ACTIVITY 3 DESIGN A FLASHLIGHT

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Thrive Outcome: Youth will learn about a basic dimension of Goal Management: Choosing a Goal.

SET Outcome: Youth will engage in scientific and engineering practices; and reflect on their own ability to "do science".

Time: 30-45 minutes

Materials:

- Copies of the GPS worksheet
- GPS Dimensions posters (meaningful, realistic, positive, stick to a plan, show persistent effort, check your progress, seek help, substitute strategies)
- Copies of the Flashlight worksheet
- Aluminum foil, tape (electrical or masking).
- For each pair: mini light bulb (2v-6v) (incandescent or LED), battery (AA, AAA, or C) and housing for the circuit (cardboard tube, cardboard square, pegboard or plastic mesh).
- Optional materials at the front table: wire (18-22 gauge, like telephone wire), wood skewers, craft sticks, brass brads, paper clips, rubber bands.
- Tools: 3-4 wire strippers/cutters, 4-5 hot glue guns, 4-5 scissors

Preparation: 30 minutes. Gather materials, hang GPS Dimensions posters around the room, leave them up for at least the amount of time to complete both activities in this chapter–use them to describe strategies and prompt youth to think about them.

Facilitator Tips:

- We suggest that youth work in pairs and sit at a shared table so they can ask for help and look at other designs.
- We recommend that you place materials in a center table instead of handing out a packet of materials to each group. This may allow groups to be more creative in their design.
- Encourage groups to share ideas and adapt ideas from each other–in GPS language, that's "adapting the strategies of others". In engineering, learning from others is an important part of being efficient.
- In a "short circuit" (for example, touching both ends of the battery with aluminum foil), the battery will get very hot. While unlikely to burn, there may be exclamations of surprise.

Directions

Say: "Over the next two meetings, we're going to be experimenting with circuits and designing and building a flashlight. One of the things we're going to be learning is how to set a goal and build some strategies to reach that goal. Did you know that the most successful people in the world all use some type of system that helps them reach their goals? The first step in that system is to know how to set a goal. Another way to think about this is 'Where are we going? What does it look like at the end?' First, let's explore how circuits work."

Part A (15 minutes): Pre-Activity, Basic Experimentation with Circuits

1. "I'm going to give your first goal: using the available materials, make the light bulb light up." This is a basic introduction to circuits. It may take some youth only a few minutes while others may need more time. For those that complete the task quickly, provide them with a second (or third) bulb and challenge them to make all of them light up.
2. After everyone is able to make their bulb light-up, ask groups to draw a diagram of the circuit. You may then want to draw a diagram on a poster/white board for the entire group to see. Ask and invite further discussion or counter evidence.
3. "Here is another goal: how could you add an on/off switch?" Prompt youth to think about the types of on/off switches they have used before—squeeze, blow, touch, flip, or throw switches.

Part B (15-20 minutes): Choosing a Goal: Design on paper

4. Ask an opening question to prompt thinking: "Think about the types of lights and lamps you have seen before. In what ways are the lights and lamps you've seen similar or different? Have you ever seen any interesting or unusual lights and lamps?"
5. Now that youth have a basic understanding of circuits, using the graph paper provided in the Prop Box, challenge youth to design (not build yet) a flashlight device that includes an on/off switch. They can plan to use whatever materials are available. The design does not need to look like a normal flashlight. As the facilitator, help guide youth as they question, share and compare their observations.
6. After each group is satisfied with their design, move directly to the ireflect exercise.

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Facilitate a discussion about what youth learned, using these prompts:

- Discuss the ways in which you were doing science and engineering.
- In this activity I gave you two goals. Can someone remind us what one of them was? What about the second one? If we just put a bunch of stuff in the middle of the table and said 'Do something with this stuff' what types of things would we have seen being created?
- When you are working on a project, how does it help you to know what the final destination is? "That's setting a goal and that's what you did when you drew the design for your flashlight."
- If you were trying to teach someone else about being successful at reaching their goals, what would you tell them?

istretch

Encourage members to complete the istretch activity on their own and bring their answers to the next meeting. At the beginning of the next meeting, spend about 5 minutes sharing their thoughts. (Handout 3)

Make copies of the handout and ask youth to do Step 1: Goal Selection only: identify one goal they have in their own life.

ACTIVITY 4 BUILD A FLASHLIGHT

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Thrive Outcome: : Youth will learn about two basic dimensions of Goal Management: Pursuing Strategies and Shifting Gears.

SET Outcome: Youth will engage in scientific and engineering practices and reflect on their own ability to "do science".

Time: 30-45 minutes, though youth may want to work for 60-90 minutes.

Materials:

- Aluminum foil, tape (electrical or masking)
- For each group: mini light bulb (2v-6v) (incandescent or LED), battery (AA, AAA, or C) and housing for the circuit (cardboard tube, cardboard square, pegboard, or plastic mesh)
- Optional materials at the front table: wire (18-22 gauge, like telephone wire), wood skewers, craft sticks, brass brads, paper clips, rubber bands
- Tools: 3-4 wire strippers/cutters, 4-5 hot glue guns, 4-5 scissors

Preparation: 30 minutes

Facilitator Tips:

- As the facilitator, it is important for you to know and use the labels of the dimensions of Pursuit of Strategies and Shifting Gears. You will not be teaching these labels to youth directly, instead by using the language and supporting behaviors that demonstrate the dimension, you will reinforce that behavior in a positive direction. Be sure you can use phrases such as:

  "I see that you're **sticking to your plan!** That's a great way to see if your strategy works."

  "You are really trying hard to make that flashlight. That's showing **persistent effort!"**

  "Let's take a few minutes to **check your progress.** How are you doing toward reaching your design goal?"

  "I see that you are really getting frustrated by that one step. Remember there are lots of other people in the room who you may be able to **seek different help** from."

  "Hmmm, what else could you try? Do you think it's time to **substitute one strategy for another?**

- Youth should work in the same pairs as they did in the last activity and it is best if they can sit around a larger table so they can share ideas as they build their design.

- We suggest that you place materials in a center table instead of handing out a packet of materials to each group. This may allow groups to be more creative in their design. Encourage groups to share ideas and adapt ideas from each other—in GPS language, that's "adapting the strategies of others". In engineering, learning from others is an important part of being efficient.
- There are many ways to design the on/off switch using conductive materials such as paperclips, aluminum foil-covered craft sticks, etc. If youth are struggling with how to incorporate the switch, ask questions to prompt their thinking.
- Another idea is to have youth deconstruct or take apart an inexpensive flashlight to see how it works.

Directions

1. Resuming from Activity 4, review what they did last week and hand out their designs.
2. Sticking to a Plan and Showing Persistent Effort: Build the Design. Once youth have a design, ask them to construct their design.
   a. You may need to float around the room providing help and assistance. Your role is that of a facilitator, ask questions to prompt thinking. There are no right or wrong ways to build their device.
3. Checking Your Progress: Test and Reflect. Prompt youth to reflect on their designs as they build and test them. Does your design work as expected? How will the on/off switch work?
4. Seeking Different Help: Share ideas with another group. At some point, you may find it useful to stop all of the groups, have them join you at a side of the room (leaving their devices behind) and conducting a full group reflection: label a poster/white board in two columns: a) What's working with my device; and b) What's not working with my device. Ask youth to share and record them on the poster.
5. Substituting Strategies: redesign & test. Ask youth to continue working on their devices, testing and redesigning.
6. Once youth are finished, have them share their devices with the full group.

ireflect

Facilitate a discussion about what youth learned, using these prompts:

- From your experience with this activity, what advice would you give to new engineers as they design and build a device?
- Let's talk about which of your strategies worked really well. Can someone tell me about how they really were sticking to their design plan? How do you think sticking to your plan can really help you with other goals that you have for yourself? What about someone who had to substitute a strategy—did someone have to change their design plan—tell us about that. Since we know that sticking to a plan is a good idea and substituting strategies is a good idea, how do you know when to move from one to the other?
- If you were trying to teach someone else about being successful at pursuing strategies to reach their goals, what would you tell them? (Try to get at seeking other help, checking progress and persistent effort).

istretch

Encourage members to complete the istretch activity on their own and bring their answers to the next meeting. At the beginning of the next meeting, spend about 5 minutes sharing their thoughts.

Continue having youth work on their GPS handout and complete Step 2 and Step 3. (Handout 3)

Note:

For younger youth, the strategies will be very simple and may actually look like small goals to get to the bigger goal. That's okay! At this point it's less important what they write, and more important that they start to understand the process. By the time they are 11 years old, their strategies may be just a little more sophisticated.

Younger youth may not be able to concretely think of something that can get in the way of reaching their goal and may struggle with the shifting gears portion. It is okay to make suggestions that seem to make sense to most children. A good one is something like, "I may not have a ride," or "I may have a lot of homework and won't be able to practice."

Flashlight Worksheet

Name: _____

1. **Choosing a Destination: Design Your Circuit**

   - Design a battery-powered light device that includes an on/off switch.
   - Think about what you will use this device for. This may help determine what the device will look like. For example:

Cylindrical

Lantern

Street Light

   - What materials will you use?

   - How will the on/off switch work?

Design your Circuit in the space below

Name Your Device: _____

Flashlight Worksheet

2. Sticking to a Plan and Showing Persistent Effort: Build the Design

3. Checking Your Progress: Test and Reflect

   Does your design work as expected?

   What changes did you make to your device from the original design?

4. Seeking Different Help: Share ideas with another group

5. Substituting Strategies: redesign & test