

Putting the 'E' in STEM by making applied science, technology, and math come alive through the [NAME] digital library. [Pre-College Resource/ Curriculum Exchange/ Resource Exchange]

Mrs. Stephanie Weber, University of Colorado, Boulder- College of Engineering and Applied Science

<https://ncwit.org/profile/stephanie-weber/>

<https://www.linkedin.com/in/stephaniedonatonweber>

Dr. Lyn Ely Swackhamer, University of Colorado Boulder

Dr. Lyn Swackhamer is the PI on the NSF funded Teach Engineering grant. Teach Engineering is a digital library of K-12 engineering education materials. Dr. Swackhamer has a PhD in education innovation with an emphasis on research and evaluation methodology. She has been the Director of Aspirations Evaluation at NCWIT for the past 9 years.

Putting the 'E' in STEM by making applied science, technology, and math come alive through the Teach Engineering digital library.

PRE-COLLEGE RESOURCE • CURRICULUM EXCHANGE • RESOURCE EXCHANGE



Partial Design
Process

Grade Level: **6** (6 - 8)

Time
Required: **5 minute Design
Challenge**

Subject
Areas: **Biology
Problem Solving**



**MS-ETS1-2
MS-ETS1-4
MS-LS1-8**

NGSS
Performance
Expectations:

Scan here
for the full
activity:



Access the
Engineering
Design
Process here:



HANDS-ON ACTIVITY

Helping Hands: Engineering Solutions for Multiple Sclerosis

Learning objectives

After this design challenge students should be able to:

- Design and prototype an assistive device to help MS patients hold a pencil and write.
- Apply the engineering design process, including brainstorming, testing, and iterating on their designs.

Instructions

Biomedical engineers design tools to help people with their daily activities. Your challenge is to design a device that can help someone with MS hold a pencil and write.

Criteria

- Must hold a pencil securely.
- Must be easy to use (i.e., can be put on and taken off easily).

Constraints for device

1. Cost – must cost less than \$5 worth of materials.
2. Materials – may only use the items provided.
3. Time – must be built in 5 minutes.
4. Size – must be sized to work for middle school students to adults.

Available Material	Cost/item
Craft stick	\$1.00
Straw	\$1.00
String (30cm)	\$1.00
Rubber band	\$0.50
Pipe cleaner	\$1.00
Note card	\$0.50
Playdough	\$1.00
Tape (30 cm)	\$0.50
Cotton balls	\$0.50

Imagine:

Brainstorm by sketching your design ideas.

Build

Build your device. (You will have 5 minutes to build.)

Analyze your device:

Design successes: Which parts of your design worked? Why do you think they worked?

Design failures: Which parts of your design did not work? Why do you think they did not work?

Constraints: If you had more time, what would you change?



Activity extensions

1. Advanced Design Challenge: Have students design a more complex assistive device for other tasks affected by fine motor skill loss, such as buttoning a shirt or using utensils.
2. Guest Speaker: Invite a healthcare professional or biomedical engineer to talk about their work with MS patients and assistive technology.
3. Math Integration: Incorporate a math activity where students calculate the cost of materials and budget for creating multiple devices, practicing real-world math skills.

Activity scaling

For younger grades: Instead of designing a device, ask students to modify a pre-made grip (e.g., foam, rubber tubing) to make it easier for someone to hold a pencil.

Helping Hands Rubric

Criteria	Needs Improvement (1)	Satisfactory (2)	Very Good (3)	Excellent (4)
Holds Pencil Securely	Device fails to hold the pencil securely.	Device holds the pencil with some wobbling.	Device holds the pencil securely with only minor wobbling.	Device holds the pencil firmly with no wobbling.
Ease of Use	Device is difficult to use and requires a lot of effort. It cannot be put on and taken off easily.	Device is somewhat easy to use but requires significant effort.	Device is relatively easy to use, requiring moderate effort.	Device is very easy to use, requiring minimal effort to operate. It can be put on and removed easily.
Cost Efficiency	Exceeds \$6 worth of materials.	Uses materials worth \$5.50-6.00.	Uses materials worth \$5.	Uses materials worth less than \$5.
Size Appropriateness	Device is not suitable for the intended hand size range of user.	Device is somewhat suitable, needing significant size adjustments.	Device is mostly suitable, with minor size adjustments needed.	Device size is perfectly suitable for a range of users from middle school students to adult.
Collaboration	I rarely worked well with my team, sharing few ideas and not listening to others.	I occasionally worked well with my team, sharing some ideas but not always listening.	I usually worked well with my team, sharing ideas and mostly listening to others.	I consistently worked well with my team, sharing ideas and listening to others.

Scan to access the Helping Hands Rubric



Thousands of engineering resources including standards aligned activities, lessons, professional development opportunities and ways to join the Engineering Community of Practice with the Teach Engineering Digital Library-can be found at teachengineering.org.