The “E” in STEM

Demystifying Engineering

Presenter:

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Next Step Action Plan

Name:_____Date: _____

Topic: E in STEM: Demystifying Engineering

Key Messages:

1. **Demystifying Engineering in Everyday Settings**
2. **Defining Engineering**
3. **Fostering Kodo's TIMI Design Process**
4. **Focus on Process Not Just Outcomes**

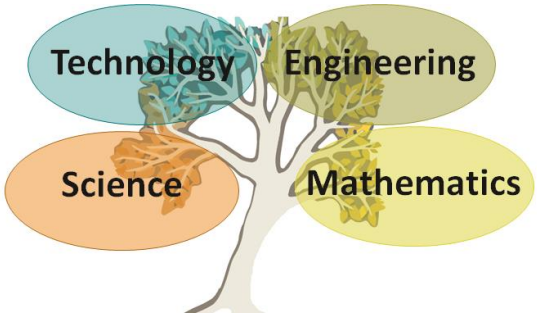
What action steps will you take to implement what you learned today in your classroom practice*?*

What current teaching practices do you want to modify or extend?

What <u>new</u> teaching practices or strategies do you want to try?

1. The E in STEM

At Kodo, we believe children are our greatest resource. Each scientist, technician, engineer, and mathematician began learning their skills in childhood, through experiences, hands-on learning, opportunities to engage in problem solving, and by participating in creative play.



SCIENCE focuses on **process** and **investigation**.

TECHNOLOGY focuses on **tools, simple machines,** and **how to use them.**

ENGINEERING focuses on **problem solving** and **material properties.**

MATHEMATICS focuses on **relationships** and **measurement**.

Engineering Integrates STEM

Science

- **Physical Science:** Force, Motion, Energy, Cause and Effect
- **Data and Analysis:** Prediction, Probability, Hypothesis, Test, Result

Technology

- Tools, simple machines

Engineering

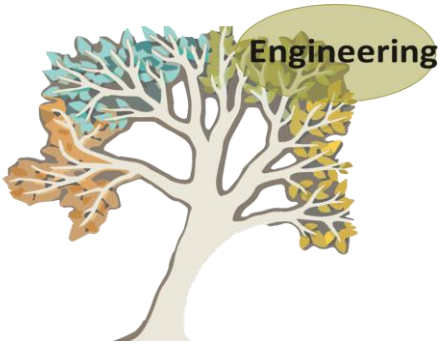
- Planning, Brainstorming, Testing, Improving
- Design, Construction, Deconstruction
- Stabilizing, Balancing, Elevating

Mathematics

- **Number and Operations:** Quantity, Quantitative Relationships (more, less, etc.)

2. Engineering focuses on problem solving and material properties

Engineering is often the STEM subject most misunderstood by educators. However, engineering is consistently evident in children's play.



Early Childhood Engineering has 2 focuses:

1. Material Properties and Attributes of Loose Parts

- diverse attributes and properties
- diverse and inventive applications and functions
- natural and man-made elements

2. Solving Problems

- The Design Process is the systematic method engineers use to solve problems.

Engineers solve everyday problems.
Engineering for adults is an applied science.
Engineers use physical science (physics), mathematics, and technology (tools) and lots of ingenuity to create solutions in everyday life.

Children are natural Engineers!
Complexity is an important part of children's work. It is evidence of the value play offers to children as they combine reasoning with imagination. When children tinker, fiddle about or mess about they often add layers to their creations. Complexity can also be a result of children who listen to one another and incorporate one another's ideas. So when children's designs are complex, teachers have the opportunity to identify not only the engineering play behaviors but the social relationships in place which support such play.

Types of Engineering

There are several types of engineering that focus on distinct types of problems to solve and is evidenced every day in the kindergarten classroom.

STRUCTURAL ENGINEERING	focuses on how we put and hold things together. Children engage in structural engineering when they build towers, buildings, and bridges using a variety of building and construction materials both indoors and out. Open-ended manipulatives and loose parts support children in exploring how to make connections and create supports for their buildings.
MECHANICAL ENGINEERING	focuses on how to design and use machines to perform certain tasks. Machinery for constructing buildings, vehicles for transporting people, tools for opening a can, and motors that energize things are all forms of mechanical engineering. Children engage in mechanical engineering when they use simple machines.
CHEMICAL ENGINEERING	combines or transforms elements and compounds to make new substances. This is demonstrated when children cook, mix paint and/or work with laboratory materials to make solutions like bubbles and items like playdough.
CIVIL ENGINEERING	deals with the design, construction and maintenance of the physical and natural environment. This is seen when children explore and build roads, bridges, tunnels, canals, embankments, and ditches.

Activity: Explore Materials Properties

With your teams:

- Play and explore with the provided materials.
- Make a list of the physical properties or characteristics of the material in the next 5 minutes.

Learning Reflection

With your team discuss and record on the chart paper the following:

- What types of materials, tools, and loose parts could you add to your classroom environment to foster engineering play behaviors?

Material Properties and Attributes of Loose Parts

- diverse attributes and properties
- diverse and inventive applications and functions
- natural and man-made elements

Consider diverse physical properties such as:	
Weight	Texture
Flexible	Stable
Porous	Absorbent
Solid	Colorful
Natural	Musical

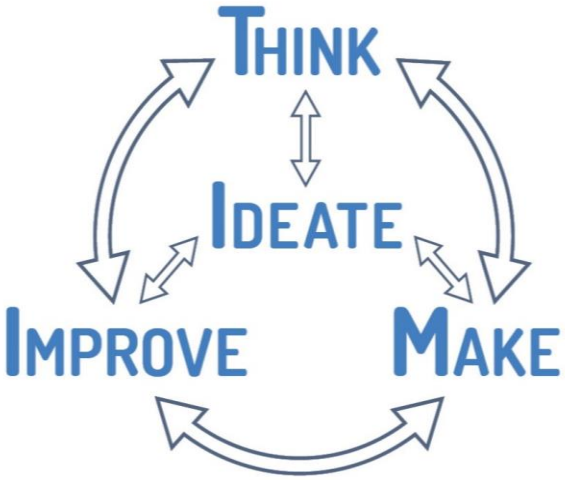
Loose Parts are the tools of play!

- They encourage children to explore and investigate.
- The most important question to ask yourselves concerning engineering for young children is, do we have enough loose parts?
- Loose parts give children a chance to play with materials in non-restrictive, creative ways, and to use the materials for purposes other than adult version of their intended use.

"In any environment both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it."

British Architect, Simon Nicholson

3. Kodo's TIMI Design Process



The TIMI Design Process

1. **THINK** - Identify and clarify the problem, outcome or goal. State what children are trying to solve or what they want to have happen. Identify situations that people want to change. State a hypothesis or desired result. Discuss how to approach and make plans.
2. **IDEATE** – Wonder about possibilities. Brainstorm ideas or solutions. Create ideas about how to proceed. Come up with at least three different ideas for how to solve any single problem. Brainstorm what materials they might use. Convey possible solutions or designs through visual or physical representations.
3. **MAKE** - Encourage children to test and try ideas or solutions as they play and investigate. Explore, experiment, and build prototypes or models of their ideas. Practice different iterations of solutions, often encountering failures, mistakes and constraints.
4. **IMPROVE** – Refine, modify and optimize designs, plans and prototypes. Document results, solutions or model. Compare, and contrast solutions or models. Analyze and evaluate each prototype and make changes to improve.

The Heart of Ideation

"In a complex world, cultivating problem-solving repertoire is an essential key to learning and the future. It is far better for a child to learn how to solve a problem five different ways, than to solve the same problems five different times. When we teach our students how to think in these ways, we're teaching them how to learn in new and creative ways."

Dr. Kenneth Wesson, Educational Consultant, Neuroscience

4. Focus on Process, Not Just Outcomes

Kodo's Investigation Based Teaching Practice™

LEARNING APPROACHES

What do you know about the difference between having a focus on Process vs a focus on Outcomes? Discuss and record advantages or disadvantages of each and how is each focus easy or difficult for you to practice?

PROCESS	OUTCOME

NOTES

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Reflection and Evaluation

Topic: _____ **Date:** _____

Please complete the following questions (front and back) and leave your evaluation with the presenter.

What I expected ……	***What I got ….***
What was most important to you and what did you find valuable?	***What will you implement or how will you change based on what you learned?***

Session Rating

Please rate the following questions on a scale of 1 to 7 by circling a number.
(1 is Low/Poor/Not Effective and 7 is High/Extremely Effective)

1. What was your overall experience of this session?

Low 1 2 3 4 5 6 7 High

2. Were the materials helpful and appropriate to your learning needs?

Low 1 2 3 4 5 6 7 High

3. Was the content of the session relevant and helpful to you?

Low 1 2 3 4 5 6 7 High

4. Was the presentation and delivery of the presenter successful in this session?

Low 1 2 3 4 5 6 7 High

5. Were the experiential activities relevant and helpful?

Low 1 2 3 4 5 6 7 High

Keepers…. What was supportive and helpful to you during this training?

Rethink…. What could the presenter do to be more effective and add value to your professional development?

Testimonial - If you are willing to provide a testimonial of what you found to be valuable, please write them here:

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