Engineering and the Louisiana Science Standards

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Objectives:

- Introduce the new Louisiana Science and Engineering practices.
- Demonstrate how to incorporate engineering practices into a lesson plan based on the new standards.
- Give participants an opportunity to create a lesson plan that incorporates engineering practices based on the new standards.

Rate your knowledge of Engineering Practices in the New Louisiana Science Standards

	I understand and could explain the topic to others.	4
	I understand and can work on my own.	3
	I understand but I still need a little help.	2
	I am finding this tricky.	1

Science and Engineering Practices in the New Louisiana Science Standards

1. Asking questions (science) and **defining problems (engineering)**
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematical and computational thinking
6. Constructing explanations (science) and **designing solutions (engineering)**
7. Engaging in argument with evidence
8. Obtaining, evaluating, and communicating information

Science and Engineering Practices in Action

- Start with a Disciplinary Core Idea (engineering challenges should be a part of a larger unit)
- Engage Students by Introducing Problem
- Build Science Content Knowledge
- Use Engineering Challenge to Apply Knowledge

Science and Engineering Practices in Action

➢ Start with a Disciplinary Core Idea(s)

NATURAL HAZARDS
A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (UE.ESS3B.a)

DEVELOPING POSSIBLE SOLUTIONS
Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (ETS.UE.1B.a)

Science and Engineering Practices in Action

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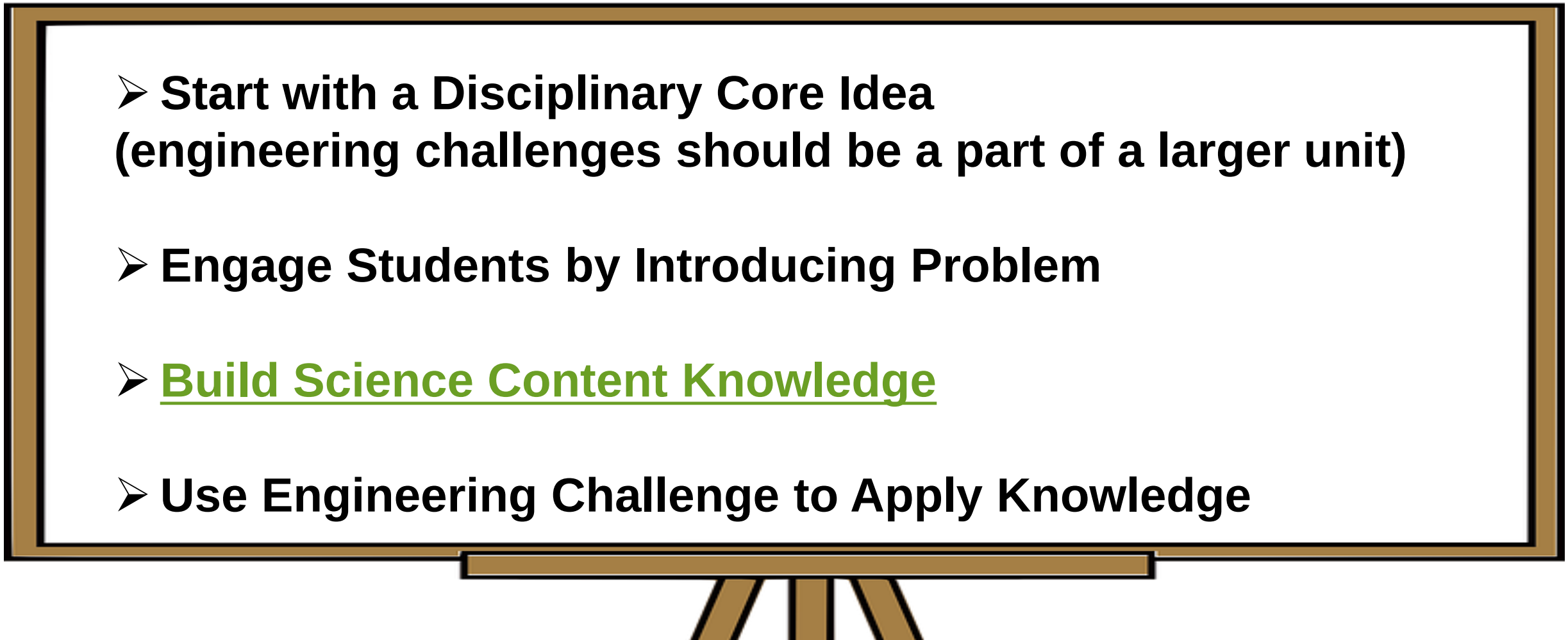
Science and Engineering Practices in Action

➢Engage Students by Introducing Problem

Discuss at your table:

- ❑ **What do you think caused the damage seen in pictures?**
- ❑ **What causes the natural hazard responsible for damage?**
- ❑ **What do you know about those natural hazards?**
- ❑ **Could anything have been done to minimize the damage?**

Science and Engineering Practices in Action



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Science and Engineering Practices in Action

➢Build Content Knowledge

- ❑ Provide instruction relating to disciplinary core idea
- ❑ Goal of instruction is for students to master content
- ❑ Mastery of content will be demonstrated through engineering design challenge

Science and Engineering Practices in Action

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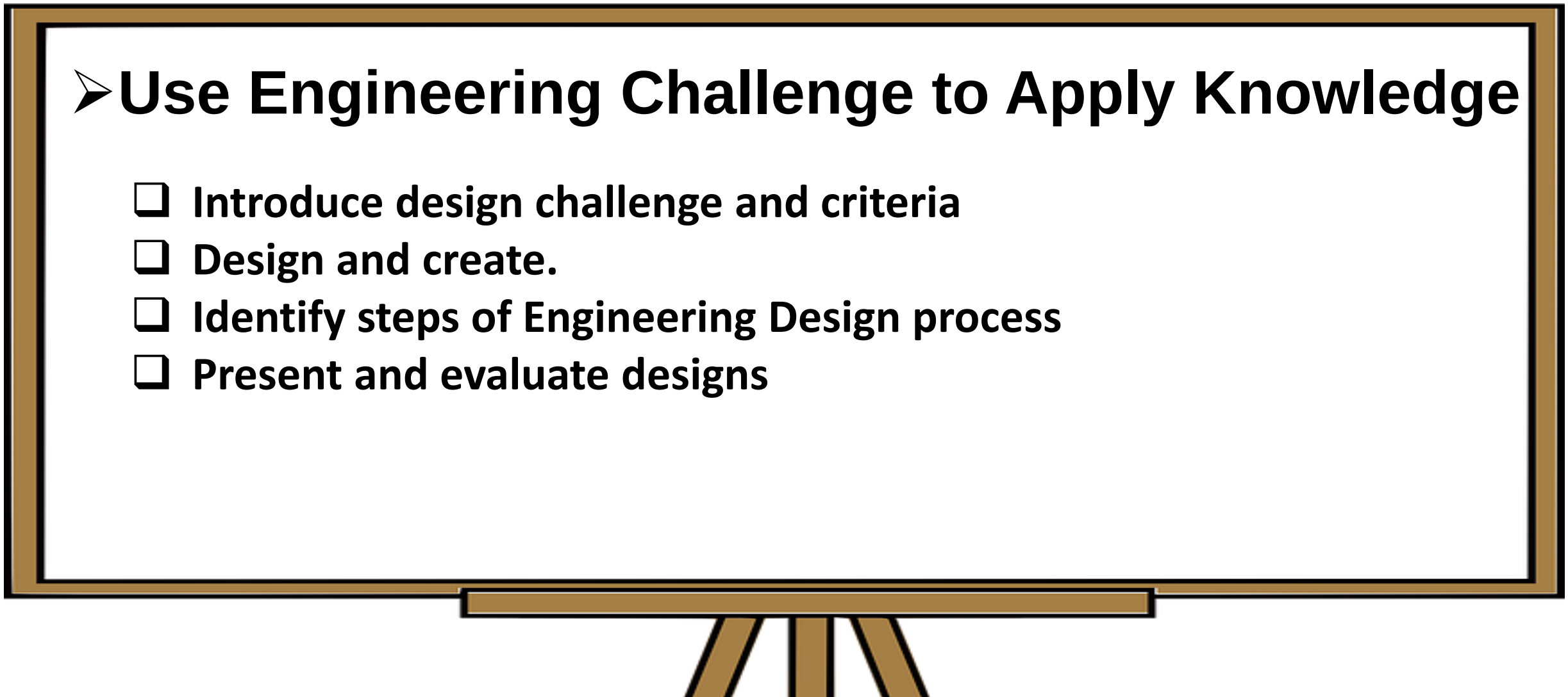
Science and Engineering Practices in Action

➢Use Engineering Challenge to Apply Knowledge

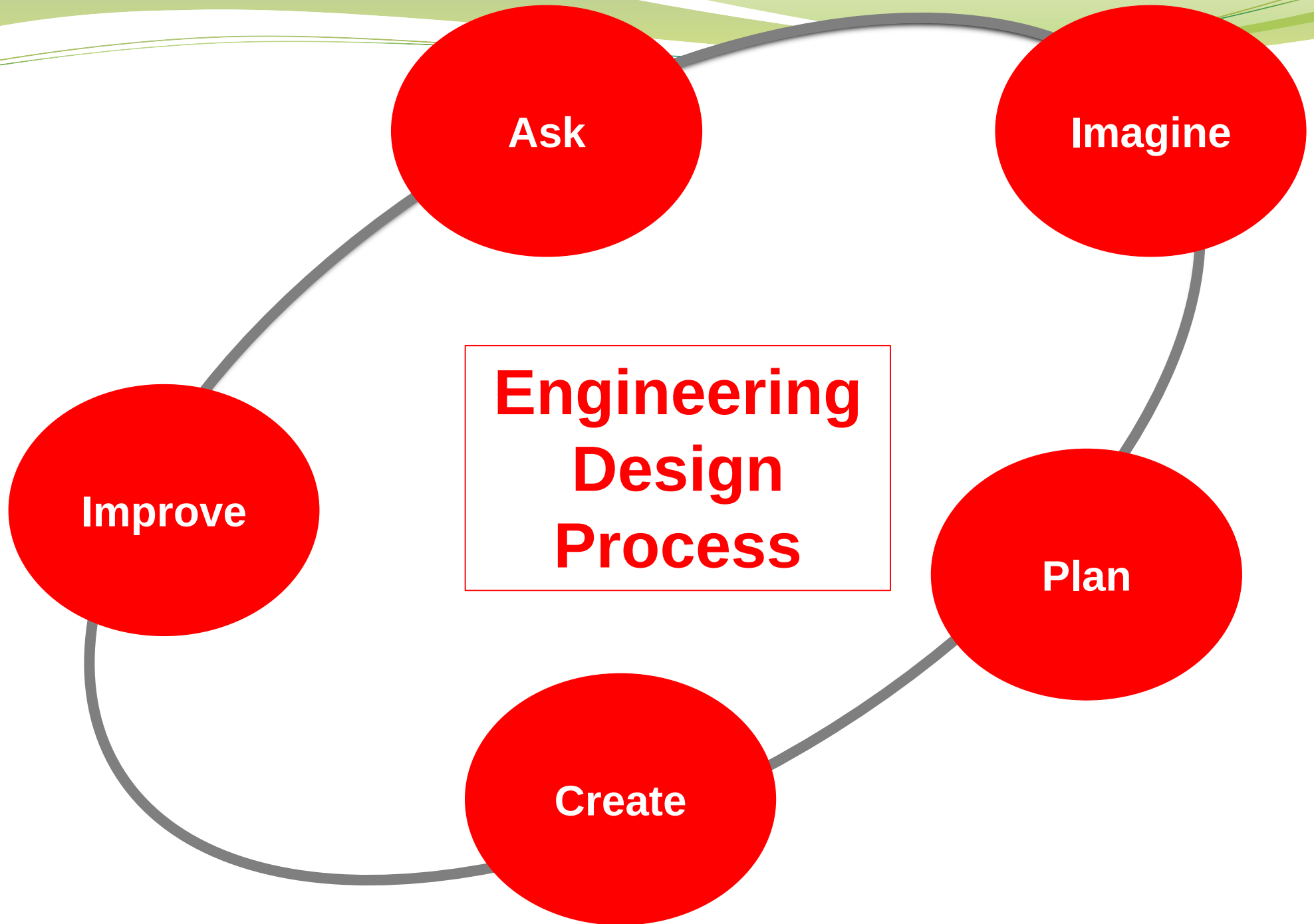
- ❑ Introduce design challenge and criteria
- ❑ Design and create.
- ❑ Identify steps of Engineering Design process
- ❑ Present and evaluate designs



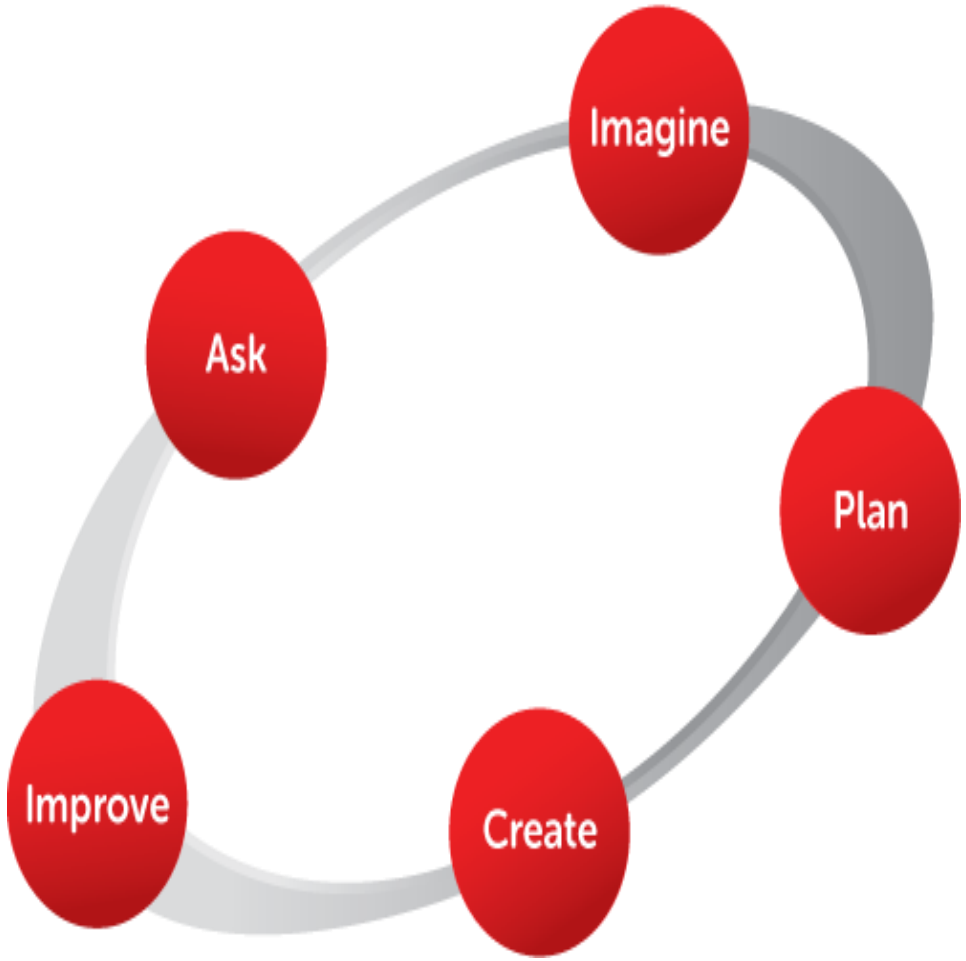
Science and Engineering Practices in Action

➢Design Challenge

- ❑ Criteria: Develop a roofing system for a house that can prevent water from entering.
- ❑ Constraints: Time, Materials
- ❑ Evaluation: Measuring amount of water that entered
- ❑ Variations: Assign cost to materials, Amount of water, Pressure of water


Ask
Imagine
Improve
Engineering Design Process
Plan
Create

Engineering Design Process



ASK: What is the problem? What do we already know (*content knowledge*)? What are our constraints?

IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.

PLAN: Draw a diagram. Make a list of supplies.

CREATE: Follow your plan. Test your design.

IMPROVE: What works? What doesn't? Modify your design to make it better.

Challenges with Challenges

TEACHERS	STUDENTS
Letting Go	Freedom
Effective Questioning	Redefining failure
Staying Focused on Purpose	Staying Focused on Criteria

Science Investigations vs. Engineering Process

Using chart paper compare and contrast a Science Investigation with the Engineering Process you used in the activity.

Science Investigation	Engineering Design Process

Similarities:

Science Investigations vs. Engineering Process

Science Investigation

- Use these materials (aluminum foil, craft sticks, straws, felt) to determine factors that create resistance to liquids.

Engineering Challenge

- Use these materials (aluminum foil, craft sticks, straws, felt) to design a waterproof roofing system.

Note: See Handout #1 Distinguishing Science Practices From Those in Engineering

Science Investigations vs. Engineering Process

- If students are trying to answer a question, they are doing science.
- If they are trying to solve a problem, they are doing engineering.

What does this look like in a Lesson Plan? (5E Model)

SCIENCE	ENGINEERING
ENGAGEMENT	ASK
EXPLORATION	IMAGINE and CREATE – draw a diagram
EXPLANATION	CREATE – test your design
ELABORATION	IMPROVE
EVALUATION	EVALUATION

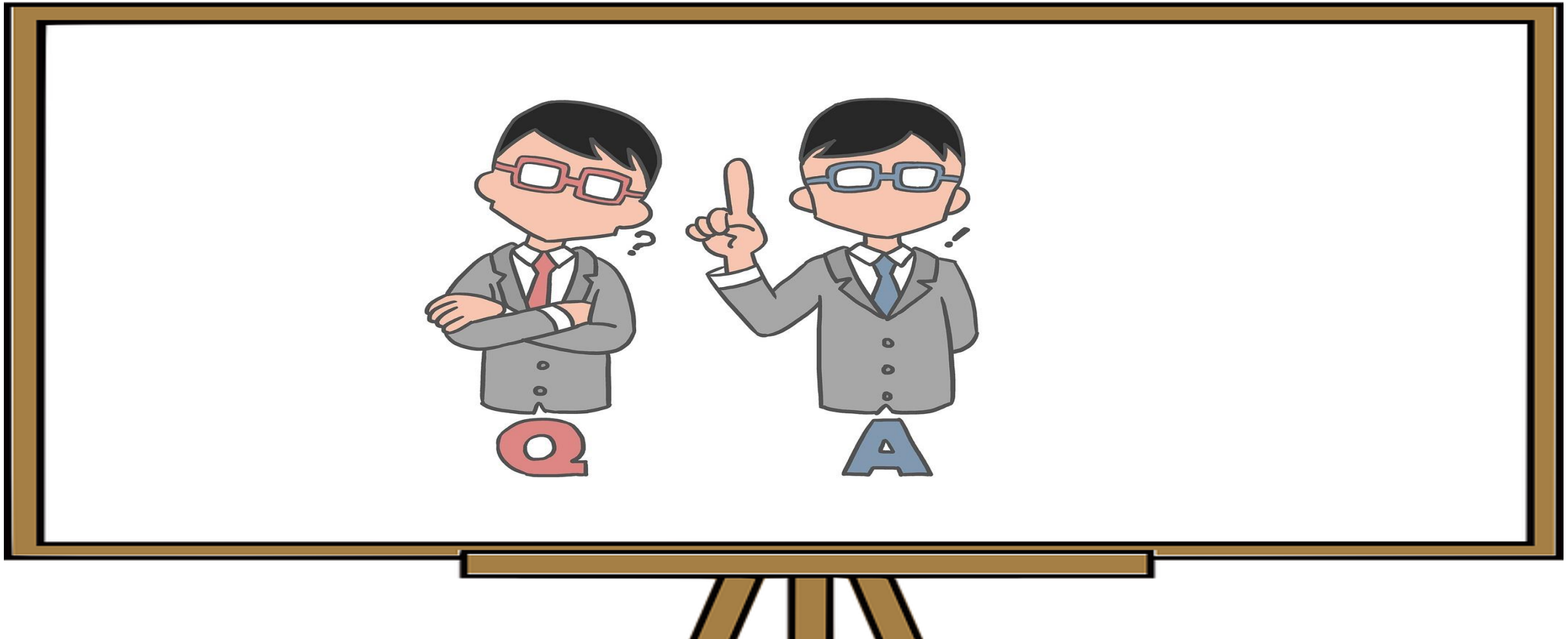
Note: See Handout #2 - 5E Lesson Plan detailed lesson plan

Create a Lesson Plan

- Work in a group (at various grade levels) to identify standards that incorporate the engineering practices.
- Identify an engineering challenge that builds on the disciplinary core idea(s).
- Create a lesson plan using the 5E model template.

Note: *See Handout #3 - Resources*

Reflections/Questions



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