Family Makers | **Ask questions to design sandals** | **Session 2**

Audience: Families with K-5 children
Session: Session 2
Time: 75+ minutes
Topic: Ask questions to design sandals
Question: Why and how do engineers ask questions to understand target users? Let's explore by designing a pair of sandals for your parents.

Session structure:

For online program (in Zoom)

- **Ignite (10 min)**: Builds relationships and ignites interests
  - Introduce the Driving Question (DQ) and emphasize "asking" in Engineering is Elementary (EiE) process to give focus to the session
  - Icebreaking activity: Watch a video clip and share about asking questions
- **Make (55 min)**: Supports families' externalization of ideas and solutions
  - Challenge: Children create a pair of sandals for their parents by asking questions to find user needs and preferences.
- **Reflect (10 min)**: Promotes families to internalize the feedback and make iterations

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Customizing your script:

- Important: Throughout this curriculum, whenever you see "Note" in red, it means you can adapt, customize, or change that section based on your specific situation. Feel free to tweak, adapt, or completely remove these sections to match your local context.

Facilitation notes:

- While *Family Makers* was originally designed as an online program, this exact same curriculum can easily be run as an in-person library program or other formats you choose (i.e., drop-in stations, take-and-make kits, social media challenges). Check out the resources for flexible implementation on Family Makers website.
- Regardless of whether you choose the online or in-person format, we highly recommend you check out the facilitation tips we developed with our rural library partners.
- We developed "a day in the life of a rural engineer" videos that you can use in each session. Links for each video can be found here.

Learning Goals:

- Understand how engineers ask questions to build solutions for specific target users.

Learning Objectives:

- Participants will plan a sandal design by identifying the user's needs (parent's comfort and activity) and sketching a solution that meets the minimum design requirements (e.g., 1-inch outsole, suitability for jumping).
- Participants will construct a sandal prototype using various materials and test it against the three required performance criteria (jumping, running, and minimum outsole height).
- Participants will improve their sandal design based on test results, and explain one thing they changed and how that change improved the sandal's stability or functionality.

Materials (for 1 caregiver/1 child):

- Session 2 Package:
  - 3 big EVA foam sheets, 6 small EVA foam sheets, 1 roll of ribbon, 4 pipe cleaners, 4 adhesive Velcro dots, 5 foil sheets, 1 sheet of vinyl,
- Others:
  - Materials around the house
- All Sessions Package:
  - 1 masking tape, 1 pair of scissors, 1 measuring tape
- List for purchasing each material and cost

  Note: Feel free to take out materials that are marked as optional if you want to reduce the total cost of the kit.

[Session curriculum]

Ignite [10 minutes]

Ignite Intro (3 min)

Section	Script
Welcome and ask for updates on session 1	***(Slide 1)*** Welcome to our second session of Family Makers! ***(Slide 2)*** Let's first reflect on last week's activity. Did anyone make improvements on the gumdrop towers you created? Here are a few questions to prompt our discussion: ● What changes did you make to your tower? ● Did you encounter challenges? How did you overcome them? ● What new features or designs did you try? Feel free to unmute and share your experiences! [Come prepared to show the tower you made from last week and talk about improvements you made to your tower.]

Ignite Icebreaking Activity (3 min)

Section	Script
Show video	***(Slide 3)*** Let's start with a fun video! ***(Slide 4)*** [Play a short video showing funny questions: https://youtu.be/XAXkxzHy7-o?si=iTw_zF_Apf1RbKuh] What did you think about the video? I thought the questions shown in the video were quite funny. I bet you ask a lot of questions at home. Some of them may be silly, and some of them may be very wise. Asking questions is really important. Why do we ask questions, and why is it important to ask questions? [Families share their thoughts on questions.] Great insights! Asking questions helps us understand what other people need or what challenges they face.

Ignite Introduce the DQ and EiE (1 min)

Section	Script
Introduce the driving question	***(Slide 5)*** For today, we are focusing on: Why and how do engineers ask questions to understand target users? The engineering design process we want to focus is asking questions. An important question that engineers first ask is: what is the problem that we could solve to make the world better? Engineers also ask questions to people who might be using the solutions they build to figure out what the user wants. Engineers also ask questions, such as: Is my solution working? What needs to be changed to make it better? Just like this, engineers don't stop asking questions. Asking questions happens throughout the engineering design process. ***(Slide 6)*** [Show the engineering design process slide: ask-imagine-plan-create-improve.] So, today we will be asking questions when we design a pair of sandals for your parents.

Ignite Connect (3 min)

Section	Script
Discuss why it is important to ask questions	***(Slide 7)*** Let's think about the questions you might ask your parents to learn more about what kind of sandals they want and spend a few minutes asking those questions. [Provide about 2 minutes for families to ask questions. The questions below will appear on the slides: • What might you ask to learn about where they plan to wear them? • What might you ask to understand the design they prefer? • Are there features that they are dissatisfied with sandals they currently own? What kind of questions would you ask to find out?] So, were you able to find out what your parents want? Were there any surprises? What would have happened if you started designing the sandals without asking questions? Would you have made the sandals that they wanted? I would like to ask for a volunteer to share what kind of questions you asked and what you found out from your parents.

	[1-2 children share what kind of questions they asked and what they found out.] Exactly! Just like engineers, asking the right questions helps us create something that truly meets someone's needs. Today, we'll use this skill to design shoes for our parents.

Make [55 minutes]

Make Simple Challenge (10 min)

Section	Script
Share reminders (1 min)	***(Slide 8)*** We will start with some simple challenges to help you tackle this challenge of the day. ***(Slide 9)*** Please remember our acronym, CHILD and try to encourage your child to take the lead as the engineer/designer.
Discuss mismatched shoes and weather conditions (3 min)	***(Slide 10)*** Let's first think about how different weather conditions or places might impact the kind of shoes we wear. ***(Slide 11)*** [Show images of mismatched weather conditions, such as snow with sandals, or rain with sneakers.] Take a look! These shoes don't seem to match the setting. What would you wear in these situations? Good job! Shoes protect us and make it easier to walk, run, and play. Engineers work hard to design shoes that can meet the demands of the environment or purpose of the shoes. Let's see the different parts of a shoe!
Discuss the concept of outsoles (3 min)	***(Slide 12)*** First, let's talk about the outsole. This is the bottom part of your shoe that touches the ground. Do you know why this part is important? [Pause for answers.]

	Exactly! The outsole helps us stay steady and keeps us safe from slipping. Engineers use different materials like rubber and plastic for outsoles to fit different environments. Let's look at some examples! ***(Slide 13)*** [Show slides of outsoles with different materials.] If you were walking on a rocky mountain, would you want a smooth outsole or a bumpy one with lots of grip? [Encourage kids to respond.] Yes! A bumpy outsole helps you hold onto rough surfaces like rocks or trails so you don't slip. Engineers add patterns, like little bumps or lines, to make outsoles grip better. What if it rains? If you had shoes with soft foam on the bottom, do you think they would keep you from slipping? [Pause for answers.] Exactly! Foam is super comfy but not great for wet places. That's why engineers use rubber for wet conditions—it grips the ground well!
Explain about engineering of running shoes (3 min)	***(Slide 14)*** Let's think about one more type of shoes—running shoes! Runners need shoes that are light and let them move fast. What do you think engineers might add to help with that? [Pause to let kids think and respond.] Great guesses! Engineers make running shoes with light, springy materials so they don't weigh runners down. They also use a bit of extra bounce in the outsole to give runners more speed! ***(Slide 15)*** Now that you know some tricks engineers use, you're ready to design your own shoe for your parents! You'll pick materials that work best for your shoe and think about how each choice could help. Let's get started and think like engineers!

Make Complex Challenge (40 min)

Section	Script
Introduction	***(Slide 16)***

(1 min)	Since it may take too long to create a pair of shoes that cover your entire foot, we are going to try to make a pair of sandals. And your user will be your parent. There are some rules! They are also in your booklet in your package. Feel free to look at them again later. Your adult member should wear the pair of sandals and… 1. Jump at least 5 times 2. Run for at least 10 seconds 3. The shoe should have a minimum of a 1-inch outsole [Leave this up on the screen for the families to see.]
Plan (3 min)	***(Slide 17)*** Open the kit and find the “session 2” package. Look at what materials you have and look at some examples of different sandal designs other people have made before. ***(Slide 18)*** Also, take a look at some examples of diverse sandals we can see in our daily lives. There are all sorts of sandals that can be used for the beach, for fancy parties, for walking, and just for comfort when you are taking a walk in your garden. With these examples in mind, try to think about the following questions while you plan your design. [Spend some time for families to sketch out or write out their ideas. Give about 3 minutes and move on. Ask them to consider these questions will be on the slides] ● What kind of structure, form, shape will your sandals have, and why? ● How will your material and structure help address the bonus challenge?
Group material hunt (3 min)	***(Slide 19)*** Now that you have your plan ready, it's time to get super creative! Before we dive into making our sandals for the big challenges, let’s go on a material hunt around your house! As you hunt for materials, think about items that can help make your sandals stronger, more stable, more comfortable, and taller with an outsole. Look for anything you think might help with your design. If you’ve already gathered materials, have them ready. We’ll have 3 minutes to do this. Your 3 minutes start now!

Create (15 min)	***(Slide 20)*** Next, let's spend about 25 minutes to make the sandals. Continue to ask questions to your parents to check if the design you are creating is meeting their needs. After we make for about 15 minutes, I am going to call everyone for a scheduled check-in to share your status, but please feel free to unmute and ask any questions when you need to. Sounds good? ***(Slide 21)*** Parents, please use these questions to help guide your children. [Ask parents to use these questions to prompt their children with planning for the making session] ● What should you do first before making it? ● What materials are suitable to make the sandals comfortable? ● What materials can you use for the outsole? ● Can you wear this outside? [Allow ample time for families to make. Let them know they can always unmute and ask questions or use chat.]
Check-in (5 min)	***(Slide 22)*** Ok, let's pause for a bit. We are going to do a quick check in. We ask that you share what kind of sandals you want to make, what were the specific requests your parents had, and share any struggles or questions you have. And we will provide some suggestions.
Test (5 min)	***(Slide 23)*** Now, we are back together. If you need more time to make, please do so. If you finalized the sandals, you can test your design. First, you need to make sure the adult member can jump at least 5 times. Then, test to see if the adult can run for at least 10 seconds. Lastly, use the measuring tape from the kit to measure your outsole to see if it is at least 1 inch tall. [Allow time for families to test it out. Ask families to change the angle of their camera if you cannot see their testing.]
Improve (8 min)	***(Slide 24)*** Based on your testing, come up with some ideas to make improvements to your sandals. Parents, help your child make improvements on their prototypes by considering these questions. [Ask parents to use these questions to prompt their children with making improvements:

	1. Test it out! Did the sandals meet all the requirements? 2. Will you tell me why or why it is not working? 3. What would you change about your design? Why?] Can anyone share what kind of improvements they made? [Have a few people share.]

Make Show and Tell (5 min)

Section	Script
Share (5 min)	***(Slide 25)*** It looks like time is up for the session today. It's ok if you haven't managed to finish. Now let's see what everyone made. Please turn your camera so we can see the sandals you made. Tell us what worked and what did not work, and what improvements you have made. [Families share their sandals.]
Congratulate and ask to take a picture	***(Slide 26)*** What you made looks amazing. ***(Slide 27)*** It's time to take pictures of what you made.

Reflect [10 minutes]

Reflect Family Conversation (5 min)

Section	Script
Family talk (3 min)	***(Slide 28)*** Now, let's take some time to reflect on what we did today. ***(Slide 29)*** I'm going to ask parents to take the lead in asking the following questions to your child while we are muted. [Ask families to mute and discuss the following questions: • Why is asking questions an important step in the engineering design process?

	● How did other families design their solutions? What was interesting? ● What was something that you learned today?]
Family sharing (2 min)	***(Slide 30)*** Now, let's come together as a whole group. I want to ask families to share at least one question they discussed. Any volunteers? [Ask families to share. If no one shared about the last question, ask someone to share.]

Reflect Wrap Up (5 min)

Section	Script
Recap the importance of asking questions (1 min)	***(Slide 31)*** I hope you enjoyed this activity. Asking questions is super important for engineers because it helps them understand what people need. If they don't ask questions to find out what users want, the product might not be as good or helpful as it could be. So, asking lots of questions helps make sure the product works well for the people who will use it! And you acted like engineers to ask questions and come up with great sandals.
Share our engineer video (3 min)	***(Slide 32)*** Before we wrap up our session, I'd like to show you a video featuring a mechanical engineer. In our final session, we'll get to meet an engineer. You won't know who it is until then, but the engineer in today's video might be the one you meet! Have you heard of biomedical engineering? Biomedical engineers solve biological and medical problems for improving health care. Meet Kiara Yough who is working as a biomedical engineer at Actuated Medical in PA. [Play the video: https://youtu.be/wAziAPKupfs?si=h4XJZ7neshAcVTzf
Introduce deepening activity and end session (1 min)	***(Slide 33)*** To learn more, we also have a deepen activity that you can do at home without us. It will be available in the booklet. ***(Slide 34)*** I hope you had a great time building and learning today. Feel free to improve your sandals at home. I know I am going to! We also challenge you to find different types of shoes in your house and analyze the

	materials that are used to design the shoes and let me know during our next session how it went! For our next session, we will move on to the “plan” and “test” stages of our engineering design process. We hope to see you all next session.