

Biomechanical and Biomedical Engineering

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CDE Standards

1st Grade

Standard: 2. Life Science

2. An organism is a living thing that has physical characteristics to help it survive

2nd Grade

Standard: 2. Life Science

2. Each plant or animal has different structures or behaviors that serve different functions

5th Grade

Standard: 2. Life Science

2. Human body systems have basic structures, functions, and needs

Objectives

The lesson is designed as a brief introduction to biomechanical and biomedical engineering. The students will be exposed to the concepts like the structure and functions of the human body, human-machine interfaces, prosthetic design, etc. The main goal is to accustom the students to think of the human body in an engineering context. This activity is aimed at students in the 3rd - 5th grades.

Materials

- Youtube videos:
 - Man Moves Robotic Hand with Mind <http://www.youtube.com/watch?v=ppILwXwsMng>
 - Ekso Bionics' Suit <http://www.youtube.com/watch?v=pzRmNYA8LIYm>
 - Oscar Pistorious – Getting Back on Track <http://www.youtube.com/watch?v=tKNeOttyAsk>
- AV system (projector, speakers, etc)

Pre-Activity Prep

This activity is designed to introduce the students to biomedical and biomechanical engineering in general, and assistive device engineering in particular. A pre-activity discussion of what is a disability, and why do they occur can help focus the students. If

Activity

The activity is designed to be a short introductory lesson to biomechanics, and basically consists of viewing the videos, and leading a short discussion on each one. Some pointers are below.

- Before starting the video viewing, a quick overview of the way the human body moves is a good idea. Stress the role of the skeleton as a support structure, the role of muscles as actuators (motors) that move the bones around, and the role of the brain as the "command and control" center.
- Guide the kids in a discussion on what happens to a person when one or more of the body systems discussed stops functioning properly. Obvious examples are amputations and paralysis.
- Explain that engineering is not just an abstract concept, but a very real way to bring about tangible results that can drastically improve the quality of life of people in need of help.

- Break up the students into small groups, and ask them to brainstorm some possible designs to help a person regain the ability to move in the case of paralyzation. Guide the team discussions as necessary, attempting to include current solutions (wheel chairs), as well as future possibilities (exo skeleton). Ask the teams to share their solutions and discuss each on as time allows.
- Play the first video, which details the efforts by a group of engineers to replace a man's lost hand with a robot prosthetic controlled by his nervous system.
- Guide a post-video discussion on the concepts introduced in the video. Ask the students to identify the specific problem addressed in the video, as well as the challenges discussed.
- The next two videos follow a similar format as the first. Both showcase a technical solution to a biomechanical or biomedical issue. Each one should be followed up by a group discussion of the key concepts addressed in the video. The fact that scientific and mathematic principles are being applied to help people in a very direct way should be stressed.

Modifications

To simplify or shorten the lesson, cutting out one or more videos is recommended.

Post Activity Evaluation

- Ask the students to describe the role of various body systems (muscles, bones, brain)
- Ask the students to describe ways to help an amputee regain the function of his legs (wheelchair, prosthetic leg, etc.)