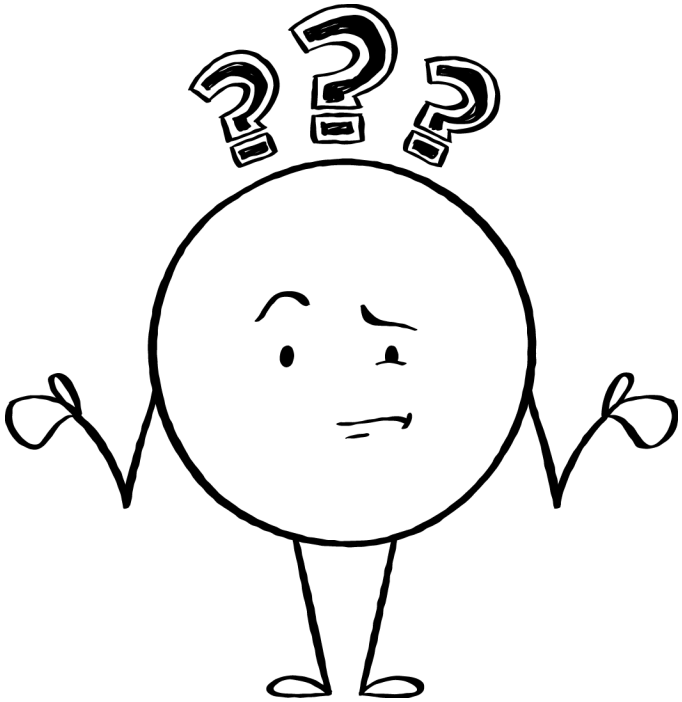
How to Create STEM Lessons



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what STEM is

Science

A body of knowledge about the physical and natural world. Scientists seek to describe, explain, and predict the natural world and its physical properties.

Technology

The body of knowledge, artifacts, processes, and systems that results from engineering. Technology is produced by humans to solve problems or meet needs and are the products of the process of engineering.

Engineering

The application of knowledge to creatively design, build, and maintain technology. Engineers seek to optimize solutions for problems, needs, and desires while considering resources and various constraints.

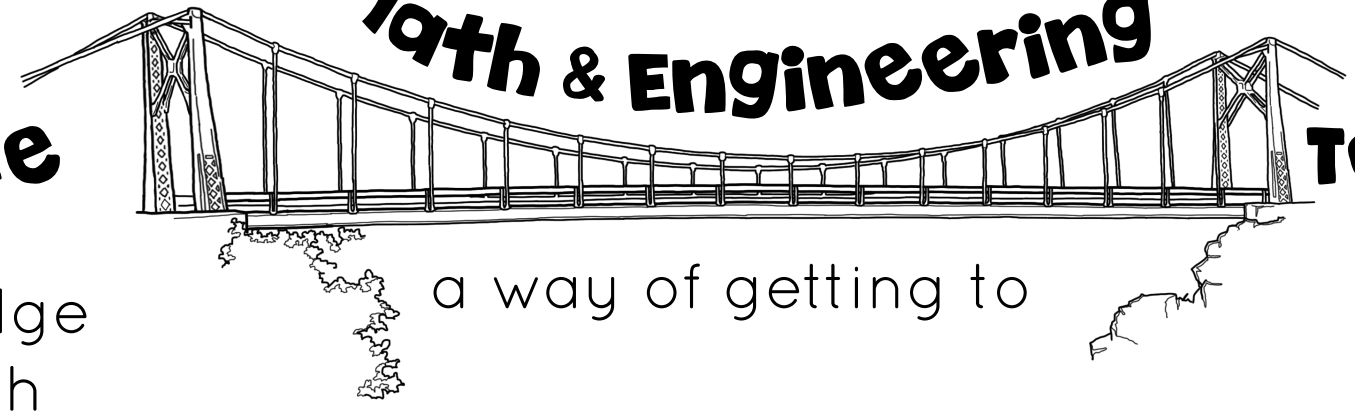
Mathematics

The science of numbers, quantities, shapes, and the relations between them.

how **STEM** fits together

Engineering Design Process
Math Practice
Habits of Mind

Science
base knowledge through *inquiry*



a way of getting to

Technology
solution to the problem *(a product)*

Interconnected Through A
Principle of Application

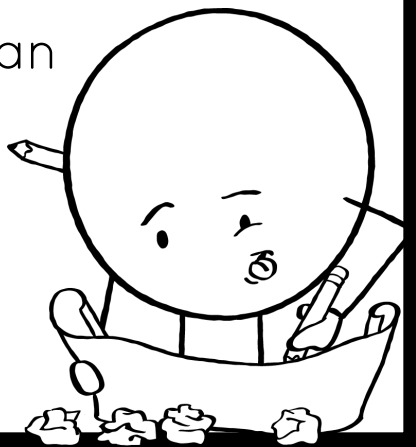
steps to planning a **STEM** project

Step 1 - Standards

- Start by looking at your scope and sequence for science topics you teach. If you teach NGSS, you'll find that they lend themselves well to STEM.
- What do you want students to take away from the lesson?

Step 2 - Choose a Problem

- Choose or create an engineering instructional unit that aligns with that content.
- Consider how an engineer themed lesson can reinforce skills and ideas your students learn in math, language arts, and ss.
- Make sure the problem is a real-world problem that can lead the students through the Engineering design process and has multiple solutions.

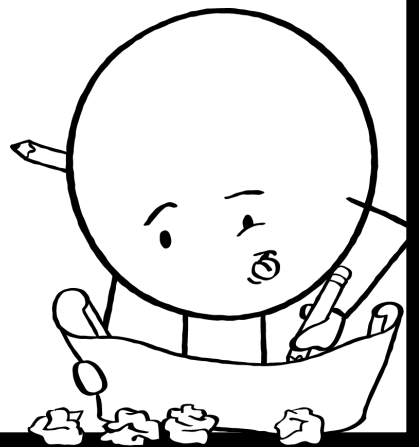


where to find **problems**

- Current events
- Local news
- Media websites
- National newspapers
- Radio programs
- Survey or poll your students
- Classroom discussions
- STEM or nonfiction picture books

Create a **scenario** that sets the stage and piques interest.

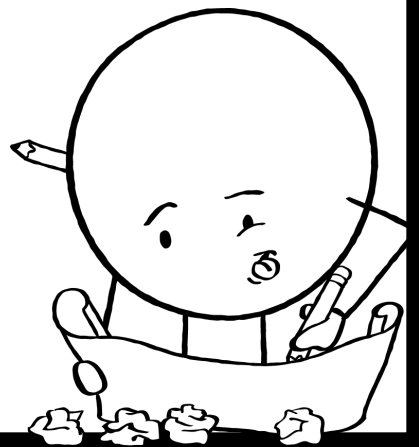
- It needs to directly ask students to solve the problem.
- It should include facts or details to get students interested, but not overwhelm them, lead to conclusions, or solve it for them.



steps to planning a **STEM** project

Step 3 - Create a Driving Question

- Driving questions often ask:
  - "What can we do..."
  - "How can we..."
  - "In what ways..."
  - "Why..." something occurs
- All activities planned in the STEM project should lend to answering/solving the problem/driving question.
- Additional student-driven "need to know" questions that promote inquiry are okay.
- Examples of questions
  - **Science Question:** How does the amount of heat energy affect water?
  - **STEM Question:** How can phase change and the states of matter be used to help provide clean water to people in third world countries?



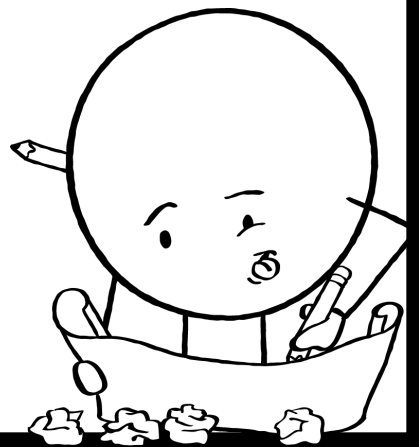
steps to planning a **STEM** project

Step 4 - Student Knowledge

Identify what your students need to know in order to solve the problem. This includes:

- Background information in math, science, and any other standards included.
- Collaboration skills, perseverance skills, etc.
- Engineering design process
- Set up, clean up, management, use of materials
- How they will communicate
- Group roles

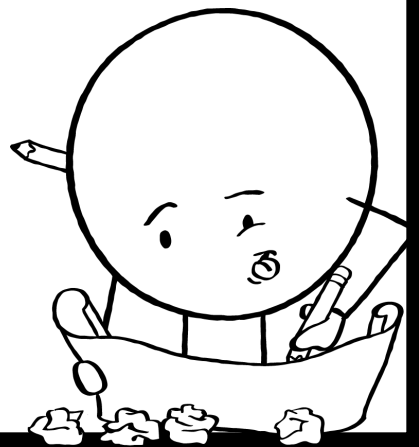
What do you want your students to achieve before, during, and after the engineering design project?



steps to planning a **STEM** project

Step 5 - Gather Materials

- Preparation is key!
- Create a list of all the materials, Gather all that is needed, count them out, group sets.
- Consider the room layout and arrangement of the materials.
- Have a materials store.

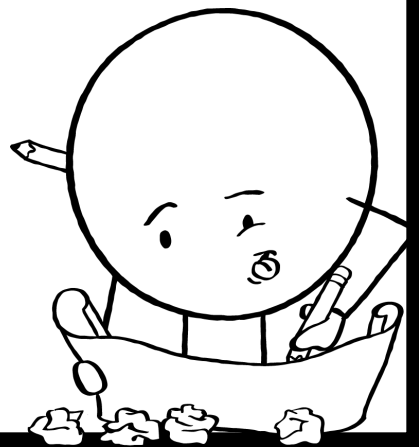


steps to planning a **STEM** project

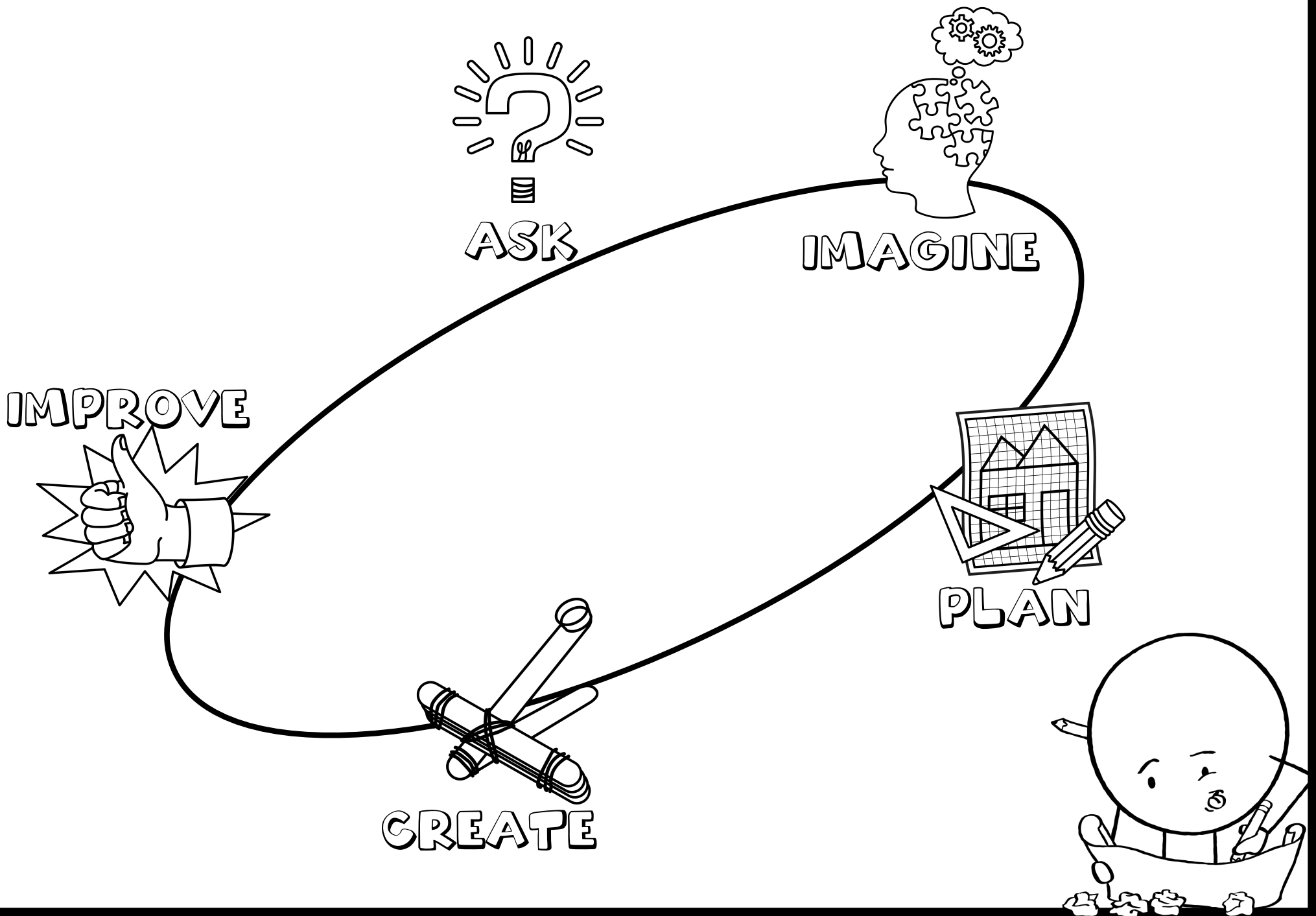
Step 6 - Design Activities

- Decide on limits and constraints
  - Ideas for constraints:
    - Laws of nature
    - Time
    - Money
    - Available Materials
    - Manufacturability
    - Environmental Regulations
- Decide on Collaboration/Teams

- Decide on specifics such how your students will gather, test, evaluate, and share their results?



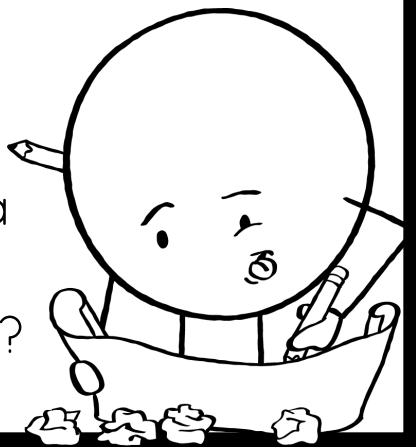
steps to planning a **STEM** project



steps to planning a **STEM** project

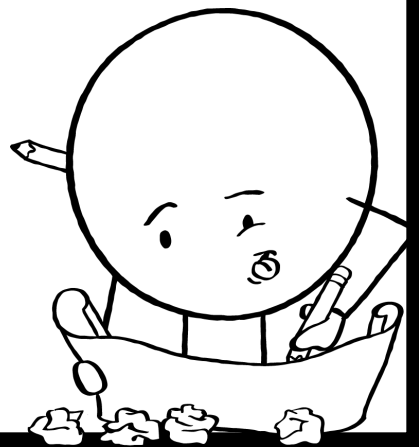
Step 7 - Assessment

- Decide on how you will assess your students (assess product & Process!)
  - Semi-structured portfolio
  - Ongoing performance assessments
  - Rubrics to document work, performance, contribution, learning objectives
  - Self-assessment/reflections
  - Peer Assessments
- Decide on questions you want to ask your students
  - How does your design reflect what you learned in the previous lesson?
  - Why did you choose these materials?
  - Did your design work as you expected? Why or why not?
  - How did the design fail?
  - What did you notice when you tested your design?
  - How might you improve your design?
  - How can you redesign your technology to (address a goal to make it faster, cheaper, stronger, etc.)
  - Did this design work better than the previous design?



other **STEM** tips

- Always structure time for whole class reflection and discussion.
- Ask about similarities and differences between various solutions.
- Downplay competition.
- Scaffold students' understanding of failure.
- Communicate clearly and consistently the expected outcomes.
- When creating make sure the how matches the why. The why is the teaching of the concepts (why we are doing the lesson) and the how is how we facilitate the student learning.
- Give time to explore materials.



the teacher's role in **STEM**

- Explain, monitor, and support
- Oversee the work of each team
- Give students the freedom to research, learn and make decisions themselves
- Give options for expression and communication
- Pause to point out when doing or using science, engineering, or math.