IDIN Skill Builder: Living Machine Instructor Guide

Time Needed:

6 hours; or 2 x 3 hour sessions.

Number of People Needed to Run the Session:

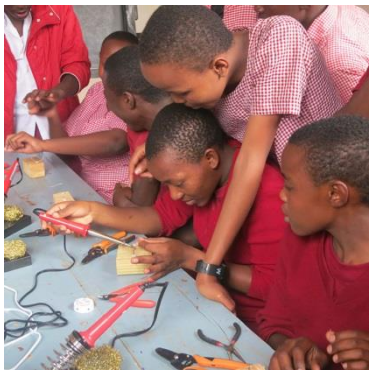
1-2 instructors per 8 participants.

Space Set-Up:

Working outside, with access to an electrical outlet, is recommended for this activity.

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

Published 20 June 2016, Version 1.0

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.

PVC pipe cutter and box cutter:

- Keep fingers clear of the blade to avoid accidental cuts.
- Always cut away from the body.
- Use a sharp blade. Dull blades require more force to cut material, which can lead to increased slipping of the blade.

Hot sand:

- Always wear heat protective gloves when working with hot sand.
- Never leave a burner on while unattended. This could start a fire.
- Wear long sleeves, long pants, and close-toed shoes to avoid serious burns if sand gets spilt.

Hammer:

- Always be aware of your surroundings to avoid injuring others.
- Keep fingers clear of the hammer when striking an object.
- Wear safety glasses. Small particles of wood can break free when hammering and get in your eye.

Wood saw or band saw:

- When cutting wood, the saw can jump around or slide on the wood 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.
- 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.
- If using a band saw, ensure safety glasses are worn, and fingers are kept a safe distance from the blade to minimize accidental cuts.

2. Overview

LEARNING OBJECTIVES

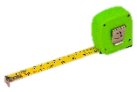
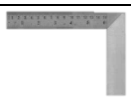
- ☐ Participants will learn ecology principles and the role of different cells in the living machine.
- ☐ Participants will learn how to find the organic materials necessary for a living machine in their local environment.
- ☐ Participants will learn how to saw wood.
- ☐ Participants will learn how to properly nail wood together.
- ☐ Participants will learn about the utility of jigs and fixtures.
- ☐ Participants will learn how to properly cut PVC pipe and plastic.
- ☐ Participants will learn how to properly bend PVC pipe.
- ☐ Participants will learn how to manipulate wire mesh.
- ☐ Participants will learn the mechanics of siphons.
- ☐ Participants will have made a functional living machine.
- ☐ Participants will learn how to maintain and care for their living machine.

LESSON PLAN

1. Review the skills to be taught and the technology to be built, including supplies and tools needed. *30 mins*
2. Explore the local environment to collect organic materials. *1 hr, 30 min*
3. Complete pre-questions in the 'Skill Builder Module User Evaluation Sheet'. *5 min*
4. Prepare the water jugs. *1 hr*
5. Create the siphon jig. *1 hr*
6. Make the siphons. *1 hr*
7. Make the plant baskets. *45 min*
8. Assemble the living machine. *45 min*
9. Complete the post-questions in the 'Skill Builder Module User Evaluation Sheet'. *15 min*

3. Materials

TOOLS

	Item	Quantity Per 8 Participants
	Pot	1
	Box cutter	2-4
	Hammer	1
	Wood saw (or band saw)	1
	C-clamp (if using wood saw)	1
	Hot plate (or stove burner)	1
	PVC pipe cutter	1-2
	Funnel	1-2
	Scoop	2
	Slip-joint pliers with cutter	4
	Heat protective gloves	2 pairs
	Bucket	2
	Tape measure	2
	Marker	8
	Pencil	1
	Square	1

Published 20 June 2016, Version 1.0

SUPPLIES

	Item	Amount (per living machine)	Cost
	PVC pipe (1/2”, or 1.3 cm diameter)	8 ft (2.4 m)	$4.00
	Sand	15 L	$1.50
	20L plastic water jug (empty)	4	Free
	Small aquarium pump (for 40 gallon, or 151 L tank)	1	$20.00
	Bubbling stone	1	$0.50
	Tygon tubing	2’ (60 cm)	$0.60
	One way valve	1	$1.50
	Scrap wood	1’ x 2’ (30cm x 60cm)	minimal
	PVC pipe caps	2	$0.20
	Water garden or wetland root plants	As much as desired	free
	Fish/snails	No more than what can live comfortably in the 20L bottle	$5.00
	Nutrients/dirt	5L	free
	Pebbles	1 bag (15L)	$4.00
	Water (filtered and environmental)	Enough to fill all jugs	free
	Nails	10	minimal
	22 gauge wire	4’ (60 cm)	$0.10
	16 gauge wire	8’ roll	$1.50
	Fine wire mesh	1 ft^2 (30 cm^2)	$0.50
	Wire mesh hardware cloth	8 ft^2 (2.4 m^2)	$8.00
		Total Cost	**$46.50**

Published 20 June 2016, Version 1.0

4. Teaching Notes

INTRODUCTION TO THE SESSION

Living machines are a great way to teach about the complexity and interdependence of ecosystems. Participants can see the changes in their miniature wetland over time. Living machines can increase awareness of the delicate balance of large ecosystems and why they must be treated with respect. A healthy living machine can even act as a biofilter for small amounts of waste.

COLLECTING ORGANIC MATERIAL

Skills

ecological principles

collecting plants and animals

collecting organic matter

Tools

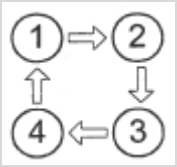
Supplies

1. Take some buckets and go exploring to gather the plants, animals, rocks, mud/muck and water that will be put in the living machine. Look for local marshes, ponds, or rivers where wetland root plants and animals are available. If this is not possible, organic materials can be bought at an aquarium store.

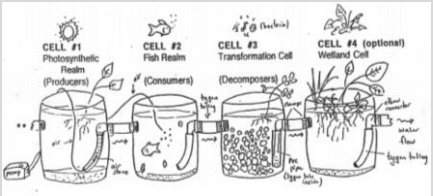
   Teaching note: It is very important to avoid the risk of introducing a harmful new species into the surrounding native environment. To avoid this risk, use organisms from the native environment or organisms that cannot survive outside of the living system. For example, if building a machine in a cold environment, purchasing warm water organisms ensures that these organisms will not be able to survive if accidentally released.

TEACHING NOTE: *ECOLOGICAL PRINCIPLES OF A LIVING MACHINE*

Number of cells. A successful living machine must have a minimum of three cells. Choosing the number of cells will depend on time and the resources available; each cell requires one water jug and one siphon.

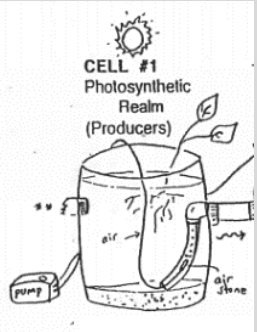


Diverse cells. Three types of cells must be present in a living machine: a **producer**, a **consumer**, and a **biofilter**. These cells work together to maintain a healthy ecosystem, and without all of them, the system is less likely to survive.

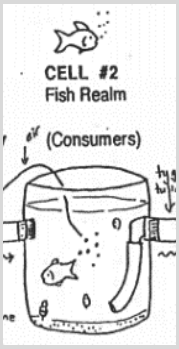


Published 20 June 2016, Version 1.0

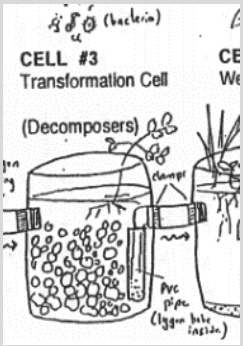
Producer cell: Producer cells contain organisms that produce food for the system and convert carbon dioxide (CO_2) to oxygen (O_2). The organisms are **aerobic**, meaning they require oxygen to survive. This cell will contain water and muck from the wetlands, and aquatic plants. Because the cell will mostly contain aquatic plants, this cell requires lots of sunlight and oxygen to be healthy. Make sure the cell is designed in order to allow water to flow over the roots.



Consumer cell: Consumer cells consume what the producer cell makes. They are also **aerobic**. This cell will contain water and muck from the wetlands, algae and plankton, vertebrates (ie, golfish), and invertebrates (ie, snails). Few plants are needed in this cell.



Biofilter cell: Biofilters are where the waste from the consumer cell is broken down by bacteria. These cells are **anaerobic**, meaning they do not require oxygen to survive. In fact, bacteria live deep down in the soil where there is almost no oxygen. These cells contain muck and slime from the wetlands, soil, and rocks. The rocks should be in a layer on top of the soil so that water can percolate down into the soil and slime. There may also be a few more aquatic plants in this cell.



TEACHING NOTE: *COLLECTING ORGANIC MATERIALS*

Mineral diversity: Mineral diversity in the living machine is important. Be sure to have sedimentary, metamorphic, and igneous rock in the system. Pebbles can be purchased at an aquarium store as well.

Mud and slime: The muck at the bottom of ponds and marshes is where bacteria breed. Makes sure that you gather samples of these, both from surface muck and deeper down mud.

Published 20 June 2016, Version 1.0

Nutrients: Although minerals and nutrients naturally occur in the mud sample taken from wetlands, it is advisable to supplement the living machine with fine mineral powders at first to make sure it is strong and will be healthy. Nitrogen, carbon, and phosphorous powders can be purchased at an aquarium store.

TEACHING NOTE: *COLLECTING PLANTS AND ANIMALS*

Gathering Producers: A healthy living machine has both producers and consumers. Producers include algae, phytoplankton, and zooplankton. These can be gathered by taking water samples and skimming the top of the water for algae.

Gathering root plants: A small but diverse sample of root plants is necessary and easy to obtain from wetlands. Be sure to include the soil and root system of the plant because this will allow it to more easily adapt to a new environment. If necessary, plants can also be obtained from an aquarium store.

Gathering animals: There should be phylogenic diversity among the animals in the living machine. This means that there should be vertebrates (such as fish), invertebrates (snails), and bacteria. It might be advisable to buy some fresh water fish and snails from an aquarium store as animals are harder to gather than plants.

LEARNING OBJECTIVES ACCOMPLISHED:

- ☐ Participants will learn ecology principles and the role of different cells in the living machine.
- ☐ Participants will learn how to find the organic materials necessary for a living machine in their local environment.

Published 20 June 2016, Version 1.0

PREPARING THE JUGS

Skills	Tools	Supplies
cutting plastic		

2. Empty the jugs if they have water in them. Using a box cutter to cut the tops off of the water jugs. Cut along the uppermost ridge in the water jug.

   Teaching note: It is easiest to cut the plastic jug by employing a rocking motion rather than a sawing motion.

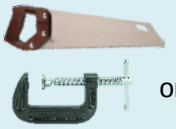
   The thick plastic of the jugs is difficult to cut through, which means there is a high risk of injuring oneself if not very cautious. Be patient while cutting the jugs to avoid the blade slipping.

3. Clean off any plastic particles that have accumulated.

LEARNING OBJECTIVES ACCOMPLISHED:

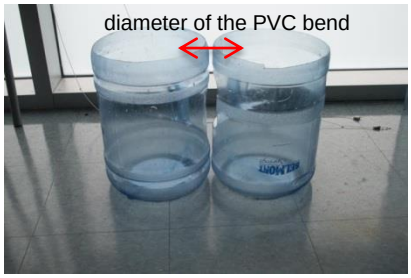
- ☐ Participants will learn how to properly cut PVC pipe and plastic.

CREATING THE SIPHON JIG *(based on instructor's discretion, the methods for creating a proper jig can be treated as a skill)*

Skills	Tools	Supplies
hammering sawing utility of a jig	  or 	

4. Determine the inner diameter of the bend in the PVC pipe and the thickness of the pipe.

   Teaching note: Explain that the purpose of a jig is to be able to consistently reproduce a part with the same critical dimensions maintained. Therefore, in this case, it is most important to accurately measure the key dimensions of the siphon to be made.

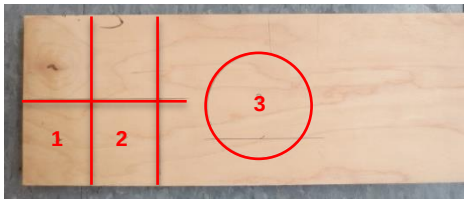


5. Sketch the layout for the jig on the scrap wood. Use a square and pencil and make adjustments to the sketch as needed. With the jugs and PVC pipe used here, the inner diameter of the desired bend is 3" (7.6cm) and the outer diameter of the pipe is 7/8" (2.2cm).

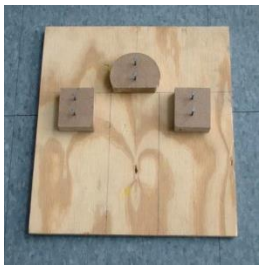
   Teaching note: Explain that using a square is important to ensure that all lines are either parallel or perpendicular.

Published 20 June 2016, Version 1.0

6. Sketch and cut out the parts needed to be affixed to the jig. If available, it is easiest to cut the pieces out on a band saw. Should that be difficult, a c-clamp to hold the wood and a wood saw can be used.



7. Nail these pieces as previously sketched out. Make sure that the nails are easy to remove, in case the jig needs to be modified. Create a test siphon to determine whether the jig works well. Make whatever adjustments are necessary.



LEARNING OBJECTIVES ACCOMPLISHED:

- ☐ Participants will learn how to saw wood.
- ☐ Participants will learn how to properly nail wood together.
- ☐ Participants will learn about the utility of jigs and fixtures.

MAKING THE SIPHON

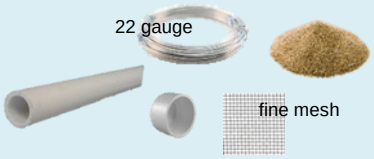
Skills

cutting PVC

bending PVC

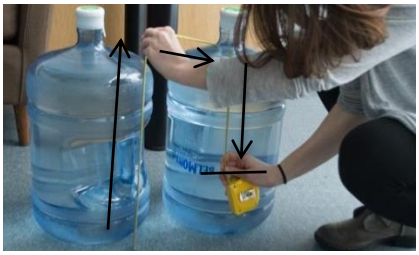
Tools

Supplies



8. Measure the length of PVC needed. This will depend on the size of the water jugs and the distance between them. The siphon must be long enough to reach the bottom of one bucket and halfway down the second bucket after it is bent. Mark the desired length on the PVC with a marker.

   Teaching note: Explain that a flexible tape measure is a good way to estimate the length of PVC needed.



Published 20 June 2016, Version 1.0

9. Use PVC cutter to cut the length of PVC. Repeat these steps until you have 4 identical pieces of PVC.

   Teaching note: A PVC cutter uses a ratcheting mechanism to cut through the PVC. Demonstrate this mechanism to the participants.

TEACHING NOTE: *DEMONSTRATE PROPER PVC CUTTING TECHNIQUE*

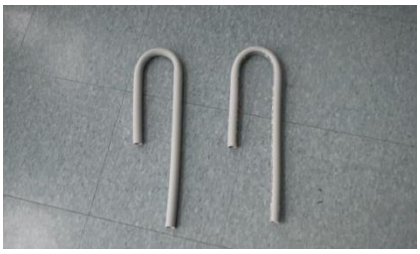
Marking the PVC. Measure and mark the length of the PVC needed before cutting.

Starting the cut. Open the jaws of the PVC cutter as wide as possible. The blade should be exposed and the opening should be wide enough to fit the PVC into. Place the tube in the jaws and squeeze the handles. The blade should ratchet downward incrementally. If the blade does not move, make sure the ratcheting mechanism is engaged.

Cutting the PVC. Keep squeezing the handles to ratchet the blade down further. If this becomes too difficult, bracing the bottom handle against the floor or tabletop while pushing on the top handle will be easier. Continue ratcheting the blade downward until it has completely cut through the PVC

10. Fill the PVC pipe with hot sand, capping both ends. Once the PVC is soft and flexible, use the jig to bend the piece. Release the sand to allow the PVC to cool and set more quickly.

    Teaching note: Use caution with hot sand. Encourage participants to use safety equipment meant to protect against intense heats.



TEACHING NOTE: *DEMONSTRATE PROPER PVC BENDING TECHNIQUE*

Heating the sand. Place a few scoops of sand into a pot and place on a burner. Stir the sand for even heating. One can test if the sand is hot enough by stirring it with a scrap piece of PVC for a few seconds. If the plastic softens, the sand is ready to use.

Fill the PVC piece completely. Cap the PVC on one end to contain the sand. Using heat protective gloves, one partner holds the tube vertical with the uncapped end facing up. The other partner pours sand into the tube with the help of a funnel. Stop pouring when the tube is full and carefully cap the open end. Filling the PVC completely with sand will also prevent the PVC from kinking

Use a jig or pattern. If the sand is hot enough, the PVC will soften. When it is soft enough, place the piece in the jig, ensuring the bend is made in the correct position. Keeping the tube in the jig, carefully uncap the ends over the pot of sand and empty the sand. This will allow the PVC to cool more rapidly. Using a jig or pattern is especially important to create nearly identical siphons.

Letting the PVC cool in the jig. Keep the piece of PVC in the jig until it is cool to the touch and does not bend easily.

11. Cut out 3 small circles of fine wire mesh. Wrap these around the long end of three of the siphons and secure with some thin wire. These will act as filters so that the siphons do not fill up with debris.

LEARNING OBJECTIVES ACCOMPLISHED:

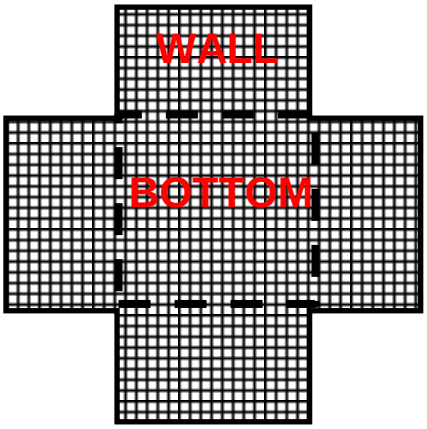
- ☐ Participants will learn about the utility of jigs and fixtures.
- ☐ Participants will learn how to properly cut PVC pipe and plastic.
- ☐ Participants will learn how to properly bend PVC pipe.
- ☐ Participants will learn how to manipulate wire mesh.
- ☐ Participants will learn the mechanics of siphons.

MAKING THE BASKETS

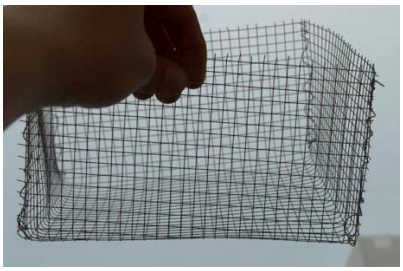
Skills	Tools	Supplies
manipulating mesh		

12. Cut out four pieces of the larger wire mesh in the shape pictured to the right. Make sure that the baskets fit into the jugs with room for the siphons and that the basket walls are tall enough to hold plants.

    Teaching note: Wire mesh is sharp when cut. Encourage participants to wear protective gloves when handling the baskets.



13. Fold up the sides of the baskets to form the walls. Use small pieces of thin wire to tie the walls together.



14. Bend lengths of the thick wire into hooks to hang the baskets from the sides of the jugs. Make the hooks longer than necessary so that the heights of the baskets can be adjusted later, as needed.

LEARNING OBJECTIVES ACCOMPLISHED:

- ☐ Participants will learn how to manipulate wire mesh.

Published 20 June 2016, Version 1.0

ASSEMBLING THE LIVING MACHINE

Skills	Tools	Supplies
siphon mechanics ecological principles		

15. Fill one jug half way with pebbles and a little mud. Add a mixture of clean water and wetlands water to the jug until the water level is high enough to reach a hanging basket (roughly 80% of the jug's height).

16. Fill one quarter of another jug with sand and a little mud. Add a mixture of clean water and wetlands water to the same level as the pebble jug.

17. Fill the last two jugs with most of the wetlands mud and a mixture of clean water and wetlands water until the water level is even with the other jugs. Choose one of these jugs to house the fish or snails. The other will house the majority of the plants.

18. Check whether the lengths of the siphons are appropriate. They should be able to hang from the jugs' walls without touching the bottom. The end of siphons in the pebble and sand jugs will be submerged under the rocks and sand.

19. The cells should be linked in the order :
    Producer → Consumer → Pebbles → Sand → Producer.

    The longer end of the siphon is placed in the source jug while the shorter end is placed in the output jug. The siphons need to be properly primed as they are added to the jugs.

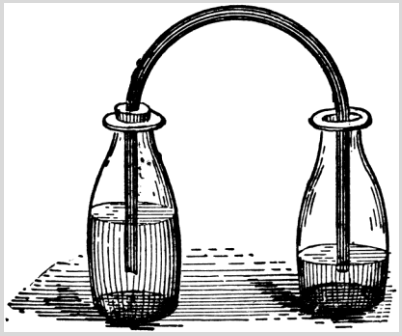
    Connect the aquarium pump in the following order:
    Pump → tygon tubing → one way valve → bubbling stone

    The bubbling stone should be inserted part way up the first siphon in the producer jug. Create a hole in the mesh filter of that siphon to pass the bubbling stone.

Published 20 June 2016, Version 1.0

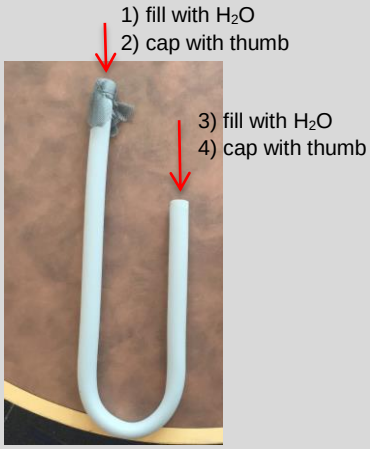
TEACHING NOTE: *PRIMING THE SIPHONS*

How a siphon works. If the water levels in two buckets are different, a pressure difference is created that drives the flow of water from the higher bucket to the lower bucket when they are connected by a siphon. Eventually, the two buckets will have the same water height. In order for this water displacement to take place, the siphon must be filled entirely with water. If there is any air, the siphon will not work.

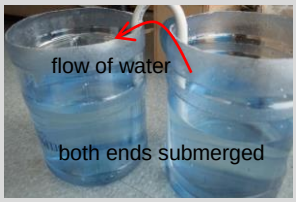


Partners can fill the siphons with water by pouring water into the open ends and placing a thumb on the openings when each side is filled to the top.

Placing the siphons in the cells. Keeping thumbs on the openings so that water doesn't spill, invert the siphon so that the ends are pointing down. Once each end is submerged in the water of the respective jug, one's thumbs can released and the siphon should be primed.



Testing the siphon. To make sure the siphon works, pour extra water into one jug so that there is a noticeable difference in water levels. Watch to see if the water levels equalize. If this does not happen, start over and prime the siphon again until it works.



20. Put soil and plants into the wire baskets and hang them in the jugs. Each jug should have a couple of plants. However, most of the plants should be placed in the basket in the producer cell (the mud-filled jug without the fish). The water should reach part of the way up these baskets. Add more water if needed.

21. Turn on the aquarium pump to aerate the water and stimulate flow between the cells. Bubbles should be noticeable on the surface of the first jug.

Published 20 June 2016, Version 1.0

TEACHING NOTE: *HOW TO MAINTAIN A LIVING MACHINE*

Sunlight. Keep the living machine in a sunny place. Plants and algae require lots of sunlight for energy.

Refresh. About four times a year, add new life to the living machine to maintain diversity in the system. Some plants and animals will inevitably die, and it is important to replace them as this happens.

Supplement. It is ok to add a small amount of food scrap and waste to the machine to "feed" it. The system can filter small amounts of waste. However, be very careful, as such a small ecosystem can easily be polluted.

Keep it filled. As time passes, water will evaporate and the water level of the living machine will go down. To keep the water level stable, make sure to add extra 'seasoned' water from time to time. This is a combination of wetlands water and regular filtered water.

Monitor plants. If it seems that the plants are growing too big or too many for the system to handle, remove or trim some back. Additionally, if there seems to be too much algae, some can be skimmed off. Be very careful to properly dispose of these plants. If they are not native species, *DO NOT* dump them into the local environment; they could be invasive. If you are unsure whether or not the plants are native, assume that they are not.

LEARNING OBJECTIVES ACCOMPLISHED:

- ☐ Participants will learn ecology principles and the role of different cells in the living machine.
- ☐ Participants will learn the mechanics of siphons.
- ☐ Participants will have made a functional living machine.
- ☐ Participants will learn how to maintain and care for their living machine.

REFLECTION AND FEEDBACK GROUP DISCUSSION QUESTIONS

- How has this activity shaped your view of your local environment?
- What key principles have you learned regarding sustainable ecosystems?
- What was the most interesting thing you learned while making the living machine?
- How could you carry the principles you learned about into your daily life?
- Of the fabrication skills learned, which do you feel would be most useful moving forward?

ACKNOWLEDGEMENTS

Skill Builders are published by the International Development Innovation Network (IDIN). IDIN builds a diverse, global network of innovators to design, develop, and disseminate low-cost technologies to alleviate poverty. IDIN and its partners are funded by the USAID U.S. Global Development Lab. For more information, visit www.idin.org.

This document has been created by support from the following members of the IDIN network:

Miguel Chaves	*CAOS Focado*
Anna Konstantinova	*Olin College of Engineering*
Deborah Leal	*IDIN Network Member*
Benjamin Linder	*Olin College of Engineering*
Mauricio Miramontes	*La Mano del Mono*
Ariana Olson	*Olin College of Engineering*
Eric Reynolds	*Massachusetts Institute of Technology*
Amy Smith	*Massachusetts Institute of Technology*
Rachel Yang	*Olin College of Engineering*

U.S. GLOBAL DEVELOPMENT LAB Powered by USAID

International Development Innovation Network

Published 20 June 2016, Version 1.0