

STEM WEEK	I'd Like to Be A Prosthetists	Biomedical Engineering
Topic	Artificial Hand Activity	
Learning Outcomes	Through completing the artificial hand activity, students design and build a prosthetic hand that can hold a ping pong ball.	
ISTE Student Standards	<p>1.4 Innovative Designer - Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions</p> <p>1.4a Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p>1.4b Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p>1.4c Students develop, test and refine prototypes as part of a cyclical design process.</p> <p>1.4d Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.</p>	
MA STE Frameworks	<p>The Science and Engineering Practices</p> <ol style="list-style-type: none"> 1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematical and computational thinking 6. Constructing explanation and designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information <p>ETS1. Engineering Design</p> <p>4.3-5-ETS1-3. Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of the tests to redesign a model or prototype.</p> <p>4.3-5-ETS1-5(MA) Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.</p> <p>6.MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit possible solutions.</p> <p>6.MS-ETS1-5(MA) Create visual representations of solutions to a design problem. Accurately interpret and apply scale and proportion to visual representations.</p> <p>6.MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution.</p> <p>7.MS-ETS1-7(MA) Construct a prototype of a solution to a given design problem.</p> <p>ETS2. Materials, Tools, and Manufacturing</p> <p>6.MS-ETS2-2(MA). Given a design task, select appropriate materials based on specific properties needed in the construction of a solution.</p>	

<p>Targeted Academic Language</p>	<p>biomedical engineer: A person who blends traditional engineering techniques with the biological sciences and medicine to improve the quality of human health and life.</p> <p>contracting: (of a muscle) To become shorter or tighter in order to affect movement of the body.</p> <p>engineer: A person who applies his/her understanding of science and math to creating things that benefit humanity and our world.</p> <p>muscular system: The anatomical system of a species that enables its movement.</p>
<p>Materials and Resources</p>	<ul style="list-style-type: none"> ● Milkshake straws ● Paper clips ● Pipe cleaners ● String ● Thread ● Modeling clay ● Paper towel Rolls ● Thin cardboard ● Scissors ● Rulers ● Glue or hot glue (depends on time available) ● Plastic or rubber rings ● Ping Pong Balls
<p>Resources</p>	<p>The Musculoskeletal System</p> <p>Artificial Hand Activity Deck</p> <p>Design Sheet</p>
<p>Essential Question</p>	<p>If a part of the human body is missing or doesn't function properly, can we create a tool to replace/support that function?</p>
<p>Pre Guiding Questions</p>	<p>What role do your muscles play in your body machine? What types of motion does your hand do? What happens if you injure (pull or tear) your bicep? What materials could we use to act as an artificial hand?</p>
<p>Instructional Procedure</p>	<p>Introduction (30 minutes)</p> <ul style="list-style-type: none"> ● Begin the lesson by having a class discussion using the Pre-Guiding questions. No correct answers are needed at this time - students should simply be sharing their current knowledge. Questions will be answered throughout the lesson. ● Use The Musculoskeletal Deck to introduce students to how our muscles and bones function in the body

	<p>Lesson Development (40 minutes)</p> <ul style="list-style-type: none"> ● Use the Artificial Hand Activity to review the engineering design process with the students. ● Let the students know what materials are provided, and the criteria and constraints for the device. Suggested constraints are provided in the Lesson 1.7 Deck or you and the students can develop your own. ● Give the students 10 minutes to design their hand using the Design Worksheet. Once you have approved the design, students can gather their materials and start constructing. ● Give students about 25 minutes to build their designs. ● Test the hand function by having students try to pick up a ping pong ball using the hand ● Give students the opportunity to engage in the full engineering design process by having them come up with a way to improve their hand and redesign their prototype. Allow them to modify their existing hand or rebuild if necessary. <p>Wrap Up/Closing (10 minutes)</p> <ul style="list-style-type: none"> ● Clean up any all materials ● Have a class discussion around what made certain designs work well. Talk about how the students could improve their designs. ● Have students reflect on the activity as a whole. What worked well? What didn't work? Suggestions for changes?
Assessments	Artificial Hand Design Sheet Complete model hand
Accommodations/ Differentiation	<ul style="list-style-type: none"> ● Read-aloud ● Scribing ● Peer support ● Google Translate
Instructional Tips/ Strategies	<p>Do the activity yourself, before trying it with students. Keep the supplies organized throughout the activity Provide students with time checks throughout the activity Offer a prize to the team whose bicep has the most force or most distance</p>
Reflection/Next Steps	<p>Did the students provide any suggestions that could be incorporated in future activities? How will you know if the students retained any of the information today? Were the students engaged? If not, what could you do differently next session? If they were engaged, what specific parts of today's lesson worked well? Did you provide enough differentiation so that all students were able to work at their level?</p>
Notes	