

Physics for the Next Generation: The Patterns Approach



Transforming Mathematics & Science Education

Through this Knowles Academy course, physics teachers will engage in an innovative approach to teaching physics that integrates project-based learning, modeling, and the science and engineering practices. The essential question that drives the approach is: “How do we find and use patterns in nature to predict the future and understand the past?”

By using the ideas described in Next Generation Science Standards, this course prepares teachers to guide their students to make predictions, plan and conduct experiments, collect data, engage in data-centered discussion and enable analysis of the results and argument from evidence. Participants in the workshop engage in the practices of science and engineering throughout the four days, starting with the anchoring experiments that contextualize the four common patterns in physics: horizontal line, linear, quadratic, and inverse. Teachers then engage in and learn to teach two project-based engineering units that serve to spiral the anchoring patterns with new physics concepts, developing conceptual, graphical, and symbolic understanding. The course includes three follow-up sessions that are designed to support teachers during the school year as they make instructional shifts.



Date: July 30–August 2, 2018

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

Location: Moorestown, NJ

Price: \$1000

Optional Graduate Course Credit Available - Additional Fees Apply

Course Objectives:

- Support students to identify common mathematical and graphical patterns in nature
- Establish coherence across physics concepts
- Contextualize student learning through problem solving and scientific inquiry
- Facilitate data-informed student discussions
- Support student writing skills using the claim, evidence and reasoning framework
- Develop formative assessments that lead to improved instruction and student learning

“We had teachers walk out saying it was the best professional development they had ever had.”

Dr. Susan Holveck
Science TOSA for Secondary Schools,
Beaverton School District



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 15 years.

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.

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Agenda:

Teachers will receive ongoing coaching that is initiated by a four-day, in-person workshop and supplemented with three virtual meetings.

Day 1:

- Experience the *Patterns Approach*
- Explore the anchoring experiments to establish horizontal line and linear mathematical patterns
- Model student talk about data

Day 2:

- Connect the *Patterns Approach* to NGSS
- Explore the anchoring experiments to establish quadratic and inverse mathematical patterns
- Learn to incorporate real-world problems into physics courses
- Explore a classroom project on texting and driving that teaches concepts of motion and computational thinking

Day 3:

- Use student-collected data to form claim-evidence-reasoning arguments
- Learn how scientific inquiry informs data-driven engineering design solutions
- Explore a classroom project on bungee jumping that teaches concepts of energy
- Learn to integrate computer programming into engineering projects

Day 4:

- Explore ways to enhance student understanding through scientific reasoning and writing
- Learn to assess student understanding in patterns-based projects
- Connect with the national *Patterns Approach* community
- Explore *Patterns Approach* resources for differentiation and continued learning

Virtual Meetings:

- Three-hour online sessions with workshop facilitators and other participants to discuss common problems of practices and implementation challenges:
 - » #1 (late September, early October): Student talk
 - » #2: (late October, early November): Writing in science
 - » #3: (late November, early December): Using formative assessment

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.