thin slivers



Making broad slivers for lamp shades



Lamp shade made out of broad slivers

7.5 Woven Box Making

The box made of woven mat can be of various sizes. The weaving pattern can also be selected as per the requirement. The example shown here is of a container box being made from a simple woven mat.

After making sufficient slivers (natural finished or dyed), make a mat as shown in the picture. Then cut the mat into the size required and join it with adhesive.

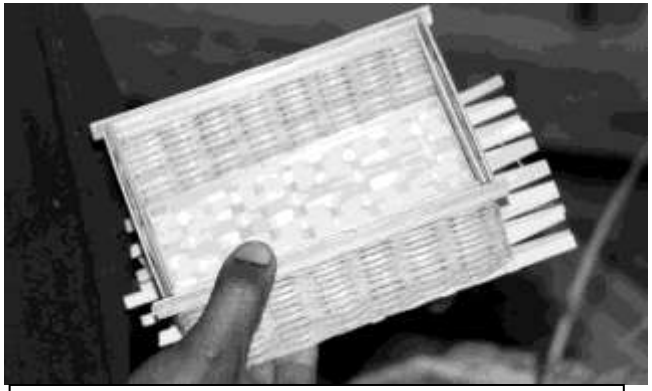
The box can be sold in sets of three or more according to the requirement of the market and various sizes and colours can be explored by individual artisans.

Step 1: The mat can be prepared by weaving the slivers

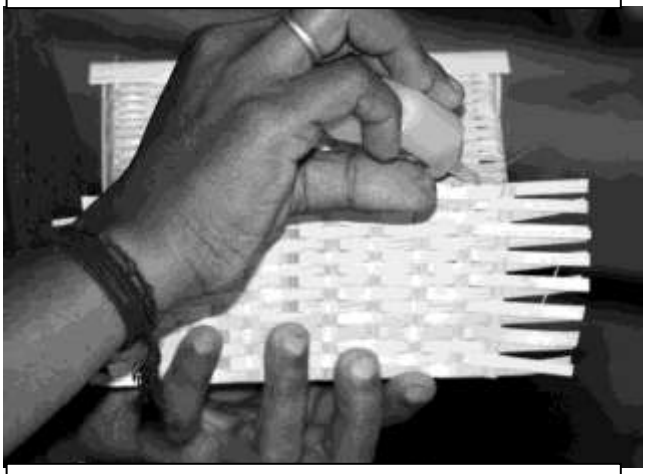
Step 2: Cut the bamboo mats according to required size

Step 3: Make the mat into a rectangular box shape and cut of the edges

Step 4: Weave a mat for the base of the box



Step 5: Cut the mat for base according to the size of the basket



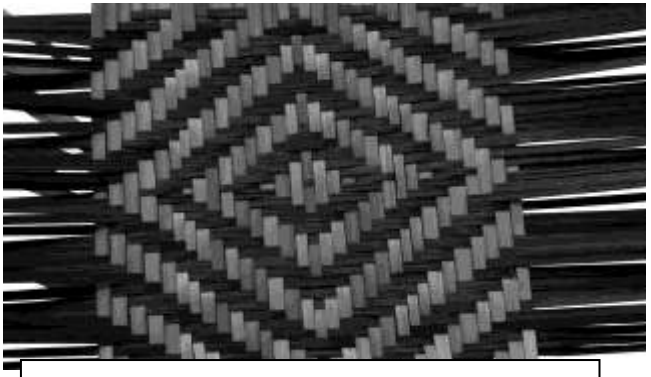
Step 6: Stick the base to the container using adhesive.

Step 7: Stick the rims of box

Step 8: Trim the edges neatly after sticking.

Step 9: Finish and clean the edges of the box by rubbing with sand paper and mellamine

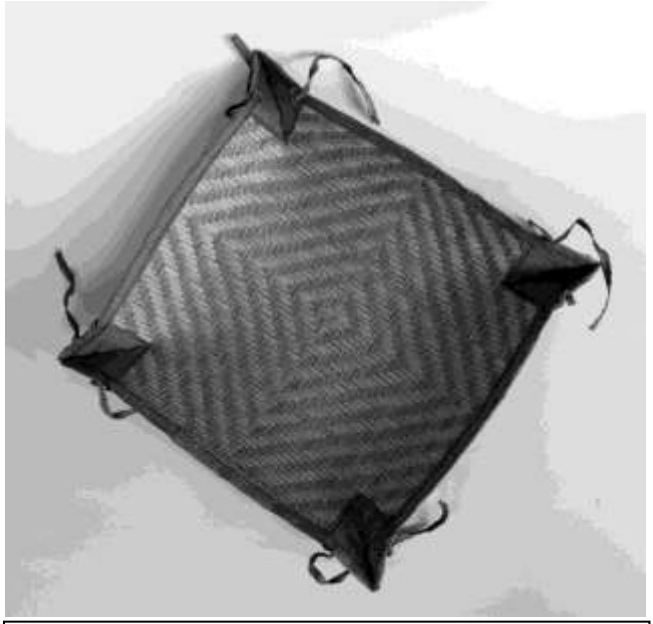
7.6 Foldable Basket



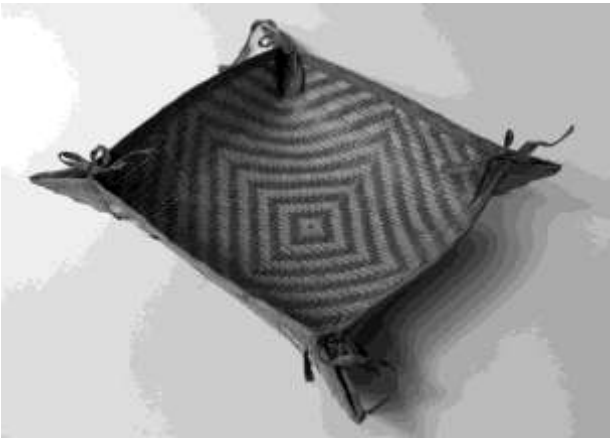
Step 1: Weave a mat as shown in the image using two colours of slivers

Step 2: Stitch the edges of the mat

Step 3: Stitch the corners of the mat



Step 4: The structure of the basket after stitching



Step 5: Tie the corners to form a basket

7.7 Other Woven Products

In the same fashion, multiple woven products can be made by weaving. Also, the products can be further modified by stitching, etc. Some examples have been mentioned below. These can be created by the methods that have been described in the previous chapters.

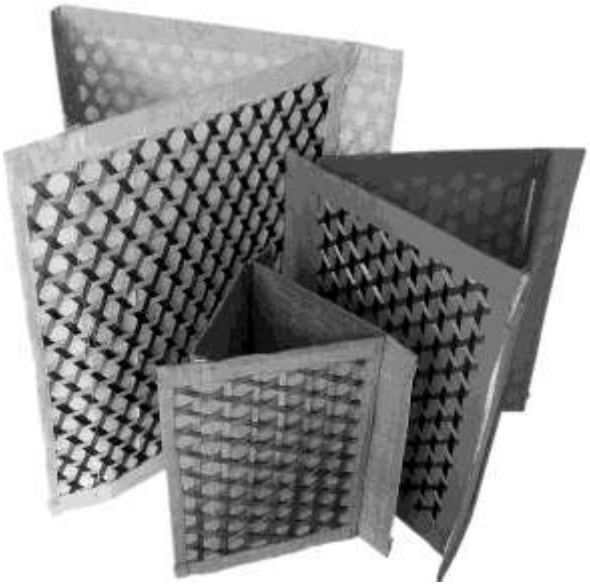
A tray with woven mat and bamboo frame around

A basket of woven mat and stitched with fabric.

Baskets of woven mat and stitched with fabric.

Gift pack of woven mat and stitched with fabric.

Fruit basket made using basket weaving technique



Lamp shades using hexagon weave and stitching.

Paper file made of weaving and stitching.

Lamp shades from woven bamboo.

Various baskets made from woven bamboo.

8. Workshop Safety

Workshop is the place where various kinds of machineries are being used and it carries the risk of potential safety hazards. The purpose of safety measure is to prevent fatal accidents and provide emergency help. Therefore, it is very important that the rules and guidelines are followed.

It is not possible for this section to cover every conceivable situation and therefore staff who have management or supervisory responsibilities must also establish and enforce safety rules to cover specific hazards in their workshops. The laws that govern occupational health and safety in a bamboo processing workplace is very important to each and every learner. The learner should be able to identify typical workplace hazards and follow procedures that will control the risks associated with those hazards to prevent injury, illness and death. The knowledge of workshop safety measures will enable the learners to respond and act appropriately in an emergency situation that may arise in a bamboo processing workplace.

The trainer should explain the warning or reporting procedures of unsafe situations in the workplace. In case of an emergency situation, the trainer or the trainee should inform the nearest hospital for treatment.

There are various safety measures followed in bamboo processing working environment. The following are some of the important safety clothing and equipment one should strictly wear while working with bamboo in the workshop. They are a) safety glass, b) mask, c) apron, d) hand gloves. and e) first aid kit.

a) Safety glass

Safety glass is glass which has safety features to protect eyes while working in the workshop. There are many types of glass available in the market like toughened glass, laminated glass and wire mesh glass for workshop safety.

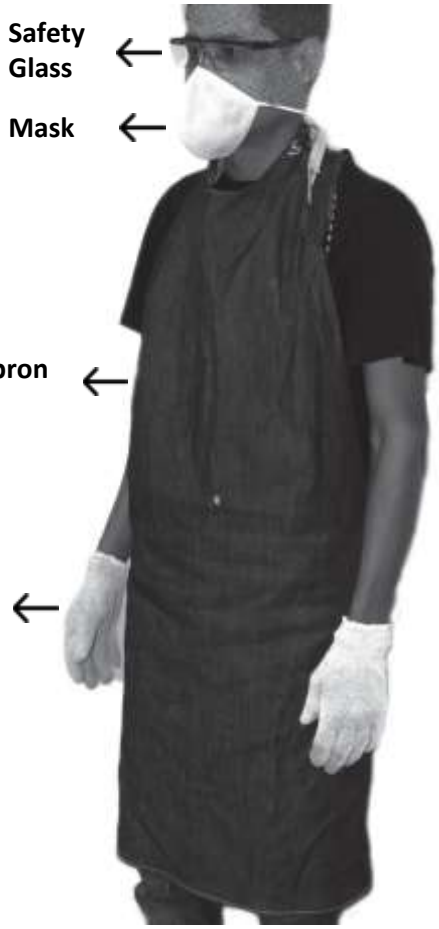
b) Mask

When working in the bamboo workshop, you can breathe in a lot of dust that can cause serious respiratory diseases. In such condition, it is advised to use dust mask to protect oneself. A dust mask is a pad held over the nose and mouth by elastic or rubber straps to

protect against dusts encountered during workshop activities.

c) Apron

An apron is an outer protective garment that covers primarily the front of the body. It is worn for various safety reasons in the workshop to protect oneself from many hazards. Aprons are available in a variety of materials and the learner should wear a thick cloth apron for bamboo activities in the workshop.



d) Hand gloves

Hand gloves are worn to protect hands from cuts and abrasions, chemicals, heat and most work environments. Hand gloves are made from leather, cotton, synthetics, nitrile, latex etc. to offer maximum protection and comfort.

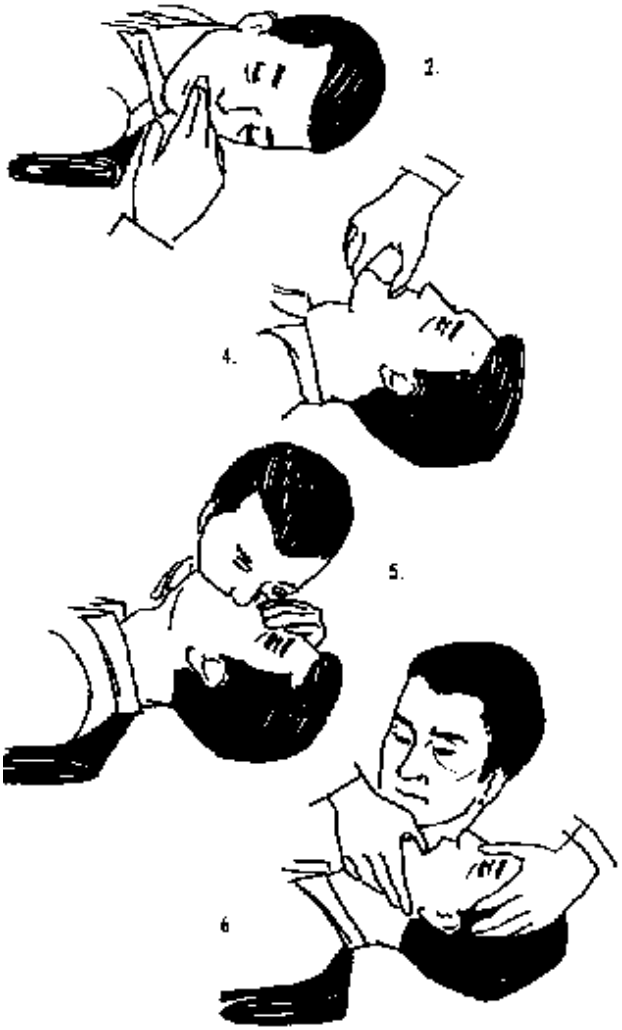
e) First aid kit

A first aid kit consists of equipment for treating minor injuries of an individual. Typical contents include adhesive bandages, crepe bandage, finger bandage, scissors, hypoallergic tape, disposable gloves, regular pain medication, gauze and disinfectant. It is important to keep all kits in a clean water proof container to keep them safe and hygienic. The contents of the kit should be checked regularly and replaced if any items are damaged or expired. Other than the above mentioned safety measure one should keep in mind the following strictly.

- No casual attitude in the workshop premise.
- Wear suitable personal clothing to the workshop conditions.
- Appropriate footwear should be worn.
- Never run in the workshop.
- Label safety equipment and maintain good condition.
- Keep all fire escape routes completely clear at all times.
- Ensure that all safety equipment remains accessible to the workshop personnel at all times.

Artificial Respiration

Artificial respiration is a procedure used to restore or maintain respiration in a person who has stopped breathing due to drowning, electric shock, choking, gas or smoke inhalation, or poisoning. This method uses mechanical or manual means to force air into and out of the lungs in a rhythmic fashion. In emergency situations, however when no professional help is available rescuers undertake the natural method mouth-to-mouth or nose-to-nose for artificial respiration.



In the first place to perform this method, any foreign material is swept out of the mouth with the hand. The patient is placed on his/her back with the head tilted backward and chin pointing upward just to avoid the tongue blocking the throat. The rescuer's mouth is then placed tightly over the victim's mouth or nose with the victim's mouth or nostrils shut. The rescuer then takes a deep breath and blows into the victim's mouth, nose or both. The breathing should be vigorous at the rate of 12 breaths per minute. Breathing exercise should be continued until natural breathing resumes or until professional help arrives.

Foundation for MSME Clusters

Foundation for MSME Clusters (FMC) is a pioneering organization specialized in promotion of Micro, Small and Medium Enterprises (MSMEs) through cluster and value chain led development. Established as a trust in June 2005, FMC has experience of working directly and indirectly with over 100,000 MSMEs in over 180 clusters in India and 15 other countries around the globe. FMC has its corporate office in Delhi and branch/representative offices in Punjab, Rajasthan, Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka and West Bengal.

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