

Engaging Math and Science Students in Engineering Design: San Francisco, CA



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 nine months of coaching and support for teachers aiming to integrate engineering design in their classrooms. Initiated by a week-long, in-person workshop facilitated by biology, physical science, and math teachers with experience in using engineering successfully, 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 and solve real-world problems.

Date: June 10–14, 2019*

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

Location: The Science Garage at South San Francisco High School, South San Francisco, CA

Price: \$1,000

Optional Graduate Course Credit Available - Additional Fees Apply



Course Objectives:

- Experience content-infused engineering design challenges and develop an NGSS-practices aligned framework for the engineering design process 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 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.

To register for this course or to learn more, visit www.knowlesteachers.org/knowles-academy.

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 programs 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 17 years.

Engaging Math and Science Students in Engineering Design

Agenda:

Teachers will receive nine months 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 with Algebra I and II, Pre-Calculus, Chemistry and Physics connections
- Co-construct your own diagram of the engineering design process
- Investigate engineering design facilitation within math and science
- 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 a biology-based engineering design challenge
- Iterate your 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 and modify engineering design challenges for my own instruction?

- Compare engineering design diagrams (affordances and tradeoffs)
- Engage in the fourth engineering design challenge (all content areas)
- 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 to workshop participants

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

- Edit a digitized, graphic-designed version of your engineering design diagram
- Discuss ethics in engineering related to students and the broader world
- Practice assessing student work using facilitator's own classroom examples and the Knowles Engineering Design Process Rubric
- Engage in your peers' engineering design challenges and provide feedback

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

- Peer teach your content-based engineering design challenge and debrief
- Plan for engineering-integrated instruction with a planning partner and receive feedback from critical friends
- Meet your coach, a teacher familiar with using engineering design in their classroom, and discuss your 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—per year! Typically, one meeting is usually held before your first engineering design implementation and one after

* Dates are subject to change; course is subject to cancellation if minimum enrollment is not met