

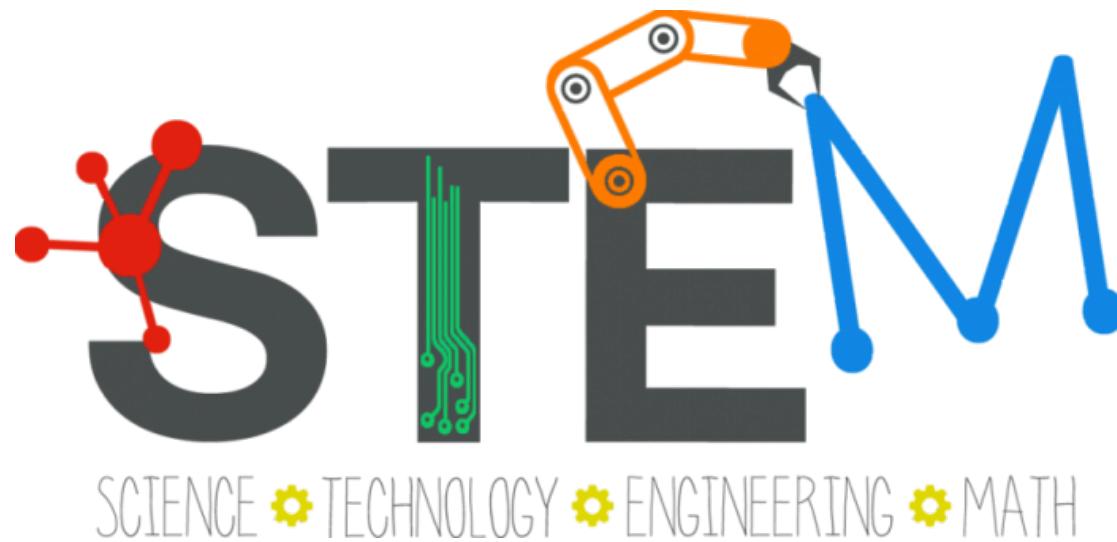
Low Tech STEM

Beth Harris | K12 STEM Conference

What is STEM?

The acronym originated in the early 1990s – although the concept was not new.

Became “official” when NSF used it in 2001.



What is STEM?

Variations on a theme

- eSTEM (environmental STEM)
- STEMIE (Science, Technology, Engineering, Mathematics, Invention and Entrepreneurship)
- iSTEM (invigorating Science, Technology, Engineering, and Mathematics)
- STEMLE (Science, Technology, Engineering, Mathematics, Law and Economics)
- STEMS^{A2} (Science, Technology, Engineering, Mathematics, Social Sciences and Sense of Place)
- METALS (STEAM + Logic)
- STREM (Science, Technology, Robotics, Engineering, and Mathematics)
- STREAM (Science, Technology, Robotics, Engineering, Arts, and Mathematics)
- STEAM (Science, Technology, Engineering, Arts, and Mathematics)
- GEMS (Girls in Engineering, Math, and Science)
- STEMM (Science, Technology, Engineering, Mathematics, and Medicine)
- AMSEE (Applied Math, Science, Engineering, and Entrepreneurship)
- THAMES (Technology, Hands-On, Art, Mathematics, Engineering, Science)
- MINT (Mathematics, Informatics, Natural sciences and Technology)

Why STEM?

In the early 2000s in the United States, the disciplines of science, technology, engineering, and mathematics became increasingly integrated following the publication of several key reports. In particular, *Rising Above the Gathering Storm* (2005), a report of the U.S. National Academies of Science, Engineering, and Medicine, emphasized the links between prosperity, knowledge-intensive jobs dependent on science and technology, and continued innovation to address societal problems. U.S. students were not achieving in the STEM disciplines at the same rate as students in other countries. The report predicted dire consequences if the country could not compete in the global economy as the result of a poorly prepared workforce. Thus, attention was focused on science, mathematics, and technology research; on economic policy; and on education. Those areas were seen as being crucial to maintaining U.S. prosperity

<https://www.britannica.com/topic/STEM-education>

Why STEM?

Or simply - jobs & the economy.

What makes STEM, STEM?

Not just 4 subject but rather INTEGRATING.

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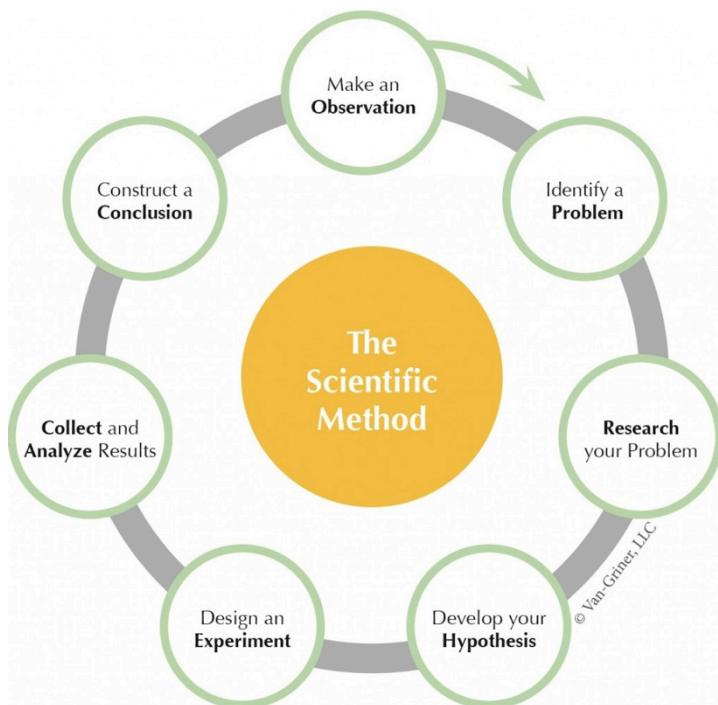
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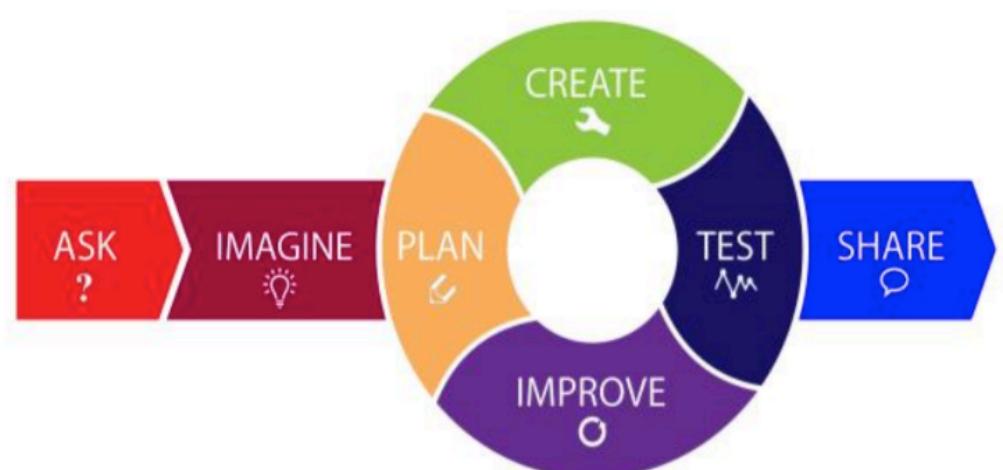
STEM at its best is problem or project based.

What makes STEM, STEM?

Answer a Question



or Solve a Problem



What makes STEM, STEM?

Science = a way for creating knowledge about how the world works (scientific method)

Engineering = a way of solving problems (engineering design process)

Mathematics = the language of science & engineering

Technology = the TOOLS that you use to do S, E and M (ie for measuring and building)

Technology

in the dictionary:

- the application of scientific knowledge for practical purposes, especially in industry.
- machinery and equipment developed from the application of scientific knowledge.
- the branch of knowledge dealing with engineering or applied sciences.

Technology

in Wikipedia:

the collection of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation.

Technology

Technology does not have to involve a keyboard, coding, robots or 3D printing.

There are plenty of rich, complex problems that are motivating, allow for creativity, use reasonable materials and are FUN.

Example 1: Strength of Materials

First, can you stick a straw through a potato?

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Challenge: Use 4 pieces of paper and a length of tape to create columns that can support the most books.

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Challenge: Use 4 pieces of paper and a length of tape to create columns that can support the most books.

What could you add to the columns to make them stronger?
(Hint - remember the potato)



Reverse Engineering

Learn a lot about how things work and how to improve or fix them.
Promotes attention to detail and documenting.

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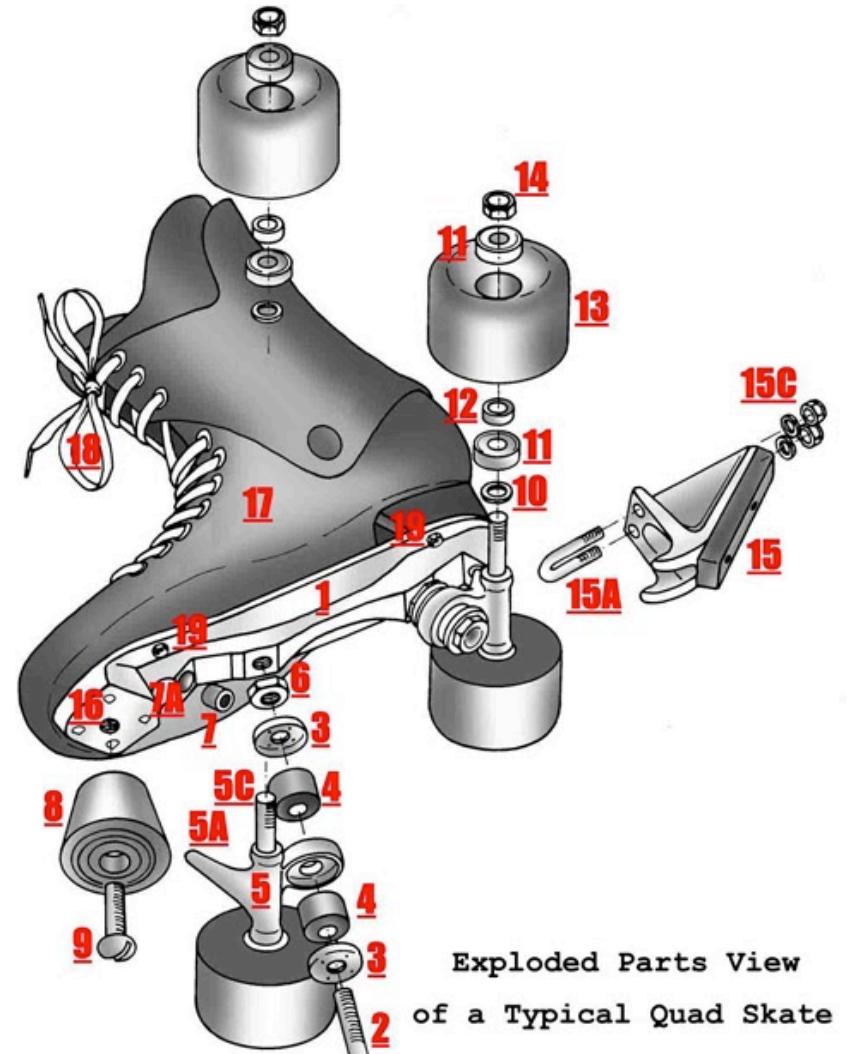
Not just taking stuff apart.

1. Observe how the object works.
2. Take apart all the pieces and record how they fit together.
3. Explore how the pieces work.
4. Put the object back together so that it works again.

Reverse Engineering

Reverse engineer a roller skate

1. Observe how the skate works.
2. Take apart all the pieces and record how they fit together.
3. Explore how the pieces work.
4. Put the object back together so that it rolls straight.



Reverse Engineering

Other easy items to reverse engineer

Stapler

Clickable pen

Flashlight – electric circuits

Pullback toy car – potential & kinetic energy

Toy dart gun – potential & kinetic energy

Bathroom or food scale – force/mass/weight

Fan – electric circuits/electromagnets

Toaster or hair dryer – heat transfer

Handheld mixer (first manual, then electric) – gears/simple machines

Example 3: Electrical Engineering - Steady Hand Game

Challenge: Make a steady hand game using an electric circuit.

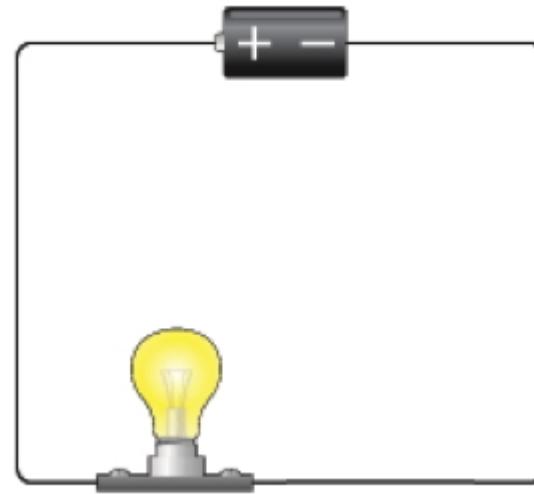
What you need to know: The goal of a steady hand game is to carefully move a loop around a wire shape without touching the wire. If you do touch the wire, an electric circuit connects which causes a bulb to light or buzzer to sound. As the name implies only a very steady hand will succeed. Making the game is much easier. Simply create a circuit inside a box that connects the wire shape to the light or buzzer, then to the battery, wire loop and back to the other end of the wire shape.



Example 3: Electrical Engineering - Steady Hand Game

Challenge: Make a steady hand game using an electric circuit.

First - make the buzzer buzz,
Then - attempt the challenge



Example 4: Balance and Center of Gravity

First, can you balance 14 nails on the head of 1 nail? How about just 10? 6? 4?

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Example 4: Balance and Center of Gravity

Next, can you do the Tiktok Chair Challenge?

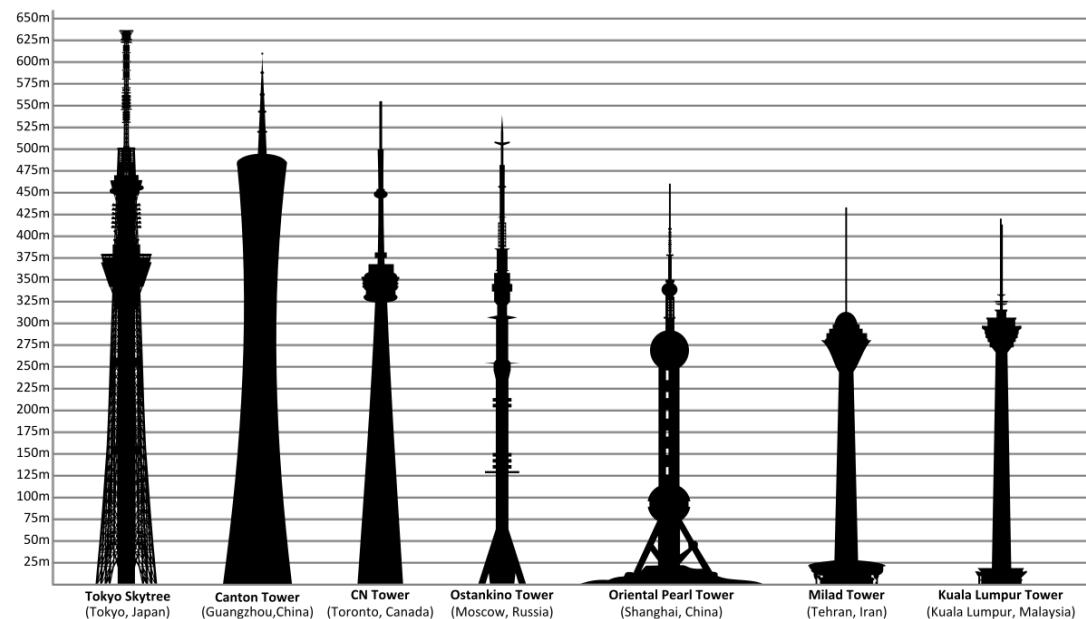


Example 4: Balance and Center of Gravity

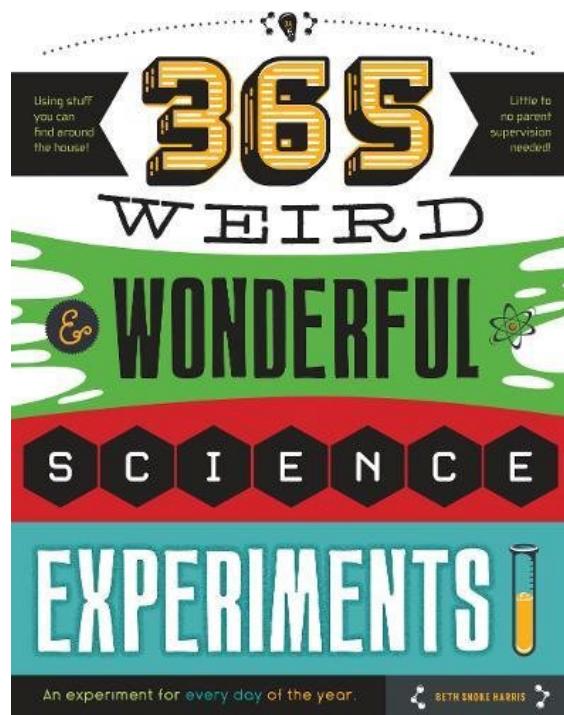
Both the balancing nails and chair challenge are related to Center of Gravity (or Center of Mass which is usually the same but not always).

Challenge: Build the tallest tower out of 1 piece of paper and 6 inches of tape.

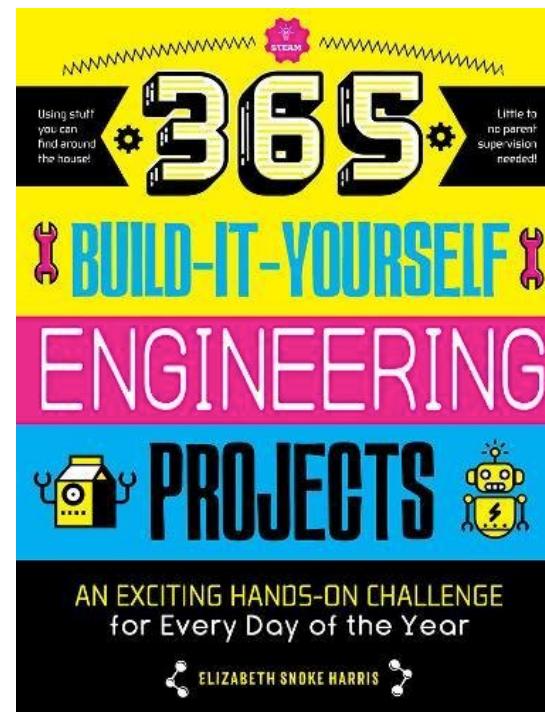
The tower must be free standing for at least 5 seconds.



Books!



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Questions?

Beth Harris

<http://seven-oaks.net>

beth@seven-oaks.net

