

Engaging Math and Science Students in Engineering Design



Transforming Mathematics & Science Education

Through this Knowles Academy course, teachers will learn to use engineering design to teach students math and/or science content, and inspire and equip them to solve real-world problems.

Endorsed by the American Society for Engineering Education, this year-long, professional development course offers 12 months of coaching and support for teachers aiming to integrate engineering design in their classrooms. Initiated by a week-long, in-person workshop, this program will assist teachers in gaining the knowledge and confidence needed to implement engineering design challenges that inspire their students to apply math and science concepts to solve real-world problems.

Date: July 20–24, 2018

Time: 8:30 a.m.–4:00 p.m. (coffee and lunch will be provided)

Location: Philadelphia, PA

Price: \$1,000

Optional Graduate Course Credit Available - Additional Fees Apply



Course Objectives:

- Experience the engineering design process and develop a framework for your classroom
- Learn how to encourage engineering mindsets in students
- Discuss the differences between engineering design facilitation and traditional math and science instruction
- Discuss ethics in engineering with a professional engineer
- Prepare for NGSS implementation of engineering-integration instruction by designing and peer teaching your own content-integrated engineering design lessons

The Knowles Teacher Initiative supports the efforts of high school mathematics and science teachers to improve education in their classrooms and beyond. We are committed to supporting a national network of mathematics and science teachers in developing as leaders and collaborators, facilitating exploration and innovation, and ultimately improving mathematics and science education in the U.S. Visit www.knowlesteachers.org to learn more.

"I really felt I got so much out of the workshop and am excited to implement ideas in my classroom next year. I felt I walked away with a deeper understanding of the engineering design process and much more confidence and skills in using the engineering design process in my science classroom."

Shannon Morey
Physics and Computer Science Teacher,
Abbott Lawrence Academy, Lawrence, MA

All Knowles Academy courses can be customized to meet the specific needs of schools and districts.

For more information, contact Knowles at academy@knowlesteachers.org.

For Teachers, By Teachers

The Knowles Academy offers professional development services that are designed and facilitated by experienced teachers.

- 01 Teachers supporting teachers:** Teachers learn best from other teachers. All professional development that we provide includes experienced teachers as instructors and coaches.
- 02 Professional community development:** Teaching can be isolating. All of our professional development services are designed to build teacher community so that participants can continue to support each other's learning and professional growth long after the professional development experience ends.
- 03 Long-term support for sustainable change:** Effective teacher professional development must be sustained and tied to classroom practice. All Knowles Academy courses include long term support from coaches, opportunities for teachers to ground their learning in current practice, and engage with other Knowles Academy participants over an extended period.
- 04 Professional expertise and leadership:** Designing and implementing effective professional development requires a diverse range of expertise and experience. All of our professional development services draw and build on the expertise developed within the Knowles community over the last 15 years.

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Agenda:

Teachers will receive one year of coaching that is initiated by a week-long, in-person workshop.

Day 1: What is engineering design?

- Define community norms and set personal goals
- Engage in two math and science content-based engineering design challenges
- Co-construct your own diagram of the engineering design process
- Investigate engineering design facilitation
- Conceptualize and reflect on the traits of an engineer
- Revisit and reflect on personal goals

Day 2: How will engineering design work in my classroom?

- Experience the facilitator's own engineering design challenge

- Iterate engineering design diagram
- Explore two Knowles engineering design planning and teaching tools—the Slices activity to help conceptualize engineering design in discrete moments of instruction, and the Low-hanging fruit tool for identifying content and lessons that are “ripe” for engineering integration
- Revisit and reflect on personal goals

Day 3: How can I evaluate engineering design challenges and instruction?

- Compare engineering design diagrams (affordances and tradeoffs)
- Engage in an engineering design challenge
- Dialogue with an engineer or engineering education guest speaker
- Analyze the four completed engineering design challenges using the Knowles Engineering Complexity Rubric
- Iterate your engineering design diagram
- Plan a content-based engineering design challenge to present on Day 4

Day 4: How will I teach and assess engineering design?

- Edit a digitized, graphic-designed version of your engineering design diagram
- Facilitate your content-based engineering design challenge and debrief
- Discuss ethics in engineering related to students and the broader world
- Practice assessing the work of the facilitator's own students
- Plan engineering-integrated lessons for your local context

Day 5: How will I use engineering design this year?

- Solve content-based engineering design challenges and debrief
- Plan for engineering-integrated math and science instruction with planning partner and receive feedback from critical friends
- Practice participating in a “Virtual Pizza Party” with your continuation coach, a teacher familiar with using engineering design in their content math or science classroom, and discuss next steps
- Complete final reflection on personal goals

After the Workshop:

- Receive a poster of your final engineering design diagram for your classroom
- Receive personalized monthly emails from your coach
- Enjoy two “Virtual Pizza Parties”—online meetings with your coach where we send you pizza! Typically, one meeting is usually held before your first engineering design implementation and one after.