Bite of Science

Engineering and 3D Printing

in

K - 12

Agenda

Industrial Engineering
3D Printing
Personal Background
K-12 Engagement

What is Industrial Engineering

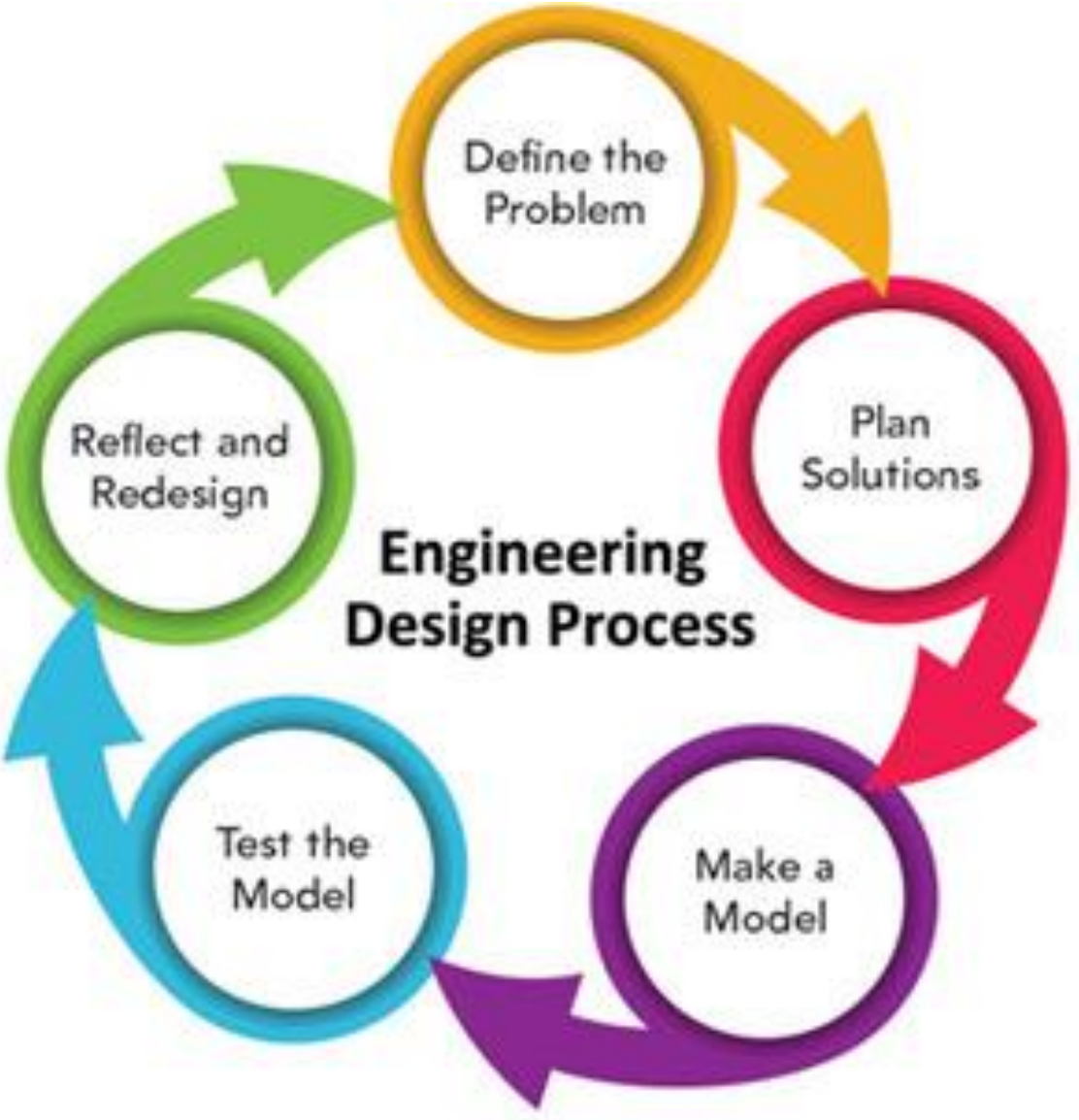
“Engineers make things. Industrial Engineers ***make things better****.”*

- Institute of Industrial Engineers

What is Industrial Engineering

Systems
Efficiency

“Making business decisions using math.”



What is Industrial Engineering

Scheduling
Quality Control
Use of Limited Resources
Cognitive Processing
Job Physiology
Manufacturing

What is 3D Printing

Additive Manufacturing

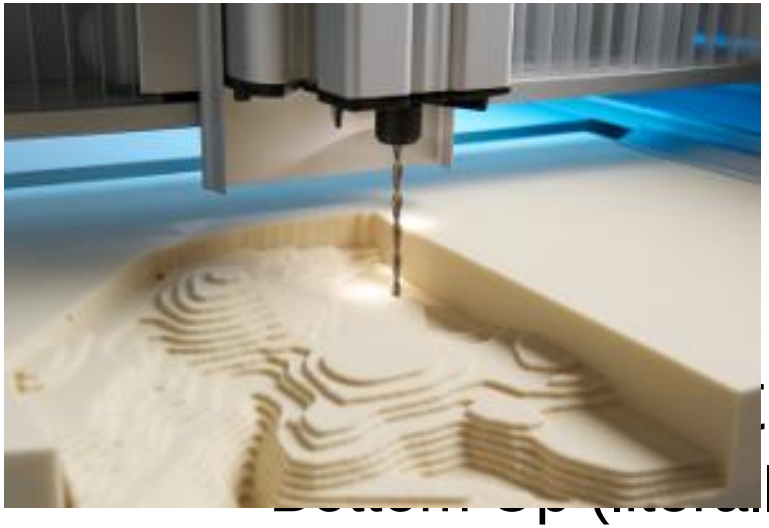
Process of ***joining materials*** to make objects ***from a 3D model***

- Different processes
- Different modeling techniques/capabilities
- Different end-uses

What is Additive Manufacturing

Traditional (subtractive) Manufacturing:

Top Down



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What is 3D Printing

Many Different Flavors

Concept has been around a long time

1860: Willeme

- Photosculpture method to recreate pictures in 3D

1890: Blanther

- Layered method to create topographical relief maps

1951: Munz

- Basis of stereolithography techniques introduced

1968: Swainson

- 3D polymerization with laser beams

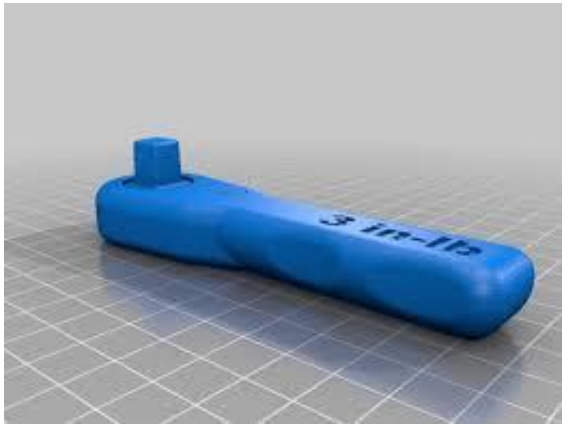
What is 3D Printing

- Today
  - Technology cost/capability boom
- Materials
  - Thermal
  - Wood
  - Skin
  - Joint-Replacements
  - Food

What is 3D Printing

Think → Design → Print
...or find someone else's design
...or scan it (...maybe)

AUTODESK®
123D® DESIGN



Personal Background

- Born in Rochester, NY
- Undergraduate in Berea, OH
  - BA in Business Administration
- Graduate in Buffalo, NY
  - MS and PhD in Industrial Engineering
  - Certificate in GIScience
- Faculty at Texas A&M University (2008 – 2015)
  - Industrial and Systems Engineering

Personal Background

- US-educated STEM student
  - Didn't love math...tolerated it
  - Graduate school minority
- Observations
  - Intangibles widely and significantly lacking
    - Communication, note taking, “think before doing”
  - Uncomfortable with estimation
    - “Back of the book” syndrome
    - No single answer

K-12 Engagement

- High School is too late
  - Visits to 11th and 12th grade classes is RECRUITMENT, not OUTREACH
- Late elementary and early middle school
  - Still excited by STEM, not “socially disuaded”
  - Beat the “brussel sprout” mentallity
    - Active versus Passive Interest
- Teaming is vital

K-12 Engagement

- Started raised3D in 2013 @ Texas A&M
  - 2-week middle school summer camp
  - 3D Printing as the application
- Consulted with Hand2Mind
  - Engineering consultant (not anymore...no COI)
  - K-5 class manipulative development/refinement

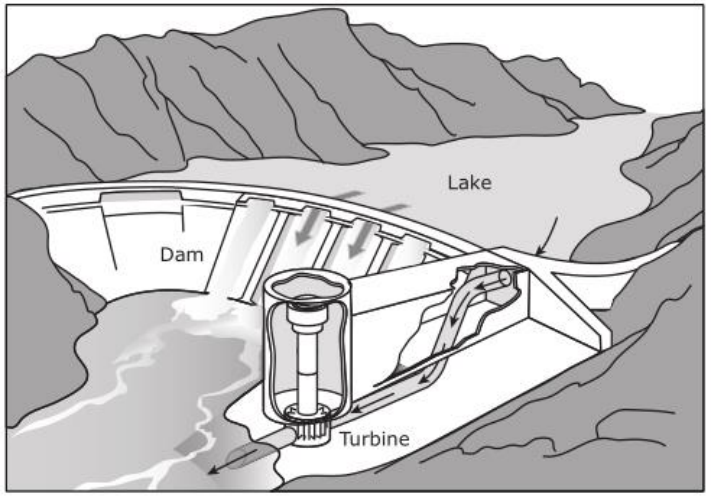
K-12 Engagement

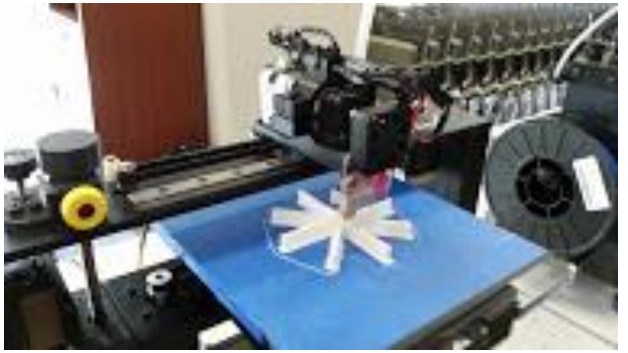
- raised3D
  - Everything is team-based and team-involved
  - Iterative
    - Conceive, critique, prototype, resolve, manufacture
  - Stress communication (report-outs to entire group)
  - Map to curriculum
    - Texas had TEKS
    - South Carolina has STEM and STEAM contiuum
    - Common Core
    - Next Generation

K-12 Engagement

Example Project

SC Grade 6 Science Standard 6.P.3 Physical Science: Energy Transfer and Conservation





K-12 Engagement

- Hand2Mind
  - Reconceptualized existing modules
  - Developed new modules centered on engineering
  - Hands-on emphasis
  - Team-based
  - Enabling iterative evaluation
  - Reusable materials

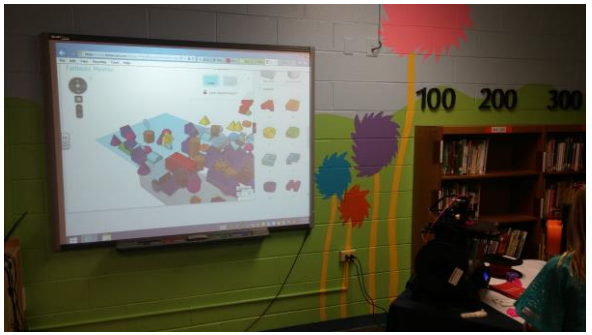
K-12 Engagement

Example Module

4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric current.

In Closing

Engineering
- Iterative
- Team-based
- Additive



Francis Marion University wants to partner Industrial Engineering (4-year BS program)

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