Engineering in Play

The purpose of this activity is for educators to explore ways children, birth to eight years, engage in problem-solving and use engineering skills in their play and daily routines.

Key Concepts

- Identifying problems
- Planning solutions
- Testing and refining solutions

Materials and Setup

- Problem-Solving and Engineering in Play Vignettes (page 2–5)
- Sample Answers (pages 6–8)

15 minutes

Small groups

In-person or virtual professional learning

Activity Instructions

- Read the vignettes that describe children in a typical play setting.
- Discuss with your group ways the children in the vignettes:
  - identify problems,
  - plan solutions, or
  - test and refine solutions.
- Consider what other skills and concepts children in the vignette might be developing and using while engaged in engineering experiences (for example, approaches to learning skills, math concepts, and science concepts).

Problem-Solving and Engineering in Play Vignettes



Infant: Problem-Solving in Play

While exploring a shape sorter, a child tests different ways to get shapes to fit into the holes of a container. They push the cylinder against the circle hole, but it does not fit. They try to get the cylinder to fit into the triangle and the square, but it still does not fit. They turn the cylinder and try again, experimenting with the way the shape might fit into different shaped openings. Finally, they orient the cylinder so that it falls into the container.

Discuss with your group ways the child in the vignette:

- identifies problems,
- plans solutions, or
- tests and refines solutions.

Consider what other skills and concepts the child in the vignette might be developing and using (for example, approaches to learning skills, math concepts, science concepts).



Toddler: Building a Stable Tower

A child builds a tower using blocks. They stack the blocks vertically, creating a tall and unstable tower. After placing yet another block, the tower topples over. They rebuild, and the tower falls again. The child builds again, this time more slowly. As the tower gets taller, they change the orientation of the blocks, placing them horizontal instead of vertical. The tower gets taller but soon begins to lean and falls again. The child continues to rebuild, this time placing all of the blocks in a horizontal position. This time, the tower remains standing. The child smiles and looks for more blocks to stack.

Discuss with your group ways the child in the vignette:

- identifies problems,
- plans solutions, or
- tests and refines solutions.

Consider what other skills and concepts the child in the vignette might be developing and using (for example, approaches to learning skills, math concepts, science concepts).



Preschool: Creating a Creek in the Sand

While playing in the sand table, children try to create a creek by digging a small trench and pouring water into it. The water seeps into the sides of the trench and causes the walls to collapse. Children try lining the trench with different materials (for example, blocks, toy cars, paper). After adding one material, they add more water and notice if it changes the way the water flows. Their educator notices their efforts and facilitates their experimentation and testing with different materials. For example, she says, "Hmmm, I notice the paper is absorbing the water, just like the sand. See how it is getting darker. I wonder if there is a material that will not absorb the water." The children continue to experiment with different materials and finally find success with several small pebbles lined up closely together.

Discuss with your group ways the children in the vignette:

- identify problems,
- plan solutions, or
- test and refine solutions.

Consider what other skills and concepts the children in the vignette might be developing and using (for example, approaches to learning skills, math concepts, science concepts).



Elementary: Creating Shade

Children are outside on a hot, sunny day during recess. A few children are playing restaurant beneath the play equipment. The sun is in their eyes. They decide to create shade using their sweaters. They tie the sweaters to different places on the play equipment, creating an umbrella-like structure. Once the structure is secure, they test their design by sitting beneath it. Sunlight is still entering into their sitting area. They climb back up the play equipment and make adjustments by moving their sweaters and tying them in different places. They continue to adjust the placement of their sweaters until they have succeeded in blocking the sun from their play space.

Discuss with your group ways the children in the vignette:

- identify problems,
- plan solutions, or
- test and refine solutions.

Consider what other skills and concepts the children in the vignette might be developing and using (for example, approaches to learning skills, math concepts, science concepts).

Sample Answers

Infant



The child in this vignette uses problem-solving skills to get the cylinder into the shape sorter. The child uses the following skills:

- Identifying problems: The child notices that the cylinder will not fit into the circle hole.
- Testing and refining solutions: The child tries to get the cylinder to fit inside other shapes. The child refines this solution by testing other shapes. The child develops another solution—turning the cylinder.

The child demonstrates approaches to learning skills. For example:

- Curiosity and initiative: The child is curious about why the cylinder will not fit. The child also shows initiative in actively trying different approaches.
- Engagement and perseverance: The child is actively engaged with the shape sorter. The child shows perseverance because they continue to try different approaches, even after encountering failure.
- Problem-solving: The child uses different strategies to solve a problem (for example, turning the shape and testing different shaped holes).

Toddler



The child demonstrates engineering skills while building a tower. For example:

- Identifying problems: The child tries to identify different problems that might be causing the tower to fall (for example, the blocks are not lined up properly, the vertical blocks are too high and unstable).
- Testing and refining solutions: The child refines their build in different ways (for example, they try to line up the blocks so they are straight, turning the blocks on their side toward the top, and turning all of the blocks on their side).

The child demonstrates approaches to learning skills, spatial thinking skills, and social emotional skills. For example:

- Persisting despite difficulties: The child continues to build the tower and tries different approaches even after experiencing repeated failures.
- Problem-solving: The child uses different strategies to solve a problem and analyzes and reflects on their approach (for example, the child slows down their build, changing the orientation of the blocks and adjusting the placement of the blocks).
- Spatial thinking: The child considers the different positions of the blocks and explores orienting them in different ways.
- Emotion regulation: The child manages their emotions, staying calm and focused in a situation that might be frustrating.

Preschool



The children demonstrate engineering skills while building at the sand table. For example:

- Identifying problems: The children notice that the water is causing the sides of the trench to collapse. The educator supports children to notice that the paper is also absorbing water.
- Testing and refining solutions: The children explore using different materials to line the trench.

The children demonstrate approaches to learning skills, explore science concepts, and use social emotional skills. For example:

- Persisting despite difficulties: The children continue to build the creek using different approaches even after experiencing repeated failures.
- Problem-solving: The children use different strategies to solve a problem and analyze and reflect on their approach (for example, the children notice that the different objects are changing the way the water flows, and they consider the success of different materials).
- Earth and space science: The children explore characteristics of dirt and notice how water interacts with the dirt.
- Collaboration: The children work together to problem-solve and iterate.

Elementary



The children demonstrate engineering skills while creating a shade structure during recess. For example:

- Identifying problems: The children notice that the sun is in their eyes and making them hot.
- Planning a solution: The children decide to create shade.
- Testing and refining solutions: The children test their design by sitting beneath it. They further refine their solution by making adjustments.

The children demonstrate approaches to learning skills, explore science concepts, and spatial thinking. For example:

- Flexibility: The children think flexibly—they use their sweaters in different ways.
- Persisting through challenges: The children show persistence. Their original structure does not work as planned so they continue to make adjustments.
- Earth and space science: The children explore the effects of the sun and ways humans interact with the environment.
- Spatial thinking: The children use spatial thinking as they design their shade structure—considering where to place the sweaters in relation to the sun.

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