

Every Child ~~Can Be~~ **IS** an Engineer



Why engineering should be a part of every elementary classroom

By Margaret Honey

“Today’s students are tomorrow’s engineers.” While statements such as this are meant to inspire, it is actually more accurate to say that today’s students *are* engineers. After all, any child who has ever built a tower using blocks, or constructed a fort or a dollhouse, or designed a virtual world in a video game has engaged in engineering.



Tips for a successful engineering lesson

- Put the learner at the center.
- Give students problems they think are worth solving.
- Give them a sense of purpose and agency, e.g., Why am I doing this? Why do I care?
- Design experiences that appeal to and engage diverse learners.
- Instill a sense of play into the project.
- Provide opportunities for students to collaborate and communicate with each other.
- Give students the space to try, fail, and try again.

Yet, engineering is often a source of anxiety for teachers—and understandably so. The Next Generation Science Standards (NGSS) integrate engineering into every grade level from kindergarten through grade 12. Most elementary teachers, however, do not have backgrounds or expertise in engineering. Even if they would like to dive in and begin teaching it, many say they lack the resources and support to prepare students to be proficient and inspire them to pursue engineering fields in college and careers.

Here are a few ways to help your teachers become as comfortable with engineering as your students are.

1. Dispel common misconceptions.

Even among the most dedicated teachers, misconceptions about engineering are common, especially in the early grades:

- Children should learn to read, write, and do basic math before tackling a subject as complex as engineering.
- Engineering is for older students who are good at math and science, and who are interested in pursuing it as a career.
- Boys like engineering more than girls do.
- Engineering is too difficult for English-language learners (ELLs) who haven't yet mastered academic English.

The first step to overcoming such misconceptions is to open a dialog and ask teachers what they think about teaching engineering in their classrooms. Ask about their preparedness and comfort levels, and what they would need to boost their content knowledge, confidence, and teaching skills in the subject.

2. Explain why engineering is important at every grade level.

One good reason to introduce engineering early is that it aligns with how young children think about and explore the world around them. At play, children love to build things and take things apart to see how they work, so engineering is naturally engaging to them.

At its core, engineering is a systematic practice for solving problems. It gives children hands-on opportunities to define problems or situations that people want to change, define criteria and constraints for possible solutions, and develop and optimize solutions. Participating in engineering design also provides meaningful ways for children to work together and develop communication and collaboration skills, which are essential for career readiness.

3. Demonstrate cross-curricular connections.

Many teachers who are apprehensive about teaching engineering are often pleasantly surprised to learn that engineering is a perfect conduit to a variety of content areas, including those in which they excel. Consider, for example, a project in which students explore how houses or buildings were constructed in a particular geographic area and historical period. By asking their students a few key questions, teachers can bring in a number of different subject areas: *Why was this building designed this way? What tools and materials were used? Why were those building materials chosen? Who used this building and for what purpose?*

Such lessons can connect engineering with subjects like archeology, biology, chemistry, earth science, English language arts, geology, geometry, history, math, meteorology, physical science, physics, social studies, and more. They also create real-world connections, which help students see how relevant each subject area is to their daily lives. In this way, engineering provides an authentic context to bring other content knowledge to bear.

Taking an interdisciplinary approach can also allay teachers' concerns about finding the time to teach yet *another* subject. Instead of carving more time out of their day, they can simply integrate engineering into the subject areas and topics they are already covering. Plus, with the right training and support, they can use engineering as a vehicle to engage students with the content more deeply than they could if students were simply reading a passage from a textbook or watching a video.

4. Emphasize the value of productive struggle and failure.

Like mathematics, engineering is not just about coming up with the right solution to a problem; it is about the process. One of the best ways to highlight the benefits of productive struggle for students is to have teachers experience it for themselves. During a faculty meeting or staff development day, set aside 10 to 15 minutes and ask teachers to engage in an engineering design project, such as inventing something to improve your breakfast experience.

As they work together to develop and optimize a solution, they will likely try, fail, and try again. Along the way, they will see how mistakes can be helpful to learning and how such experiences can help participants learn the value of effort and persistence. In addition, this hands-on experience will show them how this process can help remove the stigma of failure from the classroom and illustrate that one problem can have many solutions.

5. Provide high-quality resources to students and teachers.

Another way to help teachers is to provide them with high-quality professional development, as well as student resources that make it easy to integrate engineering into their classrooms. For example, the DIVE-in Engineering program provides curriculum and tools to meet teachers where they are now and help them continuously improve how they teach.

The program, which was developed by Accelerate Learning and the New York Hall of Science, is designed to guide students through an engaging engineering curriculum built around flexible, hands-on lessons that transform the classroom into an authentic makerspace. Providing teachers with ready-made lessons and resources, such as teacher lesson videos and guides with step-by-step instructions, makes the idea of teaching engineering much less intimidating, even if they have never taught it before.

6. Illustrate how engineering can help underrepresented populations.

The earlier a student begins learning engineering, the better. In fact, engaging children early is particularly beneficial for students from underrepresented populations. For example, engaging girls in engineering reinforces the fact that engineering and STEM professions can and should be pursued by boys and girls alike. In addition, building positive mindsets and

attitudes toward engineering makes it easier to spark the interests of students whose families have low levels of education.

Engineering also provides an ideal way to engage students who are ELLs. Because engineering affords opportunities for hands-on learning, it gives them a chance to demonstrate their abilities to think critically and solve problems, even if they are still developing their English skills and vocabulary. Further, collaboration with their peers creates rich opportunities for language learning in an authentic context.

7. Demonstrate the need and the potential.

According to the U.S. Bureau of Labor Statistics, STEM occupations are projected to grow faster than the average for all occupations. Further, wages in these occupations are generally higher than the median for all occupations. Engaging in engineering in elementary school builds awareness of STEM professions early, which will make it easier to fill the STEM pipeline in the future. If a student develops a keen interest in engineering, he or she can then take the high school math and science courses needed to pursue engineering in college or a career.

Engineering Isn't Just a Course; It's a Mindset

Engineering is about much more than meeting a set of standards or passing an assessment. It is about creating hands-on, energetic educational experiences in which learners can indulge their curiosity and nurture their creativity. When students can develop solutions to real-world problems on their own and with their peers, it builds their creativity, confidence, and self-esteem. It shows students that they can take intellectual risks and be successful learners. It helps them develop and understand the importance of qualities such as grit and resilience, and shows them that there are often many solutions to a problem. Furthermore, the solutions they come up with are often quite imaginative and inspiring. This, in turn, helps re-energize teachers.

Even if students decide not to pursue engineering or STEM after high school, they are still developing key skills that will help them survive and thrive in a constantly changing world. Thinking critically, creatively, and collaboratively are not only valuable skills for engineers, but they are valuable skills for life in the 21st century—or any century. 

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