

Teaching the Engineering Cycle Through a Series of Projects

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The Engineering Course

- ❑ One semester long junior and senior elective
- ❑ Students have had introductory classical mechanics (but no rotational motion)
- ❑ Many students have not had calculus, a few have not had trig or vectors
- ❑ Students have a wide variety of building skills
- ❑ Many but not all of the students are thinking about majoring in engineering in college

The Engineering Course

- ❑ Focus more on what a practicing engineer does and less on formal engineering coursework (very little math or CAD in the course)
- ❑ Final project is student developed to address one of the UN SDG's in some small way

Course History

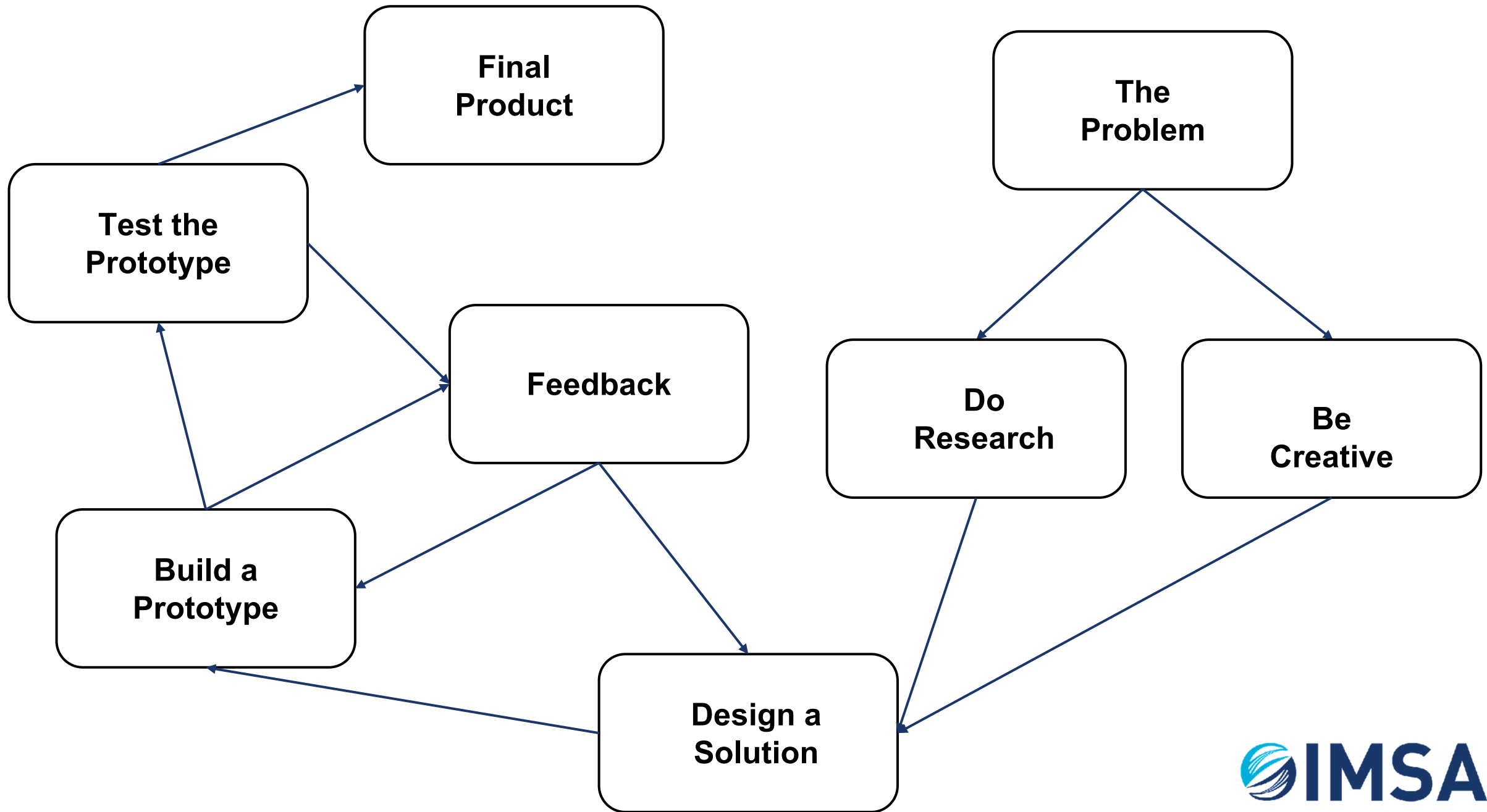
Began as a series of shorter, 2-week projects, followed by the long-term project

Over time, repetition of the engineering cycle formalized

- Alternative energy alpha and beta cycles
- 3-stage windmill design and construction
- Multiple round airplane modification and assessment
- Balsa wood cranes
- Lego Mindstorm robots

The Engineering Cycle

A lot of the course is focused on having the students go through the engineering cycle multiple times in different ways.



Balsa Wood Cranes

Pre-Project lessons and assignments:

- 1) Lesson on torque
- 1) Lesson on stress vs strain, how things break, and different types of stresses
- 1) Groups design and measure a different type of stress (tension, compression, torsion, shear, or bending) acting on the balsa wood

Balsa Wood Cranes

Goal: To build a balsa wood structure to hold a **Load** at a **Height** above the table top.

Rules:

1. The base of the crane must only contact the table within a 10 cm x 10 cm square
2. The bottom of the load must be supported above specified Height
3. The center of the load must be at horizontal **Distance** (usually 5 cm) outside the base of the crane

Materials and Supplies:

- A set number of pieces of balsa wood (0.125" x 0.125" x 36")
- One 500 g counterweight mass (cannot be a permanent part of your crane)
- Balsa wood cutter or box cutter and a ruler
- Glue to join your pieces of balsa wood together

Balsa Wood Cranes

Crane 1: Individuals, 2 sticks, 300 g load, 20 cm high, 20 points

Crane 2: Pairs, 4 sticks, 400 g load, 30 cm high, 30 points

Crane 3: Three groups of 8, 10 sticks, competitive with minimum Load, Height, and Distance, 40 points

Crane 4: Whole class, 30 sticks, score based on LxHxD, 200 min design and prep time, 45 min build time, 60 points

Airplane Project

Round 1

Assemble kit or home made design.

Optimize for distance or for accuracy

Establish best performance baselines

Round 2

Make modifications

Test

Assess Improvement, either category

Round 3

Super plane groups

Thoughts or Questions?

What projects could you do this with in your classes?