

WHAT IS ENGINEERING?

Lending a Hand:
Teaching Forces through Assistive Device Design Activity
EDP Assistive Hand Device Presentation

ENGINEERING IS...

...the application of science, math and technology, to design and build solutions for everyday problems.



...the creation of things to benefit society.

ENGINEERING DESIGN PROCESS

The formal, iterative process used to design and build solutions, often explained in 5-8 steps.

Also called EDP.



EDP VOCABULARY TERMS

Formal —

The steps of the design process are followed in a particular order (clockwise)



EDP VOCABULARY TERMS

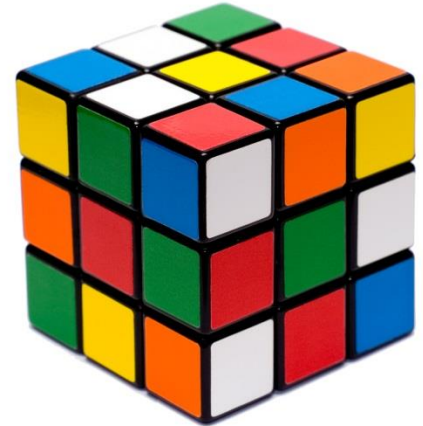
Iterative —

- Repetitive
- The Steps of the EDP may be conducted many times, resulting in the generation of many designs and prototypes.



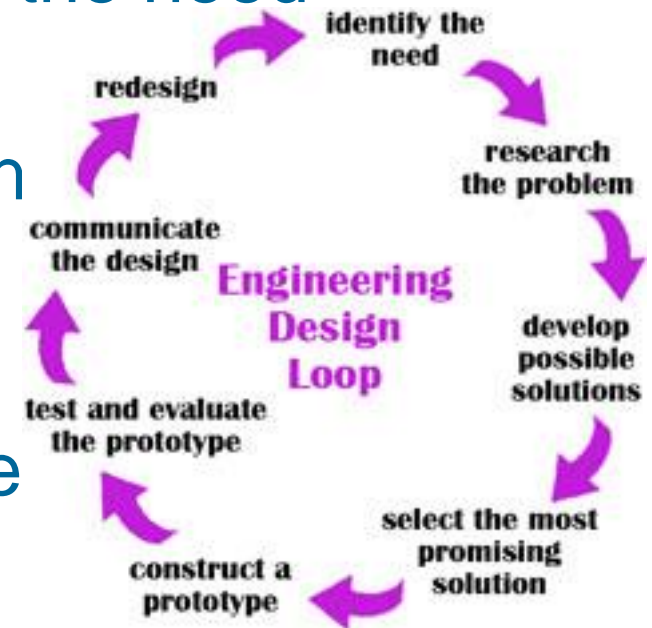
WHAT IS ENGINEERING?

- A body of knowledge
- A practice
- A field
- A way to solve today's challenges



ENGINEERING DESIGN PROCESS

1. Define the problem/Identify the need
2. Research the problem
3. Brainstorm/develop solution
4. Select the solution
5. Build/construct prototype
6. Test and evaluate prototype
7. Communicate the design
8. Redesign (as needed)



EDP VOCABULARY TERMS

Criteria —

A limitation or restriction



EDP VOCABULARY TERMS

Constraint —

- Standards against which something must be judged
- Minimum expectations assigned for a design

ENGINEERING DESIGN PROCESS

1. Define the Problem/Identify the Need

- Make clear the need for a solution.
- Identify the criteria and any constraints.



THE PROBLEM: CLIENT STATEMENT



The doctor hires you to design and build an assistive device (hand). Due to cerebral palsy, a fine motor disorder, a 12 year-old boy has difficulty conducting everyday activities.

- Assistive hand device can grip a cup that increases in weight.

CLIENT'S CRITERIA

- Must be able to grip a cup, that increases in weight.
- Cup gripped must contain at least 200 ml of sand.
- Must look somewhat similar to the human hand.
- Can be manipulated with hands.
- Costs equal to, or less than, \$50.00.
- Is completed in 5 days.



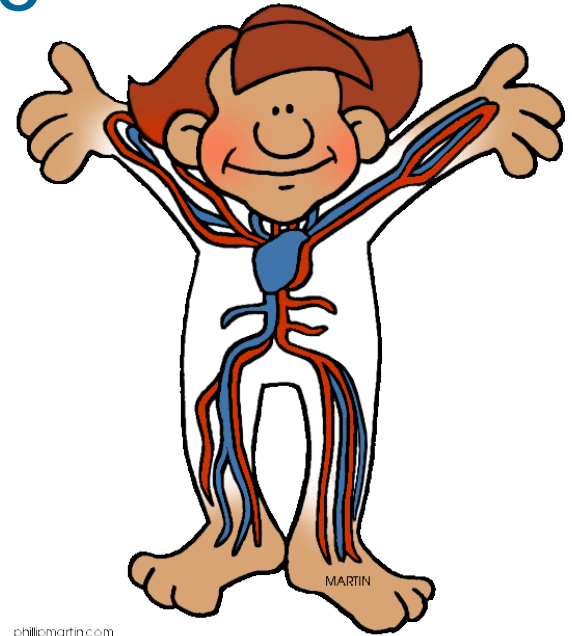
BIOMEDICAL ENGINEER

A person who uses knowledge in the STEM fields, particularly engineering and medicine, to create solutions that improve the health and quality of life for human beings.




BIOMECHANICS

The study of the motions of the human body, especially of the forces exerted by muscles on the skeletal structure.



ENGINEERING DESIGN PROCESS

2. Research the Problem

- Collect information about concepts relevant to the problem statement.
 - Take notes (in own words) from valid sources.
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REVERSE ENGINEERING

The process of conducting research on how a solution (object or process) works, in order to understand what works well and what does not work well.




Research relevant topics:

- the structure of the human hand
- the function of the human hand

And then:

Conduct *reverse engineering*:

- assistive hand devices that have already been invented
 - assistive technologies for gripping cups
 - the pros and cons of both (above) technologies
- 

REMEMBER...

In your research,
consider the *materials*
you will use and their
costs per unit



ON NOTEBOOK PAPER

Pros

Cons



BUDGET

- A determined quantity that must be considered in design and testing plans
- A constraint




ENGINEERING DESIGN PROCESS

3. Brainstorm Solutions

Generate ideas that will solve the problem (as defined in step 1, *Define the Problem/ Identify the Need*).



BRAINSTORMING RULES

1. Generate as many ideas as possible.
 2. Withhold judgment and be respectful.
 3. Encourage wild ideas.
 4. Build on others' ideas as much as possible.
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ENGINEERING DESIGN PROCESS

4. Select the Best Solution

Pick one design that will best **solve the problem.**

*All members of the design team **must agree** to start with this choice.*



ENGINEERING DESIGN PROCESS

5. Build Prototype

Followed by



6. Test and Evaluate Prototype

Observe and collect data on how your design performs, whether criteria are satisfied.



EDP VOCABULARY TERMS

User —

A person using the solution

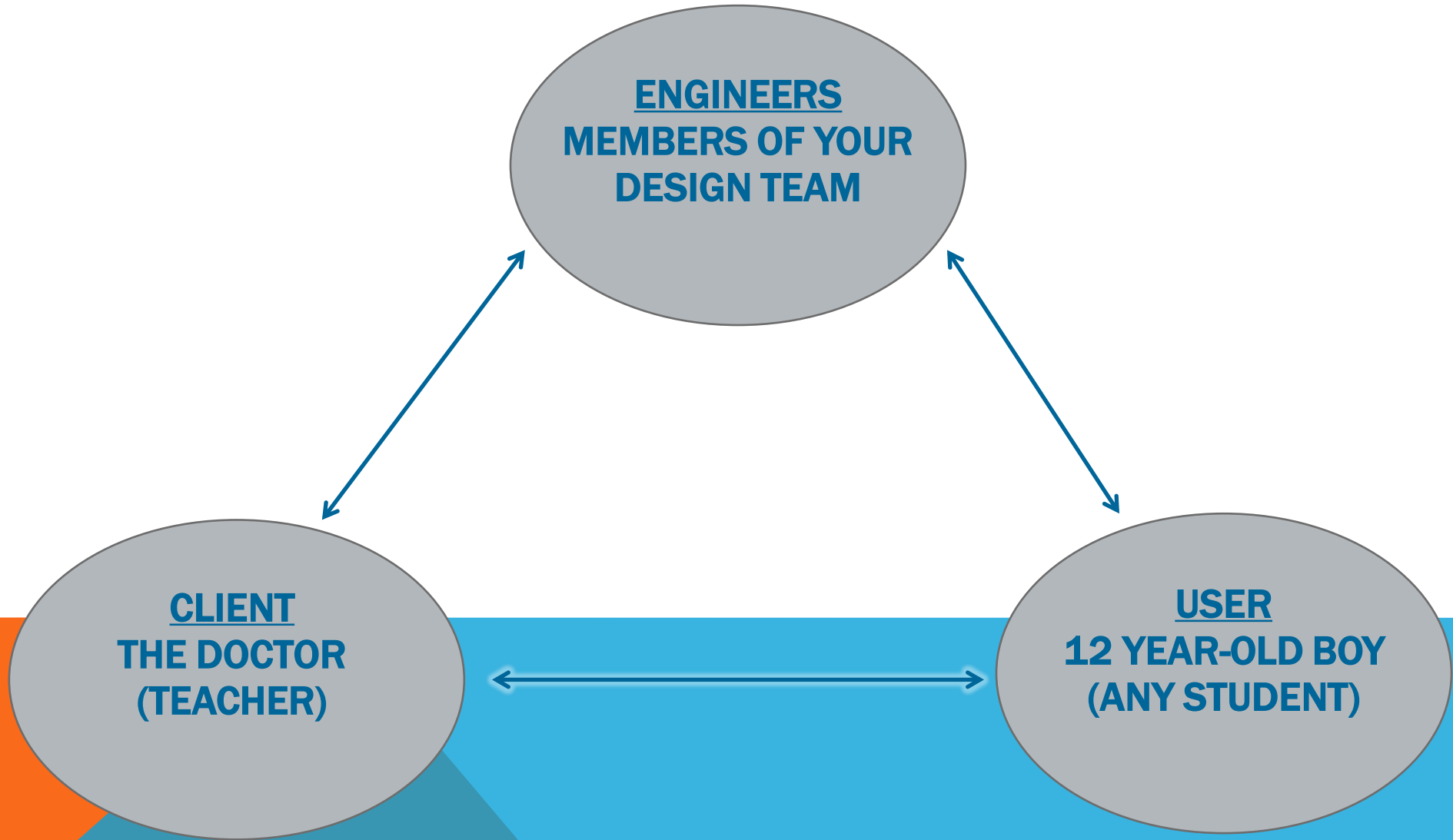
Client —

A person who hires the engineer

Engineer —

A person who designs solutions

STAKEHOLDERS



ENGINEERING DESIGN PROCESS

7. Communicate the Design

Communicate to other(s) about how your prototype performed in the test, and why.



ENGINEERING DESIGN PROCESS

8. Redesign

Go back to any step in the EDP and revise your prototype, according to feedback from step 7, *Communicate the Design*.

