

Preschool Insights & Research

THE ENGINEERS OF TOMORROW

“The children are natural builders. It doesn’t matter what they have in front of them to play with, there is always an area of the classroom that looks like a construction zone. We encourage this, it isn’t just a mess, these are young engineers at work!”

– Ffion, preschool teacher, Cambridge, UK

“I always use the blocks. They are most fun. I [like to] build a house we can play and live in.”

– Rafferty, 5

The ‘construction zone’ in Ffion’s classroom certainly doesn’t look like a mess. Quite the contrary, it is a mix of children building structures. You can see the method; a process they are following as a group. There are walls, a make-shift roof, and an adjoining garage for the toy cars. Where a weakness in the structure is identified, after a section of blocks falls to joyous giggles, a chair is agreed upon and used to support one corner.

Research in this area shows that the ways in which children build structures is a basic form of engineering thinking. The work of Brophy and Evangelou (2007) for example, observes that children understand the physical properties of their building materials well enough to create increasingly complex designs. Their hands-on building skills go far beyond the two-dimensional outline drawings they make of ‘typical’ houses. As Brophy and Evangelou state, even at this early age, they can go beyond a visual representation to an actual structure.

There is a little unrest in the building group, as a child tries to go it alone, but they are calmly reminded by the teacher that they are better builders when working together. The child simply didn’t want to fail, to have the structure collapse under the weight of the ‘roof’. The teacher pauses the flurry of activity and the group stand back - to survey the scene.

What is clear in Ffion’s class, is that the children are offered structured ways to explore being young engineers. She uses visual prompts of famous buildings, as well as solutions to structural problems in real buildings (joists, scaffolding, DIY braces). She has the words Create, Communicate, Collaborate and Consider, on posters around the construction area. When she asks Rafferty and his group to consider how best to fix the ‘leaky’ roof, the children stand for a moment and actually reflect. They know how to respond to that step in the process. Eventually, with plastic hard-helmet on, Rafferty suggests the chair. The others agree, and the engineering design process continues.

What does the research say?

The research agrees that preschool children naturally have basic engineering and construction skills. However, these are best utilized and developed when the teacher is able to provide challenges based on iterative, open-ended problems the children can solve. What if the children do not have enough blocks to complete the whole structure? What if someone knocks part of it down? What if other design or function criteria are included in the design?

Pedagogical researchers, such as Cunningham and Hester (2007), suggest teaching a systematic approach to solving construction problems, instead of the time-consuming trial-and-error method. At this age, children can become disengaged from more complex problems when they become frustrated trying to solve an issue.

Cunningham and Hester offer a simple Engineering Design Process for early childhood educators to follow:

- Ask (What is the problem? What have others done?)
- Imagine (What are some solutions? Choose the best one.)
- Plan (Draw a diagram. List materials you might need.)
- Create (Follow your plan. Create something. Test it!)
- Improve (Talk about what works. Modify what could make it better. Test it again!)

The results of this system are apparent in Ffion's classroom.

What teachers say

"The children have spent several weeks learning what each word means. They understood 'create' and 'communicate' but they had to learn to 'collaborate' and 'consider'. The last one was definitely key to helping them becoming young engineers, rather than just children playing with building toys.

And it's helping in other areas. It was such a simple idea, adding the process, but it made a huge difference. When I ask them to spell a word, or group a set of objects by properties, the collective cry is 'consider'! That's a joy to hear! I would never have considered myself that the engineering process had such applicable cross-curricular skills at this age range."

- Ffion (graduate early years teacher)

References

Brophy, Sean, & Evangelou, Demetra (2007) Precursors to engineering thinking. Presented at American Society of Engineering Education Annual Conference and Exposition, Honolulu, Hawaii.

Cunningham, Christine, & Hester, Kate (2007) Engineering is elementary: An engineering and technology curriculum for children. Presented at American Society of Engineering Education Annual Conference and Exposition, Honolulu, Hawaii.