

IDIN Skill Builder: Charcoal Press Instructor Guide

Time Needed:

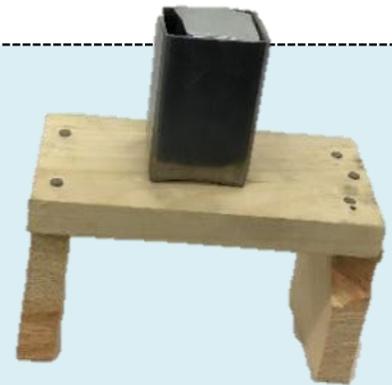
6 hours

Number of People Needed to Run the Session:

1-2 instructors per 8 participants

Space Set-Up:

This activity should be done in a room with sufficient table space. The tables should be ones which can withstand use of a mallet. If available, a workshop with vices for woodworking would be ideal.

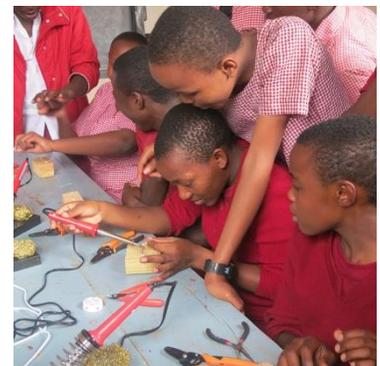


1. Introduction

PHILOSOPHY

Many people around the world go through their lives rarely using their inherent creative instincts to make a useful object with their own hands. However, a belief in one's individual ability to create technology can lead to a sense of agency and a belief that one can create positive change in the world. This idea embodies the purpose of a Skill Builder.

Those who participate in a Builder leave believing they can be creative, work with technology, and build tools to solve problems present in their own lives or in the lives of others. The experience provided is transformative; if they can successfully build this device, then by extension, they can build another. For example, creating light is a magical experience, endowing a person with the ability to replicate the power of the sun. As a person said in Zambia following a Builder, "I was a dull knife and you sharpened me."



This kind of transformation is only achieved by having participants build on their own terms, exploring the use of tools with guidance from an instructor. It is important that their devices work so they are successful and feel a sense of accomplishment; but even more important is that they felt they did it themselves and believe they could do it again.

Skill Builders are the building of a piece of technology as a means to acquiring fabrication skills, working with materials, and learning physical principles. This can range from using wire strippers and a soldering iron to create an LED light to using a hammer and chisel to shape wood into a spoon. The key to inspiring change in participants does not lie within the device created; it lies in the skills gained and the newfound sense of ability felt by participants.

For those who have never used the tools before, the initial stages of the Builder will feel awkward. Participants may "fail" at steps in the process. They should be guided out of these stumbles, not have the



stumbles solved for them. Struggling with the process and resolving issues on one's own are important in building the feeling of agency that is necessary to use these skills to address problems in the world.

Skill Builders are also a powerful experience for the instructors. When the participants have successful devices, the pride they have will be reflected in the pride instructors feel. The instructors are the first link in passing along the philosophy and skills transmitted. If the instructors are steeped in these principles, the participants will carry the philosophy and skills forward in their lives and will share with those around them.

GUIDELINES

To be an effective instructor and create a valuable experience for the participants, keep the following ideas in mind while delivering the Skill Builder.

- Allow participants to work through the steps at their own pace. It is important that everyone gets to practice using each of the tools. Since this is the first time most people have used them, it will take longer than you might expect. The length or number of sessions should account for this. If you find you still go over, arrange for more time.
- Encourage participants to form pairs and help each other through the activity. Ensure there is not a dominant person in each pair who does all of the tooling and machining.
- If a participant is having trouble, encourage those around him or her to provide help so the participants can learn from each other. When a participant has solved a problem, have them demonstrate the solution to the group so they can take credit.
- If a participant makes a mistake, help them to diagnose the problem and fix it. This should be done by encouraging them to share their thoughts on the problem and the solution, before offering your own diagnosis and solution. Avoid correcting the mistake for the participant except in extreme situations.
- It is important to practice showing, instead of telling. A visual demonstration goes much farther than an oral description of the task. During the Skill Builder, be vigilant to ensure there is more showing than speaking.
- Encourage participants to use spare materials to practice the skills before using the tools to make the final product.
- Observe and advise the participants on their technique in using the tools so they have the opportunity to improve.
- Complement the participants as they successfully complete steps in the construction process, emphasizing that they are responsible for accomplishing the task.
- Promote a sense of camaraderie in the group. Ways to do this can include a group picture, having each person sign each other's device, or taking time for each person to demonstrate their functional device. Place emphasis on each participant's success in creating a working device to increase their confidence.
- Keep the guiding principles described in the philosophy section in mind as you deliver the curriculum.

PREPARATION

To set the Skill Builder up for success, do the following ahead of time:

- Make the device yourself to discover what steps participants might find difficult and to ensure all tooling and machinery is functional.
- Set aside one set of Skill Builder parts for yourself and subassemblies to show key steps. As you lead the participants through the Skill Builder, you can demonstrate steps using your own set of parts.
- Set up at least one completed device that participants can reference as they complete the activity.
- Prepare extra material that the participants can use to practice skills.
- Print one 'Participant Skill Builder Photo Guide' per participant.
- Print one 'Skill Builder Module User Evaluation Sheet' per participant.
- Prepare supplies and tools at the work stations.
- Ensure a first aid kit is available.

- Ensure there are enough safety glasses for you and all participants to each have a pair throughout the activity. Ensure other personal protective equipment is available where necessary.

SAFETY

Below is a list of safety concerns relevant to this Skill Builder.

Chisel:

- A good chisel is sharp. As such, when using the tool, it is important to always point it away from one's body.
- It is important to be conscientious of where one's hands are placed. If one is removing large chunks of wood at a time, the chisel can jump significantly and one's hand might get jammed against the wood.

Wood saw and hacksaw:

- When cutting wood or metal, the saw can jump around or slide on the material until enough of a groove is made. It is important to keep body parts out of the direction of the blade to ensure the blade doesn't hit one's hand.
- For both the wood saw and hacksaw, a sharper blade is safer than a dull one. Using force to do the work as oppose to relying on the tool creates a higher risk situation.

Hammer:

- When placing a nail, it is best to hold the hammer close to the head and to keep fingers well out of the way of the hammer.
- Be conscious of where others are and be careful when swinging the hammer to not hit others or oneself.

2. Overview

LEARNING OBJECTIVES

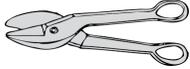
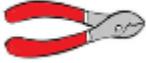
- Participants will learn how to properly measure materials for cutting.
- Participants will learn how to properly cut metal.
- Participants will learn how to bend and shape metal.
- Participants will learn how to properly cut wood.
- Participants will learn how to shape wood with a chisel.
- Participants will learn how to properly use a hammer to nail wood together.
- Participants will have made a charcoal press.

LESSON PLAN

1. Review what a charcoal press is and the tools needed to make one by hand. *10 min*
2. Complete pre-questions in the 'Skill Builder User Evaluation Sheet'. *5 min*.
3. Making the plunger. *2 hrs, 30 min*
4. Cutting parts for the table. *2 hr*
5. Assembling the table and charcoal press. *30 min*
6. Reflection and feedback. *25 min*
7. Complete the post-questions in the 'Skill Builder User Evaluation Sheet'. *15 min*

3. Materials

TOOLS

| | Item | Quantity Per 4 Participants |
|---|--|-----------------------------|
|  | Wood saw | 2-4 |
|  | Hacksaw | 2-4 |
|  | Chisel (3/4", 1.9cm) | 4 |
|  | Chisel (1", 2.54cm) | 4 |
|  | Hammer | 4 |
|  | Metal shears | 2-4 |
|  | File | 4 |
|  | Pliers | 4 |
|  | Square | 4 |
|  | Scissors | 4 |
|  | Pencil | 8 |
|  | Marker | 8 |
|  | Mallet (if available) | 4 |
|  | Hardwood block (alternative to mallet) | 4 |
|  | Vice | 4 |
|  | C-clamp (alternative to vice) | 4-8 |
|  | Sand paper | Small piece |

SUPPLIES

| | Item | Amount | Cost |
|---|---|--------|--------------|
|  | Wood plank (12" x 4" x 1", 30cm x 10cm x 2.5cm) | 1 | \$1-2 |
|  | Square metal tube (4" x 2" x 2" with 0.065" wall, 10cm x 5cm x 5cm with 1.5mm wall) | 1 | \$1-2 |
|  | Square metal tube (4" x 1/2" x 1/2" with 0.065" wall, 10cm x 1.3cm x 1.3cm with 1.6mm wall) | 1 | \$1-2 |
|  | Nails | 4 | minimal |
| | Total Cost | | \$3-6 |

4. Teaching Notes

INTRODUCTION TO THE SESSION

Charcoal dust is in plenty of places where charcoal is made and sold. The dust, when mixed with a cassava porridge, can be formed into charcoal briquettes. The charcoal dust is no longer wasted, but recovered and used as fuel.

Some people currently make charcoal briquettes by hand, but these briquettes have weak structural integrity, minimizing the burn time. This charcoal press makes very strong briquettes from the charcoal dust mixture. After the briquettes are dried in the sun, they are ready for use as an effective cooking fuel.



MAKING THE PLUNGER

| Skills | Tools | Supplies |
|----------------------------------|--|---|
| sawing hammering tin snips | A collection of tools including a screwdriver, a blue vise, red-handled pliers, a hacksaw, a square, a hammer, and a black marker. | A 2"x2" metal tube, a 1/2"x1/2" metal tube, and a flat metal plate. |

1. Measure a 3.5" (9cm) long section of the 4" x 2" x 2" (10cm x 5cm x 5cm) metal tubing. Mark with a line on one side of the metal tubing to indicate where to cut the metal with the hacksaw in a later step. Use the square to make sure the line is straight.



2. Mark the same line along all sides of the metal tubing. Also, mark a 1/2" (1.3cm) long line starting at the top of the tube and going down along every corner.

Teaching note: Explain that the straight lines will help the participants cut a straight line with the hacksaw.



3. Place the metal in the vice. Use the hacksaw to cut along the line drawn such that a 3.5" (9cm) piece of metal tubing is produced.

Teaching note: Explain that proper hacksaw technique includes cutting at a 45 degree angle with force on the forward stroke only.



TEACHING NOTE: DEMONSTRATE PROPER USAGE OF A HACKSAW

Mark the entire cut line. While using a hacksaw, the blade can drift and the cut surface may end up crooked. In order to watch whether the saw is travelling straight, it is important to have a line along which to measure. Therefore, draw a line across the entire piece you are cutting. As you use the saw, watch that you are following the line and make slight adjustments as needed.



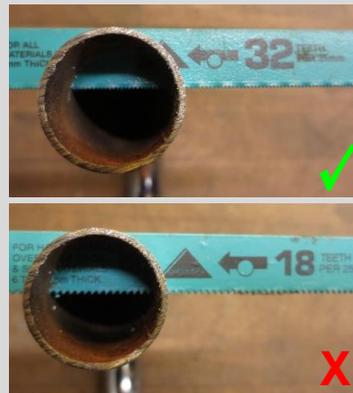
Position yourself appropriately. Stand with feet apart, one foot in front of the other (if you hold the saw in your right hand, the left foot should be in front of the right foot. The opposite is true if you hold the saw in your left hand). Keep shoulder, arm, and blade in line with each other.



Use a thumb to stabilize the blade while initiating the cut. The most difficult part of using a hacksaw is initiating the cut. The smooth surface of the metal causes the blade to jump around. Place a thumb along the line where the cut is intended. Hold the blade against the thumb so that it travels in a steady, straight line. Make slow cuts so that the blade does not jump, using the thumb to continue steadying the blade. Once the cut is deep enough, the blade will not jump and you can hold the saw with both hands.



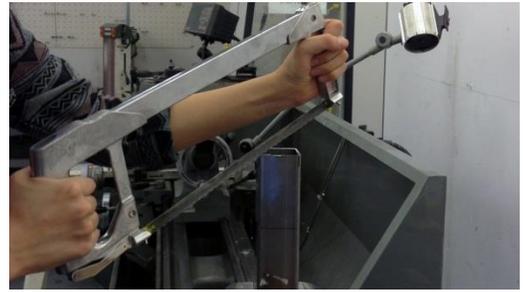
Let the saw do the work. Choosing a saw with the appropriate number of teeth per inch is important to using a hacksaw efficiently. More teeth per inch should be used on thinner material while fewer teeth per inch should be used on thicker material. For cutting pipe, more teeth per inch will make for a smoother cut and the blade will catch less.



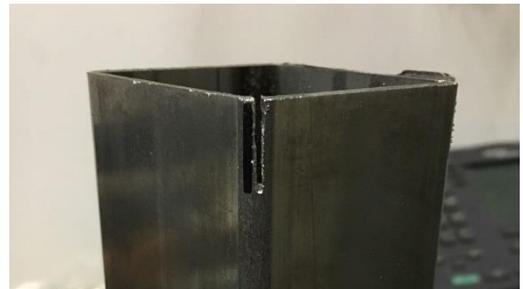
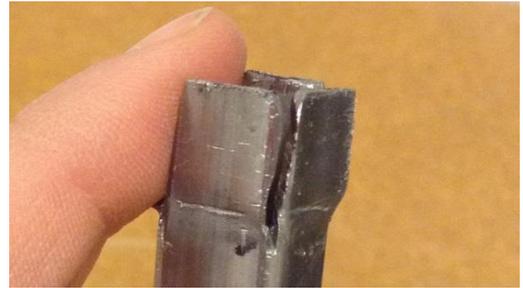
Once you've made the groove, start sawing back and forth. Cut at a 45 degree angle. Ensure that the saw remains vertical, that the shoulder, arm and blade are all in line, and that force is on the forward stroke only. Let the saw do the work. Putting too much force onto the saw will make the arm tired but the material will not cut more quickly. Hacksaw blades only cut in a single direction, and should be oriented in the saw with the teeth pointing forward. Make the forward strokes with strength, but draw the blade back without using force.



4. Use the hacksaw to cut downward along the $\frac{1}{2}$ " (1.3cm) lines drawn at the corners to form the tabs.



5. Repeat steps 1, 2, and 3 to create a 3" (7.6cm) long section of the 4" x $\frac{1}{2}$ " x $\frac{1}{2}$ " (10cm x 1.3cm x 1.3cm) metal tubing. You will now have one 3.5" (9cm) piece of the larger metal tubing and one 3" (7.6cm) piece of the smaller metal tubing, each with $\frac{1}{2}$ " (1.3cm) tall tabs on each side.



6. Place the metal piece in a table vice vertically. The larger 4" x 2" x 2" (10cm x 1.3cm x 1.3cm) square metal tubing will have its tabs *bent inwards*, while the 4" x $\frac{1}{2}$ " x $\frac{1}{2}$ " (10cm x 1.3cm x 1.3cm) metal tubing will have its tabs *bent outwards*.

Take pliers and grip the metal at the base of the fold to begin the bend. Take the hammer and strike the tab to reinforce the bend. Repeat with each ta

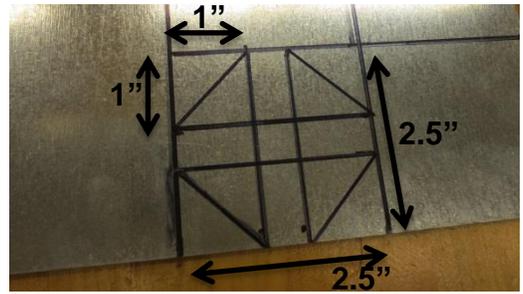
Teaching note: Explain that it's only necessary to hammer the tabs until flat. Too much force can bend the tabs too far in one direction.



7. File the corners as they can become sharp from being bent over.

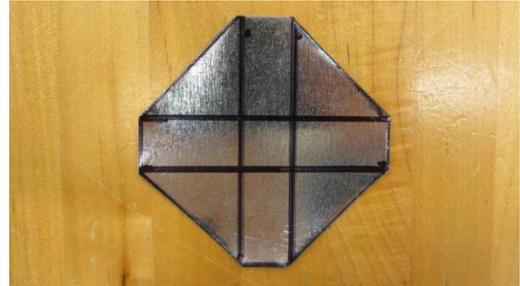


8. Mark a 2.5" x 2.5" (6.4cm x 6.4cm) square onto a piece of sheet metal. Mark 1" (2.5cm) from each corner and draw lines connecting these marks. Use the ruler to make sure the lines are straight.



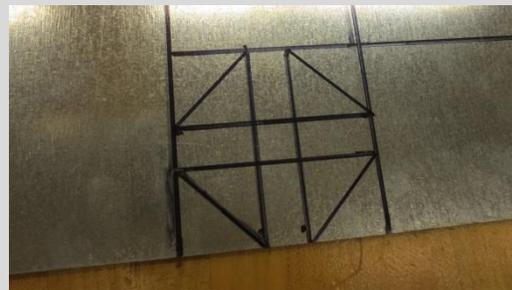
9. Take tin snips or metal shears and cut along the outer lines to create a diamond shape.

Teaching note: Use the correct directional shears—ones that do not orient right or left. Explain that the metal should be inserted as far as possible into the mouth when cutting.



TEACHING NOTE: DEMONSTRATE PROPER USAGE OF TIN SNIPS

Mark the cut. Before cutting any material from the sheet metal, it is important to sketch guidelines for the desired cut onto the metal.



Use the correct directional snips. For the straight edges, use the straight snips (in yellow). If there are any curves, those are easiest cut with either left curved or right curved tin snips the correct directional snips that orient in the way that the arc curves.



Place the metal into the mouth of the snips. Make sure that the sheet metal is inserted as far as possible into the mouth when cutting.



10. Align the ejector (the smaller piece of square pipe) with the sheet metal piece such that each tab points toward each corner of the diamond. Use the pliers to bend the flaps over the tabs.



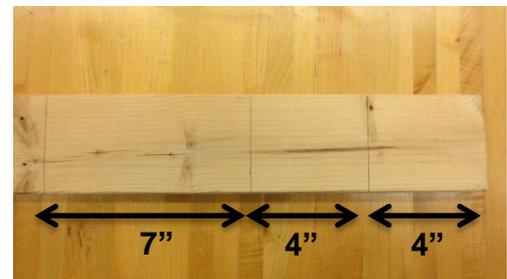
LEARNING OBJECTIVES ACCOMPLISHED:

- Participants will learn how to properly measure materials for cutting.
- Participants will learn how to properly cut metal.
- Participants will learn how to bend and shape metal.

CUTTING PARTS FOR THE TABLE

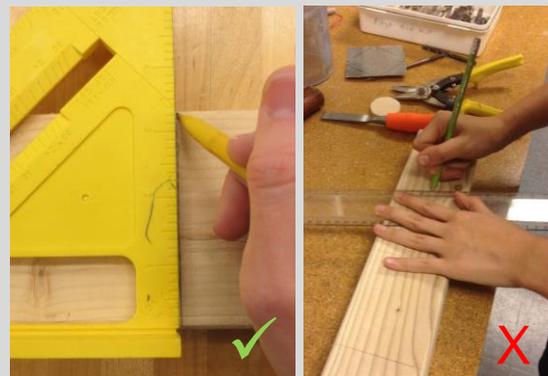
| Skills | Tools | Supplies |
|-----------|-------------|----------|
| sawing | Hand saw | Wood |
| chiseling | Pencil | |
| sketching | Mallet | |
| | Chisel | |
| | Putty knife | |
| | Square | |
| | Vise | |
| | Sandpaper | |

11. Using a pencil, measure two 4" (10cm) sections of wood and one 7" (17.8cm) section.



TEACHING NOTE: DEMONSTRATE PROPER MARKING OF WOOD

Mark straight lines. To start, measure where the cut line should be on the wood. To ensure a straight cut, the wood should have a line down it for the saw to follow. Further, use a square to make sure the line is perpendicular to the long edge of the wood and not diagonal.

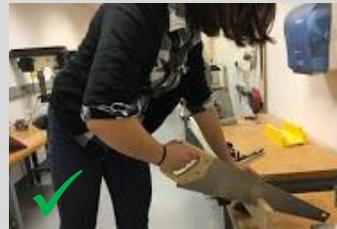


12. Place the wood in the vice. Use the wood saw to cut along the drawn lines. You will end up with two 4" (10cm) pieces of wood and one 7" (17.8cm) piece of wood.



TEACHING NOTE: DEMONSTRATE PROPER USAGE OF A WOOD SAW

Proper blade position. It is important to be comfortable and able to move your arm back and forth easily, holding the saw straight up and down. You should saw directly in front of your shoulder. Sawing to the side of your shoulder can cause the saw to twist and result in a crooked cut.



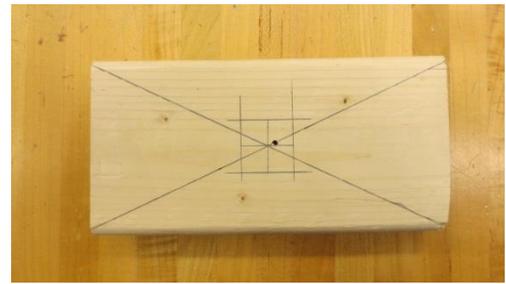
Starting the cut. Place the saw on the cut line. Pull the saw back along the top edge of the wood until a groove is formed. This will help guide the blade as you start sawing.



Sawing. Hold the saw at a 45 degree angle from the horizontal as you cut. Start moving the saw back and forth. Not much pressure is needed, it is better to let the saw do most of the work. As you get near the end of the cut, slow down the pace of the saw to avoid splitting the wood.



13. Mark a 1" x 1" (2.5cm x 2.5cm) square in the center of the long piece of wood with a pencil. It is useful to mark an "X" on the wood by connecting the corners in order to find the center (where the lines intersect).

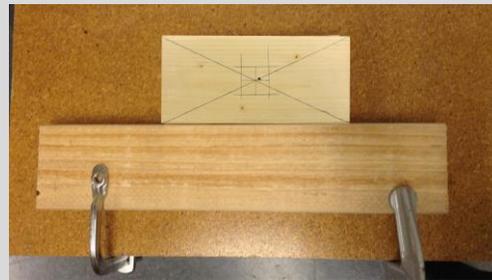


14. Use chisels to remove the material inside the square. This hole will be for the stem of the ejector to go through when the press is assembled. Use sand paper to smooth the edges if needed.



TEACHING NOTE: DEMONSTRATE PROPER USAGE OF A CHISEL

Set up the workstation. Clamp a piece of scrap wood to a table. This block will be a surface for the wood being chiseled to press against so it does not slide around. The wood being chiseled can be rotated as needed in order to keep it stable against the clamped down piece.



Define the edges. Start by using a larger chisel (1" or 2.5cm in this case) to define the edges of the hole. Hold the chisel vertically on the edge of the hole and hit with the mallet or wood block. Do not make the cut too deep or you will risk splitting the wood. The first cuts just need to define the edges of the hole.



Remove material. Use a smaller chisel (3/4" or 1.8cm in this case) to remove wood inside the hole. Hold the chisel at an angle with the beveled side down. To make cuts in the material, hit the angled chisel with the mallet or wood block. Chisel towards the center of the hole. Remove small pieces of wood at a time to avoid splitting the wood, and cut in all directions.



Using both chisels. As you remove more material with the smaller chisel, the hole will become deeper. As this happens, it is important to redefine the edges of the hole. Make vertical cuts with the large chisel as needed to mark the edges of the hole. Near the end of the hole, it is important to remove even smaller pieces of the wood as it is more likely to split the closer the bottom of the hole is to the bottom of the wood.

LEARNING OBJECTIVES ACCOMPLISHED:

- ❑ Participants will learn how to properly measure materials for cutting
- ❑ Participants will learn how to properly cut wood
- ❑ Participants will learn how to shape wood with a chisel.

ASSEMBLING THE TABLE

| Skills | Tools | Supplies |
|-----------|---|---|
| hammering |  |  |

15. Once all the wood is cut and the hole is chiseled into the long piece, the pieces must be nailed together to make a table. Place one nail in each corner so that there is enough room on either side to avoid splitting the wood.



TEACHING NOTE: DEMONSTRATE PROPER HAMMERING TECHNIQUE

Marking the wood. Nails should be placed so that they are inset from the corners to prevent splitting the wood.



Placing the nail. Begin by nailing into the first piece, before placing the two pieces together and nailing into the second piece. To ensure the nail is in the correct position, hold it at an angle, resting the point on the drawn mark. Then, straighten the nail, creating a small indent on the mark.



Hammering. Hold the nail firmly to keep it straight with driving it into the wood. It will tend to lean at an angle if not held in place, which leads to the wood potentially splitting or the sharp point of the nail poking out of the finished product. Start by holding the hammer close to the head for control. Once the nail is firmly in the board, hold the hammer further away from the head for power. Drive the nail in until its head is flush with the board's surface.



16. Assemble the final press by sliding the ejector piece into the cup so the tubing sticks out the bottom and the sheet metal square is resting on the bottom of the cup. The cup then is placed on top of the wooden table with the ejector going through the hole in the wood.



LEARNING OBJECTIVES ACCOMPLISHED:

- Participants will learn how to properly nail wood together.
- Participants will have made a charcoal press.

REFLECTION AND FEEDBACK GROUP DISCUSSION QUESTIONS

- Besides another charcoal press, what would you make with the new skills you've acquired?
- How long did you think it would take you to make the charcoal press when you first started?
- What was the most interesting thing you learned while making the charcoal press?
- Which skill that you learned are you most excited about?
- Which skill that you learned would you like to have spent more time practicing?

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