

A photograph of an astronaut in a white space suit with an American flag patch on the sleeve, floating in space. The astronaut's helmet is visible, and the background is the dark void of space with some distant stars and a faint view of Earth's horizon.

3Doodler[®] EDU

Design Challenge

3D High-Tech Fabrics

Facilitator's Guide

🚩 The Challenge

Using the 3Doodler, plastic strands, a material of your choice and conductive thread and LEDs, create a new fabric that solves a high-tech problem under water, in space or in extreme cold or heat.

👁️ Overview

⌚ Total Time: 150 minutes (3 Class Periods)

This challenge explores how high-tech fabrics are made and why they are needed, for everything from underwater exploration to protecting firefighters and synthetic skin. Use this challenge as a quick sprint to investigate the qualities of 3D printing and fibers. Participants can explore the use of the 3Doodler to support fibers through frameworks, protection of connectors or interlayers. Show examples of high-tech fabrics. Feel free to include aluminum foil or plastic bags as material options in addition to fabrics.

⚡ Challenge Background

💡 Take It Further

Use the sample textiles created in this Design Challenge as a starting point or proof of concept for a bigger product design project.

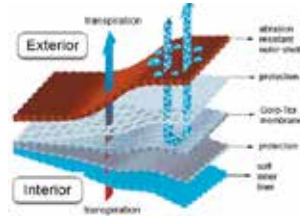


Fig.1



Fig.2

What is fabric? We mostly think of fabric as the cloth that makes up our jeans and t-shirts. But fabric can be very high tech. Fabric can be made to repel water, like Gore-Tex, to stop bullets, like Kevlar, or used in cell and tissue repair, like nanofibers. Fabrics can be woven, knitted, felted or melted into sheets. New trends in e-textiles incorporate electronic components, LEDs or even remote signaling into clothing, backpacks and location devices.

✂ Materials & Tools

🕒 Before You Start Doodling

We recommend using a DoodlePad or clear tape placed over paper as a foundation to keep your Doodles in place and so that you can peel them off with ease.



- A.** 3Doodler Pens and Plastic Strands of various colors (one per student, or have students work in pairs or small groups)
- B.** Tools (from your 3Doodler box) plus needle-nose pliers or scissors for snipping plastic ends
- C.** Clear plastic tape or DoodlePad for Doodling foundation
- D.** Paper for Doodling foundation and extra sketching/note-taking space
- E.** Drawing utensils (markers, pens or pencils)
- F.** Camera or video recording device to document the Challenge and results
- G.** Wide variety of fabric scraps
- H.** Plastic bags, aluminum foil or felt
- I.** Yarn or string and various size sewing needles
- J.** Conductive thread, tape or marker, LEDs and watch batteries.

📅 Challenge Organization

✂️ Remember to Snip Those Ends

We recommend pliers or scissors for snipping plastic ends. Make sure to keep your plastic ends clean to prevent clogs and jams. Snip plastic after removing it from the 3Doodler pen to make sure it's clean for the next time.

Challenges are organized into 50-minute periods so they can fit into a traditional classroom structure, or be combined into a single workshop with breaks in between activities. This Challenge is designed to have participants work in short sprints to quickly explore the concepts.

🖥️ Class 1: Investigate & Imagine

🕒 Total Time: 50 min.

🔍 Investigate (🕒 25 min.)

Step 1: In teams of two, investigate the qualities of different types of fabrics.

Consider the following questions:

- How does the fabric's construction influence how it is used?
- Which fabrics are stretchy and which are stable?
- Are the fabrics translucent or opaque?
- Does the fabric come in different thicknesses?

Step 2: Choose an extreme environment such as underwater, outerspace, extreme cold or heat, or any other extreme environment and research how different fabrics have been constructed and used in those environments.

💬 Imagine (🕒 25 min.)

Step 1: With your knowledge of fabrics and your extreme environment, think of ways your fabric would be useful in that particular environment:

- What are all of the things that could go wrong in your extreme environment?
- How could a new fabric supply the solution?

Step 2: Working as a team, draw out 10 quick ideas that can help you communicate or solve the problem your team will explore.

Step 3: Play with the 3Doodler and see how you would use the plastic strands to make your fabric ideas work.

📝 Facilitator's Notes

In Class 1, guide participants through their investigation by having them go through the qualities of high-tech fabrics. Show resources where they can find examples on the web and locate high-tech fabrics as well as "low-tech" fabrics, such as cotton, leather, wool and silk, which are used in everyday products to touch and analyze. Fabrics can be found in bandages and sterile gauze as well as in clothing, accessories, packing materials and bags. Bring enough pieces for everyone to explore. Consider using leftover scraps or having a fabric collection day to minimize waste and save costs.

📷 Challenge Documentation

Take photos & videos of your process using a camera. Document what to do and what not to do. Share your experience with the online community using #3DoodlerEDU!

🖥️ Class 2: Build

🕒 Total Time: 50 min.

🧱 Build (🕒 50 min.)

Step 1: Decide which problem your team will solve from the fabric ideas developed during the Imagine phase.

Step 2: Working with the 3Doodler and plastic strands, as well as plastic bags or aluminum foil, conductive thread and LEDs, experiment with creating your fabric.

As you make your fabric, consider these questions:

- What kind of structure will it take?
- How will it integrate other technology?
- How will it be attached to other materials?

📝 Facilitator's Notes

In Class 2, participants will use the 3Doodler and any other materials provided to bring their ideas to life. Help participants think through the qualities of the plastic strands and the other materials and which would be their best application. If participants get stuck, have them analyze fabrics being used in these extreme environment currently and ask them to consider how could they improve them with new features.

🖥️ Class 3: Test, Present & Reflect

🕒 Total Time: 50 min.

📊 Test (🕒 30 min.)

Step 1: Now it's time to test out your fabric for strength, flexibility and resilience.

Step 2: Make last minute improvements to your fabric based on the results of Step 1.

Step 3: Discuss how your team will present the fabric. Write up a quick summary of your research and testing methods.

📝 Facilitator's Notes

In Class 3, participants will have time to test and improve their high-tech fabric prior to their presentation. Have participants make any last minute changes and prepare a demonstration for the group presentation and reflection session.

🗨️ Present & Reflect (🕒 20 min.)

Step 1: Present your fabric and your test findings to the whole group.

Step 2: Discuss what worked, design obstacles you faced, and how your team would improve the fabric for a future version. Provide feedback using the "I Like, I Wonder, I Wish" model. Don't forget to record video and take pictures of your final product.

🔗 More Information:

For further information and inspiration about the high-tech fabrics, visit:

- <http://goo.gl/ls4Ssm>
- <http://goo.gl/XQ0mdj>

🖼 Images:

Cover Page: <https://goo.gl/E6DEJZ>

Fig. 1: https://upload.wikimedia.org/wikipedia/commons/9/94/Goretex_schemaen.png

Fig. 2: https://pixabay.com/static/uploads/photo/2015/03/11/15/19/divers-668777_960_720.jpg