

OPERATION Design Challenge

Leader Guide

Style
ENGINEERS

Fashion
through science

WITH THIS ACTIVITY

- At a Glance
- Design Challenge Handout
- Creating Teams Handout
- Team Jobs Handout
- Testing Checklist Handout
- Poster
- Sketchstorming Template - EDP



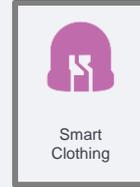
We are
Engineers!



Movement
Improvement



Marvelous
Materials



Smart
Clothing



Patternmaking
Tools n' Tech

Big Picture

Young designers apply key concepts from all of the modules by creating a design prototype.

What's the goal?

Young designers will investigate potential solutions to a design challenge and construct a prototype garment which addresses the requirements of the design challenge using the engineering design process (EDP).

This activity typically is the culmination of multiple activities (e.g. one to two activities from each module) and references concepts about the EDP, movement, adding LED lights to garments, insulation, impact protection, and patternmaking and construction of a garment. We suggest that you complete (at least) one activity from each module before completing this capstone activity.

Materials

What they need: (per group)

- Design Challenge Handout
- Creating Teams Handout
- Team Jobs Handout
- Testing Checklist Handout
- Regular paper
- Pencils
- Colored Pencils
- Pencil Sharpener
- Duct tape
- LED bulbs, coin cell batteries, battery holders, conductive thread (See supply section at end)

Supplies to Share

- Variety of fabrics
 - Various textures, structures, and thicknesses, etc.

...Materials continued on next page

Preparation Time: 1 Hour

Activity Time: 3-6 Hours

Difficulty: Level 4



Preparation

1. Choose one of the Design Challenges
2. Prepare and lay out all the supplies.
3. Print all handouts for each group.
4. Prepare big sheets of paper for brainstorming.
5. Put up the Engineering Design Process poster

Grouping

Young designers are in groups of 3-5, with one leader per group. (Work with same group that they have worked with for other activities, or create a new group).

Included with this activity is a *Creating Teams* Handout students fill out prior to this activity (or at the beginning of the program, if using the same groups throughout) to identify their strengths and interests to help you create well-balanced groups.

Stage 1: Let's Get Started!

1. Have each team of young designers choose a team name!
2. Choose one (of three) design challenges and introduce the final project
 - **Say to the designers:** *Similar to real-world engineers, this project requires strong teamwork, design, construction, testing, and communication. Before we begin the design and creation stages, let's take a look at the Engineering Design Process and gather some information about the project.*
3. Review the EDP and re-iterate that the young designers should follow each step.

Materials (Continued)

Supplies to Share (Continued)

- Variety of non-fabric materials, e.g.
 - Foam, egg cartons, cardboard, paper
 - Craft Foam
 - Plastic dryer vent tubing
 - Zippers, buttons
 - Any material that can be cut, and is safe to work with – be creative!
- Decorative materials
 - Glitter, pipe-cleaners, felt, yarn
- Hot glue gun
- More duct tape – fun colors
- Fabric Glue
- Safety Pins
- Sewing Machines – threaded

4. Direct the designers to read the final project design challenge:

- **Say to the designers:** *Remember, you have already explored each of the things your garment needs to do, but now we need to figure out how to put them all together into one outfit.*
- **Say to the designers:** *Instead of asking ‘what do we want to design?’ ask ‘why do we want to design that?’ and ‘what problem (or need) will our design ultimately be solving?’*

5. Ask the designers to discuss the design challenge in their group.

- *What is the problem? What does the design need to do?*

Clarify any remaining questions the groups have about the design challenge and what they are supposed to do.

VOCABULARY

Brainstorming: Ways to solve specific problems, gather information, stimulate creative thinking, and develop new ideas through unrestrained and spontaneous group discussion.

Stage 2: Brainstorming

6. Brainstorm the final garment (see *Sketchstorming* activity) design.

7. To start the brainstorming process for the final project, use a big sheet of paper with sections for each requirement (see below) and sketch templates. Reference any prior brainstorming sessions (big papers).

Prepare big sheets of paper that look like this for the brainstorming sessions:

How will you meet the design requirements?	Sketches
Movement & Mobility:	
Wearable Electronics:	
Insulation & Impact Protection:	
Patternmaking:	
Make it look good!	

8. Have teams generate as many ideas on the big paper and the sketch templates as they can. Spend 10-15 minutes on this.
 - a. **Say to the designers:** *Think about all the activities you have done and everything you have learned up to this point. Try to come up with as many ideas as you can that combine all these concepts into one garment design!*
- Once teams have generated a handful of ideas, it is time to converge to one idea. Spend approximately 20 minutes on this part. At the end of that time, teams should have a ‘final’ sketch that the group would like to assemble.
 - o **Say to the designers:** *Now that you have lots of ideas, as a team you should decide on one design for your first prototype. It can be a combination of lots of different designs. Draw out one final sketch that your group would like to assemble. Write down your inspiration for this design.*
9. Leaders should help the teams through this process and make sure that it remains diplomatic and that every voice is heard!
10. Have a representative from each team come to the front of the room to present the idea to the rest of the teams, including their inspiration for each feature.
 - o **Ask:** *Why did you choose this idea? Encourage questions from other leaders and designers.*
11. Give the teams a little more time to refine their ideas after the Q&A (if necessary).
12. Use the *Team Jobs* handout to assign roles within the groups or prototype assembly. Direct the designers to the handout and have them self-select their roles.
 - **Say to the designers:** *Good design teams break down the responsibilities to individuals. Pick the role you would like to perform on the team. Remember, all members of the team should participate in everything, but it is good to have one person keeping track of each assigned role.*
 - **Jobs include:** *Materials Specialist, Sewing Specialist, Electronics Specialist, Stylist, and Reporter.*

Stage 3: Create, Test, Refine

13. Have teams plan how they will accomplish the task (e.g. what needs to happen first, what can happen at the same time, etc.).
14. Get the attention of the group to introduce the next steps of the design challenge, and to define 'prototype'.
 - **Say to the designers:** *Now, you have the opportunity to start creating a prototype design. A prototype is used to test different aspects of a product before the design is finalized. For example, a team of engineers designing a new running shoe might produce several cardboard and paper prototypes to illustrate how the final product would look.*
 - *New designs often have problems, so once your team is done constructing your prototype, test it using the checklist. If it does not meet your requirements, re-design and re-test. Engineers often do this many times before determining the final solution to a problem.*
 - *On the table you have many possible construction materials. Be safe with scissors, hot glue, sewing machines, etc.*
 - *Challenge your team to use the full time allowed, testing and revising until your prototype is very good!*

Stage 4: Runway Show & Presentations

15. Conclude the project with a Runway Show (see Engineering the Runway activity)
 - **Say to the designers:** *The final challenge will be for your model to present your design. You can develop a dance routine to show off your brilliant design, or simply have the model do a model walk so everyone can admire your team's work!*
 - *The reporter will give us the final report on the garment by answering questions according to the Fashion Show Script. It is the job of the entire team to come up with the answers, but the reporter is the one who will write it down in a script!*
 - **Now it is time to experiment with the materials and begin constructing your prototype design!**
16. Leaders work hands-on helping the teams execute the vision for their final projects. See if you can help them keep on track by coming up with alternate methods of construction. Leaders also make sure that the teams go through each step of the Engineering Design Process, especially the testing and revising steps.
17. Warn the teams when there is 1 hour left.

Supply Specifics

Component	Description	Picture	Suggested Sources
Coin Cell Battery Holder	<ul style="list-style-type: none"> Battery holder for 3V, CR2032, 20mm coin cell batteries for sew-on use. 		<ul style="list-style-type: none"> www.digikey.com www.sparkfun.com
Coin Cell Battery	<ul style="list-style-type: none"> CR2032 3V 20.0mm 		<ul style="list-style-type: none"> www.digikey.com www.Amazon.com
LEDs	<ul style="list-style-type: none"> 3mm LEDs in assorted colors (note that different colors use different voltages. Should be no more than 2.2v) 		<ul style="list-style-type: none"> www.digikey.com www.Amazon.com
Conductive Thread	<ul style="list-style-type: none"> Conductive thread, 2 ply Lame Lifesaver sells a 200 yd. spool cost efficient for quantities. For small amounts on cards or bobbins see the other suppliers 		<p>Lame Lifesaver: http://members.shaw.ca/ubik/thread/order.htm</p> <ul style="list-style-type: none"> Ships from Canada – so allow extra time for shipping! www.sparkfun.com www.adafruit.com Both of these suppliers sell smaller quantity bobbins and cards.