BYF Session Curriculum

Session: 6 – Building a bridge

Materials:

* A few handfuls of popsicle sticks for each group
* Playdough container for each group
* Catapults built in session 1
* Safety glasses for each student

Objectives:

* Students will construct a bridge that shows structural integrity.
* Students will exhibit engineering skills by building the tallest tower they can.

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| Greeting Activity – 10minConnections with solid fill | Slide 2Huckle Buckle BeanstalkChoose an item to hide around the room. The object of the game is to be the first to find the hidden object without showing the other players where that object is hidden. Have all students put their heads down and close their eyes so they don’t see where the item is hidden. The person hiding the item – the hider – can throw the other students off by making noises in different corners of the room. The item must be hidden where it can be seen without moving any objects around. When the hider says go, the rest of the students can get out of their seats and look for the item. When a student sees the item, they quietly sneak back to their seat, sit down, and say “Huckle Buckle Beanstalk!” They now get to hide the item in the next round. After about half of the students have found the item – turn it into a hot and cold game. The students in their seats can give clues to those still searching.  |
| Objective Preview – 10minPresentation with media with solid fill | Slides 3-6Life Skill:* Problem Solving
	+ Working through problems until they are solved
	+ **Today you are going to be presented with a series of problems and it will be your job to find a solution. Practicing problem solving will mean that you stick with the problem until you find a solution.**
* Critical Thinking
	+ Evaluating the solutions you are going to try so that you can choose the best one
	+ **Even as we work to solve problems, we can’t just take the first solution that comes along. Critical thinking means that we are going to try and choose the BEST solution to our problems.**

Construction Skill: * Structural integrity
	+ **We are going to build bridges and towers today! This means that we will need to experiment with how much weight our structures can hold. That is structural integrity.**
* Engineering
	+ **Engineering is using what we know to solve new problems in creative ways. There is a lot of engineering in construction! Everything from how much weight a crane can hold, roof shapes for houses, how tall a skyscraper can be, and how long a bridge is safe. We are going to use a lot of those skills in our problem solving today.**
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| Pre-Teach – 10 minPresentation with media with solid fill | Slides 7Materials/Tool Handling:* **Today we are going to use popsicle sticks and playdough to make a bridge, a tower, and a neighborhood! You can decide how you want to use your materials but there are some things you should know about structural integrity before we get started.**
	+ Watch this video on what makes bridges strong:
		- <https://youtu.be/oVOnRPefcno>
	+ Watch this video about what allows a tower to be tall:
		- <https://youtu.be/el1K-xILtwo>

Safety Expectation: * Everyone is responsible for their own part of the project.
	+ **Project managers be sure you communicate well with your group members to get an accurate vision for your project. Remember the game we played in session 1? Use your communication skills today!**
	+ **Also make sure that we are listening to our group members and validating their ideas. Use critical thinking – someone else in your group might have a better solution than you do to the problems your group will face.**
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| Focus Activity – 1hourHammer with solid fill | Slides 8-14Build a bridge:* **Using the materials you have, build a bridge that can hold a small book.**
	+ Allow students 10-12 minutes to do this, more if needed.
	+ Have groups test their bridges with small books from around the classroom.
		- Ask: **Whose bridge works?**
		- **Why does it work?** Reference the video from the pre-teach to help answer these questions.
	+ Discussion questions
		- **What did you see that was similar?**
		- **What did you see was different?**
		- **What are the advantages and disadvantages of your neighborhood based on what you saw?**

Build a neighborhood:* **Using the resources you have, build a neighborhood**.
	+ Allow students 10-12 minutes to complete this
	+ After the time is up, have students do a gallery walk to each of the other neighborhoods.
	+ Ask students for their observations about the different neighborhoods. Have them discuss the following questions in their groups, then share out whole class.
		- **What did you see that was similar?**
		- **What did you see was different?**
		- **What are the advantages and disadvantages of your neighborhood based on what you saw?**
		- **What would you change?**
	+ Say: **There are lots of different ways to accomplish a goal.** **This is why engineers,** **architects and designers often work in groups. Collaboration helps us make our products better. Keep this in mind as we move into harder challenges.**

Build a tower:* **Using the resources you have, try and build the tallest tower.**
	+ Allow 10-12 minutes for students to construct a tower from their playdough and popsicle sticks.
	+ Have students do another gallery walk to all the other towers. Have them observe the many ways people tried to get more height to their tower.
	+ Ask: **What helped the tallest towers tall?**
		- Reference the video from the pre-teaching
	+ Discussion questions
		- **What did you see that was similar?**
		- **What did you see was different?**
		- **What are the advantages and disadvantages of your neighborhood based on what you saw?**

Final Challenge: Choose your adventure* Longest bridge
	+ **Try and make your bridge** **as long as you can. Our goal is the longest bridge.**
		- Allow 10-12 minutes for students to extend their bridges.
		- See whose bridge is the longest.
* Tallest structure
	+ **Try and build the tallest tower as a second draft, knowing what you know now.**
		- Allow 10-12 minutes for students to extend their towers.
		- See whose tower is the tallest.
* Most houses
	+ **Try and build the neighborhood with as many houses as possible!**
		- Allow 10-12 minutes for students to expand their neighborhoods.
		- See whose neighborhood has the most houses.

Catapult Battle: * **Demolition is a big part of construction work too!**
* Use the catapults built in session 1 to have a battle and knock down the towers, bridges, and neighborhoods.
	+ Split the class in half and give them opposite sides of the room.
	+ Designate four feet of “demilitarized zone” between the two sides.
	+ Supply each side with lots of marshmallows in a variety of sizes
	+ Tell each side to place their structures. **These structures are not to be moved during the war. Just like in a real natural disaster or war you can’t move bridges, towers, and neighborhoods around.**
	+ Set a timer for 3 minutes and tell students to **Fire away and try and destroy as many of the other team’s structures as possible.**
	+ After the three minutes talk about what structures withstood the attack and which did not.
		- **What makes a structure strong?**
		- These are things commercial construction workers work towards. And what people who work in demolition need to work around.

*Note:**If you want to continue the battle allow students to make changes to where they placed their structures and repeat the process. If necessary or conducive, make the demilitarized zone smaller.*  |
| Job Exploration – 20min Presentation with media with solid fill | Slides 15-19Awareness of careers in commercial construction:* **Residential**
* **Civil**
* **Commercial construction is the branch of construction that builds big buildings like you see in cities. This often includes large bridges and skyscraper towers. Building these big projects takes a lot of specialized work.**
	+ Welder
		- **Welders use heat to work with metal and strengthen its connections. This** **particular career involves lots of sparks!**
	+ Ironworker
		- **Ironworkers place and install iron or steel girders, columns and other construction materials to form the infrastructure all around us. Ironworkers must always be paying attention to details to check vertical and horizontal alignment. This often means balancing from the top of new skyscrapers!**
	+ Tower crane operator
		- **These craft professionals use their knowledge of load calculations and crane operations to hoist heavy materials off the ground and to significant heights.**
	+ Civil engineer
		- **Civil engineers design, construct, supervise, operate and maintain large construction projects and systems including roads, buildings, airports, tunnels, dams, bridges and systems for water supply and sewage treatment.**

**Now, let's hear from a real industry professional who can tell us about their career in residential construction!** * + Introduce a community partner if applicable.
	+ If no community partner can attend introduce the video.
* Show slide with general salary information on it.
* Open the floor for students to ask their own questions of the industry professional.
	+ Note: If no industry professional is available ask students what their questions would be and make a list. Send this list to your Coordinator and they will try to get those questions answered.

Videos:Inside the hard hat Welder: <https://youtu.be/BQzERXpnP00> Inside the hard hat Ironworker: <https://youtu.be/ELeycZxidWY> Inside the hard hat Tower Crane Operator: <https://youtu.be/fDfsMZhMg4U> Questions for industry professionals: * What soft skills are important in your job?
* What does your “office” look like? Work Environment?
* What education did you need to get this job?
* What is your favorite part of your job?
* What is some good advice to someone who wants to go into your field?
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| Wrap-Up – 10 min Customer review with solid fill | Slide 20 Survey for the end of the club:<https://forms.gle/J6vdHU32C6FzvwDt8> Note: This survey is slightly longer than previous ones due to it being the last session. Be sure to allow some extra time for this.  |