Popsicle Stick, Binder Clip & Clothespin Challenges

Summary of Activity:

Activity Description: Using a set of simple reusable materials, participants will be challenged to use their knowledge of stable structures to complete different challenges with the given supplies.

STEAM Skills:

- Engineering
- Architecture
- Construction Skills
- Creativity
- Problem solving SKills

Ideal Age Group: Could be all ages, or anything from K-8.

Materials and Supplies:

• Spring Open & Close Clothespins (~25)	The regular size used for laundry, exact amount does not matter.
• Popsicle Sticks (~75)	Can be regular size or jumbo sized, exact amount does not matter
• Binder Clips (~20)	The mini or regular size work well, the jumbo size ones do not. Xact amount does not matter

General supplies needed: None.

TALKING POINTS AND BACKGROUND:

One Approach: Theme the activity around the design process and have participants apply it while working through the activity.

1. **Define the Problem:** The first stage is for the architect to work with the client to figure out what the problem is. Why does the client need this structure? What is its purpose? Who will be using the building? What do they need when they are in the building?

2. **Collect Information:** The second stage is to start looking for inspiration to influence your design. You could walk outside taking pictures of interesting shapes on buildings or interesting natural formations, you could make some sketches of parts you think might be interesting in the final design. You can also gather more information about the project for inspiration

3. **Brainstorm and Analyze Ideas:** The third stage involves taking all of your inspiration, ideas and information and looking for ways to connect them. You are always thinking about how the ideas you have come up with would be used by the client and if you have met all of the clients needs in the project.

4. **Develop Solutions:** In the fourth stage you start to turn your ideas and notes into reality. An architect may make a digital mock-up or floor plan of what the structure could look like or they may choose to build a miniature physical model as a prototype.

5. **Gather Feedback:** In this stage you want to show and explain your ideas to as many people as possible and could include co-workers, friends or family. Listen to their ideas carefully and ask them questions to learn more about their thoughts on the design.

6. **Improve:** In the sixth stage of the design process you should think about all of the feedback you have received and decide what you want to and don't want to incorporate into your design. You can incorporate these into your mock-up or prototype.

Second Approach: Theme the activity around strong and stable structures

- Who is responsible for building strong and stable structures?
    - **Engineers:** Someone who designs, builds or maintains engines, public works and structures.
    - Why is it important to build bridges, buildings and other structures sturdily? What happens if it isn't built properly? https://www.youtube.com/watch?v=j-zczJXSxnw (Gallopin' Gertie Bridge Collapse)
- Bridges, buildings and other structures must be built securely and safely, (taking into account the weight it will be under and changing weather) as without a strong base they can collapse.

- How do we make structures strong? What shape should be used?

Circle: The circle is the strongest structural shape because stress is distributed equally along the arc of the circle. In nature, the sphere is the strongest 3D shape!
    - Examples: storage silos, storage tanks, helmets, planets

The triangle: One of the strongest shapes, the triangle is able to hold its shape under immense weight, due to its strong base and two strong supports leading to the point."
    - If you built a bridge with rectangle supports and the weight became too much, the rectangles would collapse on themselves. With triangular supports, the triangles would not collapse!

Hexagon: One of the strongest shapes, hexagons often appear in nature due to their design and weight bearing capacities. Where can we find hexagons in nature?"
    - Beehives! These shapes can be created with less wax, allowing for a stronger structure with less work for the hive.
    - Hexagons are one of the only shapes that **tesselate** perfectly; fitting in perfectly without gaps or overlapping.

PROCEDURE:

This activity will introduce participants to creating designs and solving building challenges using a set of supplies that they can assemble and disassemble easily. This time is very free form and should encourage the kids to think creatively to solve each challenge, there are no wrong answers here! Encourage kids to test and improve their designs if they work through the challenges quickly.

Challenge 1 Supportive & Safe Structures:

Instruct the participants to create a structure that holds the largest possible weight. Participants can use books, toys or other objects from home to test their design. Encourage the kids to start with small weights and increase until the structure collapses. Have them think about how they could modify their design to improve its weight bearing capabilities and encourage them to continue to try new or creative designs.

Challenge 2 Tall & Safe Structures:

Instruct participants to create the tallest free standing (not taped to the floor or another object, unsupported by other people or objects) structure. Have participants use their ruler to regularly measure how tall the tower is. If the tower collapses, have the participants try another design. For an additional challenge, participants test how much weight their tower can hold at its highest point. Another challenge could be to limit the number of a certain supply the participants can use, such as clothespins or binder clips.

Challenge 3 Creative Structures:

Instruct Participants to create a structure with the largest number of geometric shapes incorporated. Participants can build any kind of structure they want and can use any combination of shapes they would like. Have participants think about what kinds of shapes might be the strongest or supportive. WHat shapes do the participants find most interesting? Can they make a structure using only their favorite shape?

Challenge 4 Chain Reactions:

Instruct Participants to use the materials to create a domino effect. They may supplement their building supplies with materials from home. Prompt participants to think about how to keep each component safe and unmoving until needed for the final reveal. How many components can they add? Can they use all of their supplies together?

Adaptations:

- For groups the same activities apply, but encourage teammates to plan out their designs in advance
- For younger ages you can guide them through some of the challenges if they are getting stuck. Very young children may need to be shown how to use a binder clip
- Older groups could have an added limited time challenge added with additional restrictions such as you can only use x of a certain supply

Tips and Tricks:

The nice part with these materials is they are all reusable! If someone gets stuck or their structure falls apart, encourage them to think about what worked well and what they didn't like about their original design before trying again.

References or Other Links:

- Design Process
- Architecture
- inspiration: 5 Engineering Challenges with Clothespins, Binder Clips, and Craft Sticks - Frugal Fun For Boys and Girls (frugalfun4boys.com)