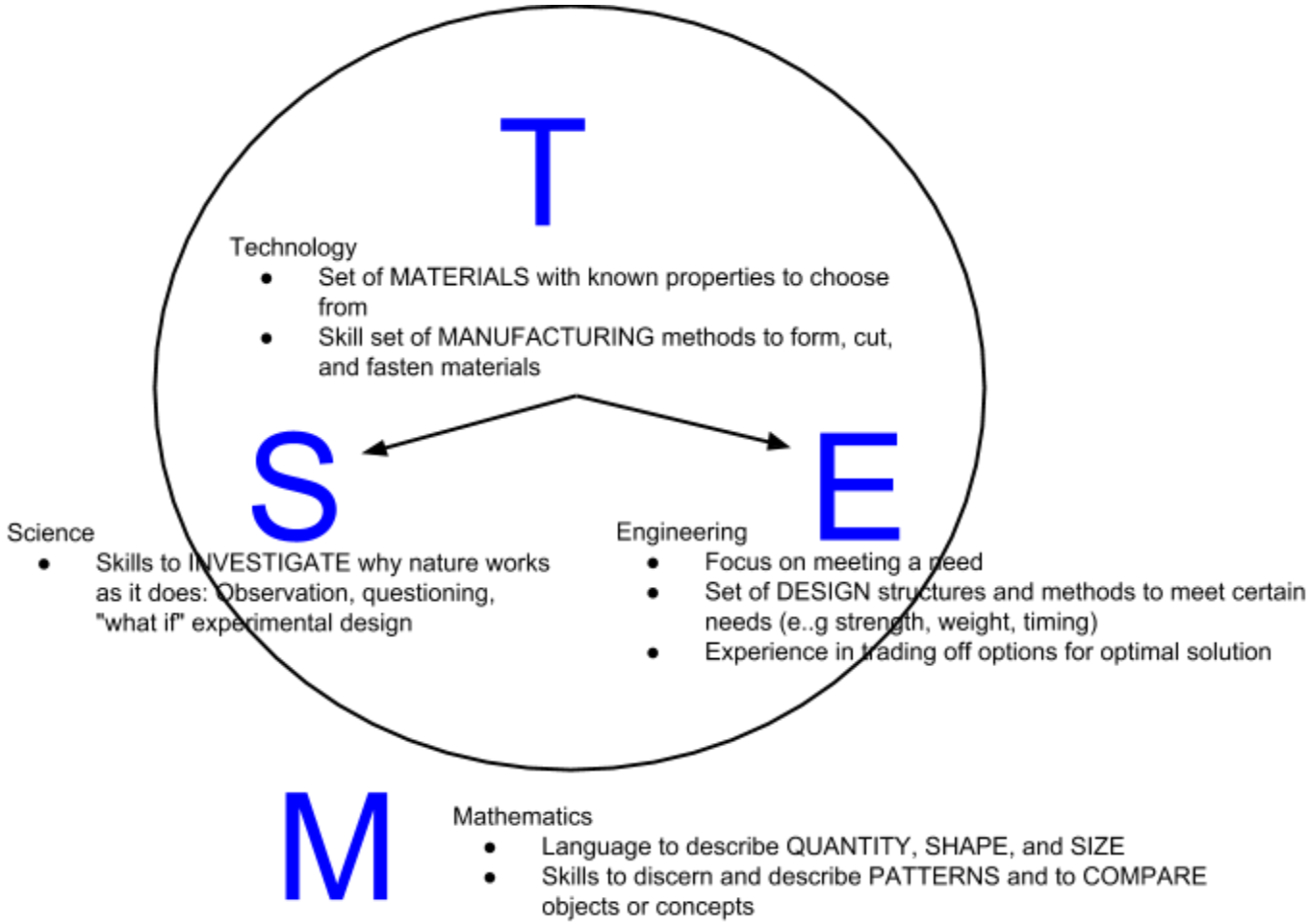
STEM Eye on Early Childhood



It may be helpful to think of ***Technology*** experiences first. ***Science*** experiences can then be introduced to answer children's questions on *why* materials behave as they do, and ***Engineering*** challenges are designed to leverage the Technology knowledge and skill set to meet a need. ***Mathematics*** provides the language to describe scientific observations and engineering design and mathematical thinking can help students find patterns and compare solutions or ideas in a more precise manner.

STEM Eye on **Stages of Block Play Development**

from Erikson Online Module 3

Stage	**STEM eye on stage**
Discovering (gathering and transporting)	From a STEM perspective, children are developing a sense of the material ***technology*** in this stage through this activity. In the case of wooden blocks, they are getting a sense of the texture, weight, and density of wood. They are getting a sense of shapes that can be made from them, and how they behave in a group. (I get the sense that children don't just carry one block at a time in this stage, but instead try to figure out how to bring multiple pieces to their work area at a time.)
Repetition (towers and paths)	In this stage, children experience situations where the blocks can stand and fall. This gives them base experiences which are expected in elementary school where they are asked to make ***scientific*** observations. Often, something noteworthy is either like something that has been seen before or different from what is expected. By giving children experiences in towers rising and falling, and paths being spread out in various configurations, they have these base experiences to compare other (up, down, and out) experiences such as plants growing, birds flying, and clouds moving.
Bridges	Bridges require composition of a number of basic structural elements such as columns, beams, and trusses. These are some of the first ***engineering*** design structures learned by humans.
Enclosures	Building enclosures is one of the first constructions that humans made: to shelter themselves and their flock, to provide defense, and to memorialize important occasions. This reflects the application of Technology, Science, and Engineering towards a fundamental human need, the main focus of all ***engineering*** efforts.
Patterns and Symmetry	The ability to see the pattern outside of several discrete instances is an important part of ***mathematical*** thinking. Mathematics in its higher levels of mastery also helps predict what may happen outside of concrete observed experiences. This is why mathematical modeling and analysis is an important part of engineering design.
Representing / Pretending	Creating for the purposes of representing or pretending leverages all the aspects of STEM: Creating a solution for the purposes of pretending (a very specific need) is the essence of engineering. Selecting the right materials and how to assemble them in different geometric arrangements requires knowledge of technology and mathematics. Understanding the forces involved requires scientific understanding, and comparing effectiveness of solutions requires mathematical thinking.

Eliciting more STEM

Using the example in video (building block game)

More Technology	● Introduce different materials as building options, making sure children have time to get comfortable using each. Otherwise they will stick the material they feel the most comfortable with. ***This introduces them to different materials*** and helps them determine properties of each type and how they may or may not be useful in the construction. ● Challenge children to use different material to create similar designs. For example, after building with blocks, ask them how they might use paper to build the same design. This introduces an opportunity to ***learn different manufacturing methods*** such as folding or taping paper into columns or beams.
More Science	● As children build towers or pathways have them observe what seems to work well. Different sizes, materials, shapes? This helps hone their ***observation skills*** and ***determine variables*** that may affect an observed outcome. ● Help children formulate "what if" questions: What if we used this piece? What if we placed the piece here? What if we turned the piece around? What if we tried some other kit/material? These "what if" scenarios are the beginning of the ***formulation of the scientific research question***.
More Engineering	● The teacher did this by asking if placing a block in a particular place would make the structure taller. Since the goal (need) was to make the structure as tall as possible, she helps children refocus on that to be ***problem-oriented***. This is different from a scientific approach which would be more like "what if we placed this piece here? what would happen?" In the engineering approach, it is how an action brings us closer or further from our (measurable) objective. ● Asking children to look around the room (or think of their own personal experiences) to see what structures shapes are used in building things that are tall can be a way to help children tap into ***existing design elements***. For example, looking under a table to see how the legs and tabletop are shaped and interact help children see that they can get design ideas from the existing world. ● ***Trying again*** was done nicely when the teacher invited the girl to trade a piece for one she realized might be better. This ability to keep trying once a "dead end" is found is important in the problem solving process. ● Having other children contribute to idea generation, as was done by taking turns, also helps develop ***good brainstorming skills***.
More Mathematics	● The teacher did a good job using geometric vocabulary to give students language to talk about design ideas and decisions. ● Thinking about spatial understanding can also help children develop a good foundation at this stage. Gesturing is an important part of creating a concrete understanding of spatial relationships such as taller, longer, in front, on top, etc. ● Having children also turn objects in their hands (rotating them) to see the different shapes and ways to stand blocks or assemble them helps develop a sense of three dimensions, an area that is important to STEM success and that some children (especially girls) are statistically noted to struggle with.