

Hands on Engineering Activity 3

Topic: Basic Biomechanics

Learning Objective: Constructing a mechanical hand out of paper/cardboard and string *A lot of students wanted to do this project after seeing the example model in class.* Mechanical engineering and some biomedical engineering. Basic biomechanics of the hand. Overlap between understanding biology and implementing engineering.

Alignment with NGSS Grades 3-5

Performance Expectations and Disciplinary Core Ideas for Engineering Design

- 3-5 ETS 1-1 Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, and cost.
- 3-5 ETS1-2 Generate and compare possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Crosscutting Concepts and Connections to Engineering, Technology, and Applications of Science

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Science and technology support each other. Tools and instruments are used to answer scientific questions, while scientific discoveries lead to the development of new technologies.

Materials:

- Construction paper and/or cardboard (whichever is more available)
- String
- Tape
- Scissors
- Straws

Detailed Description

- Activity
 - Brief discussion of mechanical and biomedical engineering
 - Talk about real-life examples like robotic prosthetic hands
 - Lesser known examples like metal hips and implants
 - Some of the considerations that must be made
 - Biocompatibility and biomaterials → infection

- Timeline of biomedical device development
- Project – give students construction paper and/or cardboard and guide them in constructing a mechanical hand, including proper joint locations, number of fingers, and movement using the strings
 - Talk a little bit about the biomechanics of the hand and the complexities involved
 - Give a brief overview of what the project needs to have, and ideally show an example, but for the rest of the time let it be a bit more independent and help when necessary
- Clean up & discuss
 - Gauge what students learned during the lesson about biomedical engineering and mechanical engineering
 - Ask what other topics they would be interested in learning more about and doing projects on

How will you conclude the lesson to enforce the learning objective:

Ask students what they learned from the activity today. What kinds of observations did they have? What adjustments did they have to make when working on the project?

What science process skills will this lesson exercise?

Gaining hands-on experience and dexterity in constructing something, Being able to mentally consolidate different disciplines: bioengineering = mechanical engineering + biology

Safety precautions

Scissors, Paper or cardboard cuts