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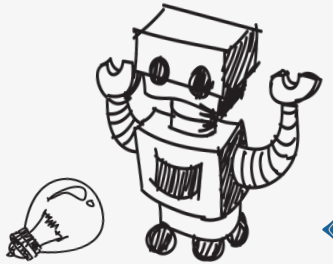
TRY Engineering

Lesson Plan:

Cracking the Code



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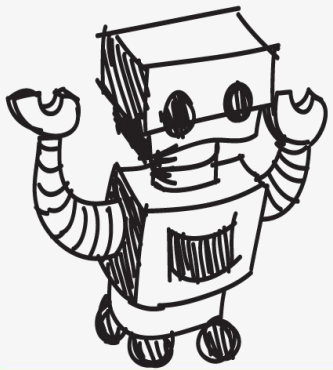
The Design Challenge



The Design Challenge

You are a team of engineers given the challenge to identify problems associated with the current barcode system and propose a new system or product to improve the current barcode system.

Material

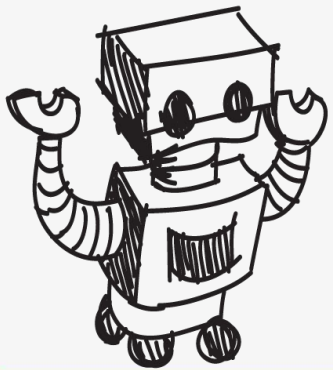
Materials – Required

- Barcodes from five different products
- Access to Internet
- Paper

Consider...

- Before you get started building, consider three shortcomings of the current barcode system (for example, sometimes the barcode is scratched and the computer can't pick it up, or sometimes the check-out person has to run it across two or three times before the computer picks it up).

Reflect & Debrief



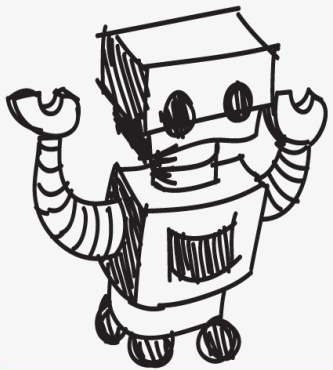
Reflection

- How do you think technology, and the introduction of barcodes have impacted the day to day life of check-out personnel at grocery stores? What's easier? What's harder?
- Barcodes on medicine bottles or tubes help alert people to side effects and guidelines for taking their medication. How do you think this impacts society?
- What ethical considerations would engineers discuss about barcoding blood donations?
- What computer errors could negatively impact society through the barcode system? Give examples?

Reflection

- How could a computer or software engineer help prevent errors in the barcode system?
- What other applications can you think of where engineers could develop equipment to embed important information? More ethical implications?

Engineering Design Process



The Engineering Design Process

Learn about the engineering design process (EDP). The process engineers use to solve problems.

(Video 1:47)

Source: TeachEngineering YouTube Channel http://www.youtube.com/watch?v=b0ISWaNoz-c

Engineering Design Process

- Divide into teams
- Review the challenge and criteria & constraints
- Brainstorm possible solutions (sketch while you brainstorm!)
- Choose best solution and build a prototype
- Test then redesign until solution is optimized
- Reflect as a team and debrief as a class

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Productive Failure

- The engineering design process involves productive failure: test, fail, redesign. Iterate again and again until you have the best possible solution.
- It is important to document iterations to keep track of each redesign. Use the engineering notebook to sketch ideas, document iterations and any measurement and/or calculations.
- It’s also important to showcase the fact that there can be multiple solutions to the same problem. There’s no one “right” solution.

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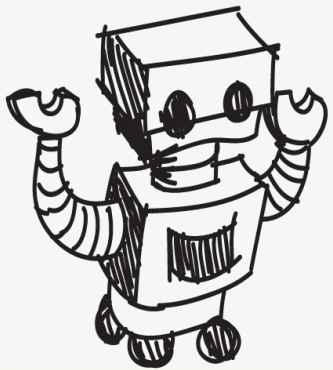
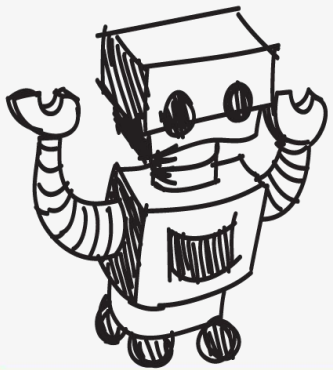
Vocabulary



Vocabulary

- Barcode Reader: Optical scanner that can read barcodes
- Constraints: Limitations with material, time, size of team, etc.
- Criteria: Conditions that the design must satisfy like its overall size, etc.
- Engineers: Inventors and problem-solvers of the world. Twenty-five major specialties are recognized in engineering (see infographic).
- Engineering Design Process: Process engineers use to solve problems.
- Engineering Habits of Mind (EHM): Six unique ways that engineers think.
- Iteration: Test & redesign is one iteration. Repeat (multiple iterations).
- Prototype: A working model of the solution to be tested.
- UPC: Stands for Universal Product Code, which is a barcode

Dig Deeper



Dig Deeper into the Topic

Internet Connections

- American Mathematical Association: The Digital Revolution - Barcodes http://www.ams.org/publicoutreach/feature-column/fcarc-barcodes1)
- Barcode Lookup (https://www.barcodelookup.com/)

Recommended Reading

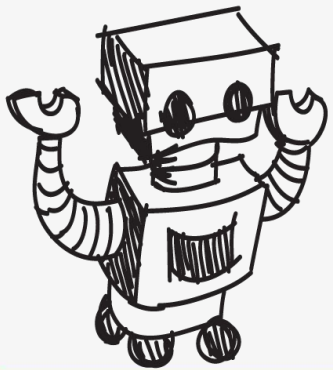
- Revolution at the Checkout Counter: The Explosion of the Barcode (ISBN: 0674767209)
- Code: The Hidden Language of Computer Hardware and Software, by Charles Petzold (ISBN: 0735611319)
- Raising the Bar [Code]: The Value of Auto-ID Technology (ISBN: 0324300786)

Dig Deeper into the Topic

Writing Activity

- Younger Students: Write an essay or a paragraph describing whether or not you think there were more errors in charging for items at a grocery store before or after the implementation of the computer scanned barcode system.
- Older Students: Write an essay or a paragraph describing how running a grocery store would be different if there were no barcodes? Explain what it might have been like to conduct an inventory listing in 1960. How has computer engineering changed the shopping experience?

Engineering Fields



What is Engineering?

Learn about engineering and how engineers are creative problem solvers and innovators who work to make the world a better place.
(Video 3:43)

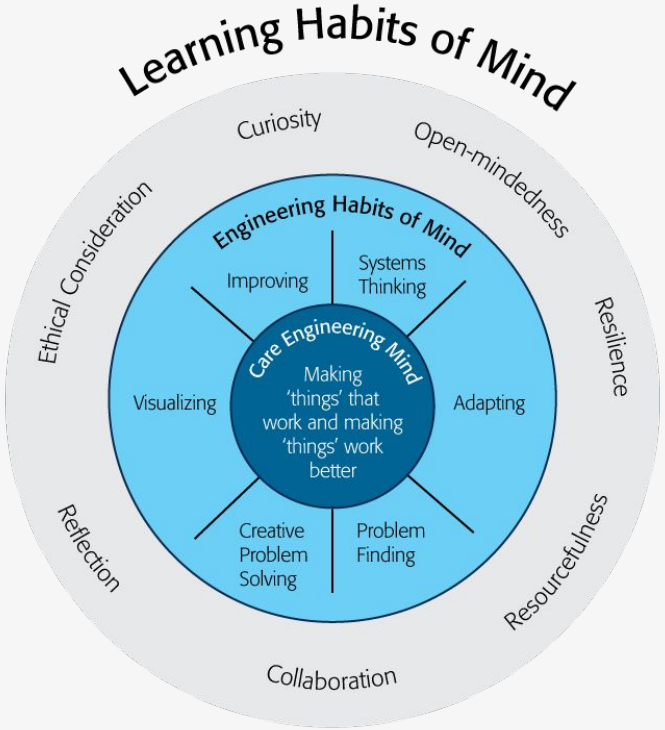
Source: TeachEngineering YouTube Channel - http://www.youtube.com/watch?v=H9VDkvqGmVo

Related Engineering Fields

- There are several types of engineering fields that are involved with barcode systems. Here are just some of the related engineering fields.
  - Software engineering
  - Computer engineering

- Download the Engineering Fields Infographic How will **YOU** change the world?

Engineering Habits of Mind



Engineering Habits of Mind (EHM) is about how engineers think everyday. The Core Engineering Mind is about making things that work and making them work better.

Source: https://online-journals.org/index.php/i-jep/article/view/5366)

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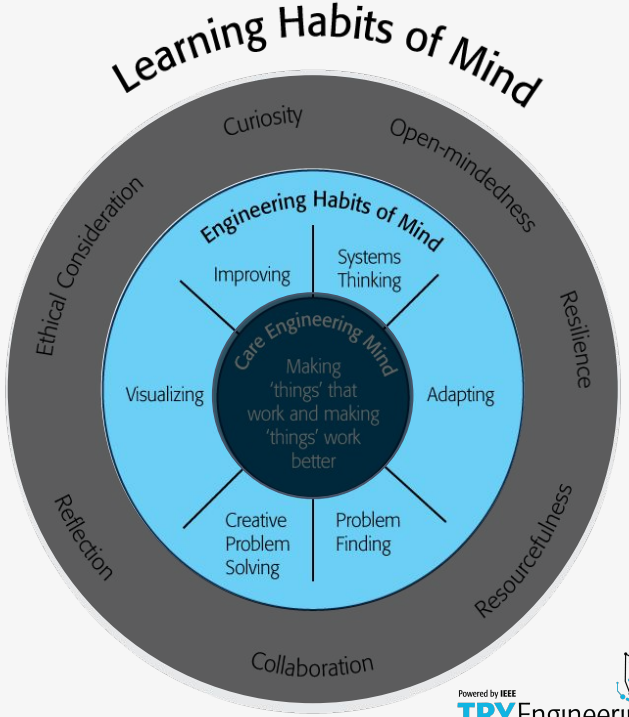
Engineering Habits of Mind Checklist

- ❑ **Systems thinking**
- ❑ **Problem-finding**
- ❑ **Visualising**
- ❑ **Improving**
- ❑ **Creative problem-solving**
- ❑ **Adapting**



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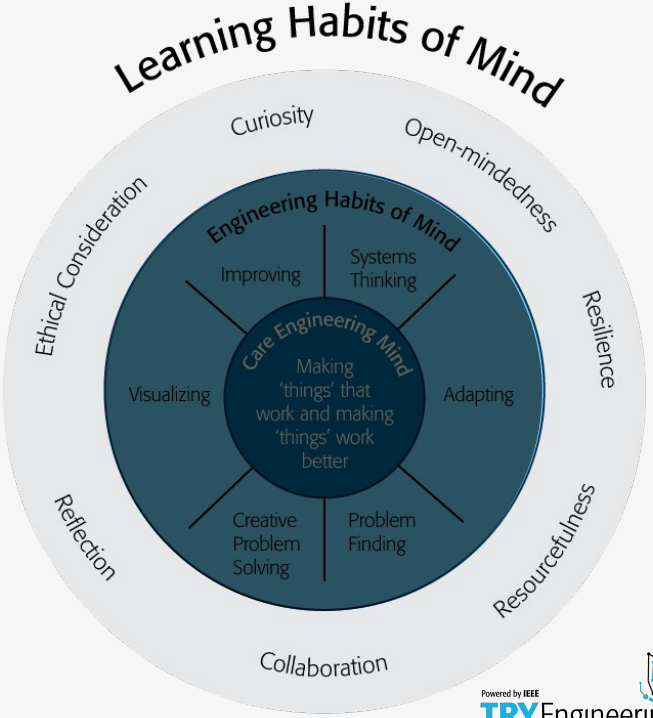
Learning Habits of Mind Checklist

- ❑ **Open-mindedness**
- ❑ **Resilience**
- ❑ **Resourcefulness**
- ❑ **Collaboration**
- ❑ **Reflection**
- ❑ **Ethical Consideration**
- ❑ **Curiosity**



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Greatest Engineering Achievements of the 20th Century

Source: http://www.greatachievements.org/

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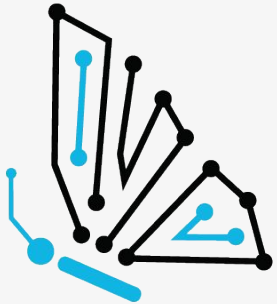
Learn more about how engineers make the world a better place

For more engineering lesson plans and resources like games, engineering careers, and STEM opportunities visit IEEE's TryEngineering.org



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