

PROFESSIONAL DEVELOPMENT CATALOG

2011 - 2012

Center for Innovation in Engineering and Science Education
(CIESE)



CIESE Receives Presidential Award for
Excellence in Science, Mathematics, and
Engineering Mentoring
January 2011

Beth McGrath, Executive Director of CIESE accepts
congratulations from President Obama



STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY

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MESSAGE FROM THE DIRECTOR



I am honored and excited to have recently joined the energetic, creative and accomplished community at the Stevens Institute of Technology as the new Director of the Center for Innovation in Engineering and Science Education. CIESE has a long and impressive history introducing and supporting STEM innovation within and across K-12 and post-secondary education. In fact, we have been so successful that my position was added to extend our capacity. I am pleased to be supporting Beth McGrath, who is now Senior Research Associate and Executive Director of CIESE. I am pleased be working with Beth and our talented team to guide and support existing projects, provide strategic guidance and seek new opportunities to extend our reach and effectiveness.

We are at a transformational moment in education in the United States with unprecedented attention to increasing teaching effectiveness, closing achievement gaps across students from diverse backgrounds, drawing upon the affordances of technology to advance learning, and making challenging science and engineering learning a part of every students' experience. In fact, in July a new national effort, *A Framework for K-12 Science Education* was released. "The framework highlights the power of integrating understanding the ideas of science with engagement in the practices of science and is designed to build students' proficiency and appreciation for science over multiple years of school. Of particular note is the prominent place given to the ideas and practices of engineering."

Understanding how science, engineering and technology permeate our daily lives is critical to college and career readiness, democratic citizenship and daily decision-making. Understanding how the natural world works, how scientific understanding develops and is confirmed and refined in the light of new evidence, and how engineering and design processes lead to the technology around us needs to be at the center of every student's education.

For more than 20 years, the Center for Innovation in Engineering and Science Education (CIESE) at Stevens Institute of Technology has delivered high quality teacher professional development, based in educational theory, learning research, and two decades of experience, that integrates rigorous STEM content, engaging and interactive technologies, and proven instructional strategies. External evaluation of CIESE programs shows that this combination of STEM content, instructional strategies and innovative classroom resources are having an impact on both teacher knowledge and student achievement.

We welcome the opportunity to work with you to plan STEM implementations, professional development programs, coaching/mentoring sessions, or explore a long-term partnership with us. We invite you to review the opportunities listed in this catalog. In whatever program you enroll, you will benefit from the excitement that intensive professional development training provides while becoming part of a vibrant learning community from which to build and enhance your professional goals.



Arthur Camins

Intensive Professional Development Programs

- **In-District Coaching**
- **Curriculum Design**
- **Customized Programs**

CIESE Mission

The mission of the Center for Innovation in Engineering and Science Education (CIESE) at Stevens Institute of Technology is to catalyze and support excellence in teaching and learning of science, technology, engineering, and mathematics (STEM) and other core subjects through innovative, research-based instructional strategies and use of novel technologies. For over 20 years, CIESE has collaborated with teachers, administrators, schools and school districts in long-term programs that emphasize high quality, standards-based, technology integrated curriculum materials and administrative counsel.

Professional Development Options

CIESE offers a variety of programs to support school and district improvement in science, technology, engineering, and mathematics. Any of the individual workshops listed in this catalog or Intensive Science, Technology and Engineering Programs can be delivered as described or customized to suit specific needs and times. Workshops can combine face-to-face, online or a blended solution to meet professional development goals, combined with on-site coaching to ensure effective classroom implementation and evaluation. Workshops can be grade level and subject-area specific. Professional development for up to 20 teachers can be provided at your school, district classroom, computer lab, or on the Stevens campus.

In-District Workshops

CIESE offers a wide array of workshops that explore innovative, instructional strategies and technologies that enhance student achievement in science, mathematics, language arts/literacy and other core subjects. Teachers learn by using inquiry-based curricula, hands-on learning activities, innovative curriculum materials and cutting-edge technologies. Workshops can be grade level and/or subject-area specific and customized to district priorities, curricula, timelines and budgets. Workshops correlate to the NJ Core Curriculum Content Standards.

Fees:

The cost of in-district professional development includes up to 20 workshop participants. For some workshops, there are optional companion curriculum materials that can be purchased separately by the district or Stevens can provide these materials, at cost, to workshop participants, if desired.

- Full day workshop cost: \$2,000

Professional Development Hours

Professional development hours are awarded based on actual instructional time.

Workshop Benefits:

- Save on training: serve more teachers and save travel time and expenses.
- Flexible location: on our campus, in-district, local school or satellite locations.
- Convenient times: days, evenings, weekends during the school year and intensive summer workshops are available.
- Team building: learn proven strategies that can be implemented in the classroom, while interfacing with other teachers.
- Expert instructional staff: learn from instructors who possess both deep content expertise in science, technology, engineering, and mathematics, and K-12 classroom expertise.

In-District Coaching

Experienced CIESE instructors are available to work with teachers to enhance content knowledge, support the integration of exemplary curricula into classrooms, model and critique lessons, implement new technologies, conduct curriculum planning/review, or help develop a project management plan. These programs allow for one-on-one guidance and support with multiple teachers over an extended period. CIESE coaches can help teachers brainstorm ways to enrich their lessons by identifying available resources, technologies, and instructional strategies that increase student learning.

Fees:

A series of meetings with individual teachers or multiple teachers at one school or district wide can be purchased as shown below. Meetings can be scheduled on a weekly or monthly basis or used back-to-back for an intensive short term experience. Costs include preparation time and travel. Any workshop listed in this catalog may be substituted for any of the coaching visits if desired.

- 1-9 full day visits to one school: \$1,300/visit
- 10 or more full day visits to one school: \$1,100/visit (15% discount)

District Consulting

District consulting provides an on-going relationship that allows time for needs assessment, planning and development of a comprehensive educational solution to specific district needs. District consulting is tailored to provide services such as: customized professional development workshops, curriculum review and planning, technology integration strategies, classroom coaching/mentoring, instruction and assessment, and alignment of curriculum with the New Jersey Core Curriculum Content Standards and the Common Core Standards. For additional information and fee schedule, contact Patricia Slater by email at patricia.slater@stevens.edu or by phone at 201.216.5375.

Instructional Staff

CIESE instructors possess both deep content expertise in science, technology, engineering, and mathematics, and K-12 classroom experience. Many have worked as field scientists and practicing engineers before becoming elementary, middle, or high school classroom teachers. All have led intensive professional development programs, provided on-site classroom mentoring and coaching, developed curricula, and managed international and national telecollaborative projects.

Proven Results

Our workshop results set new standards for educational effectiveness. In a recent program offered by CIESE, *Partnership to Improve Student Achievement (PISA)*, a three-year Mathematics and Science Partnership program sponsored by the New Jersey Department of Education, findings indicate:

- Participating teachers showed science and engineering learning gains almost 3 times greater than teachers in a comparison group, and their students had science and engineering gains more than 2.5 times greater than comparison students
- For science gains alone, students of participating teachers had learning gains almost 2 times greater than students in the comparison group.

Enroll your staff in a professional development workshop and reap the benefits of our real-world-know-how and experience.

Contact and Scheduling Information

For additional information on professional development workshops, coaching, district consulting, fee schedules or to schedule an in-district workshop, contact:

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What Participants Say:

This is the most organized, effective workshop I've ever attended. Not only were the ideas excellent, but you really made me THINK about my interactions with my students. Middle School Teacher

The workshop was full of high interest investigations and hands-on activities that will get students to participate instead of just vegetating. High School Teacher

The scientific inquiry and engineering design process are both eye-openers for me, as far as teaching is concerned. Elementary Teacher

Excellent! Very innovative. The workshop gave me many techniques that can be taken back to classroom to use. Fourth Grade Mathematics Teacher

Workshops for Elementary School Teachers

Engineering is Elementary (EiE) Workshops (pages 8-9)

These workshops feature lessons that integrate applied science content within an engineering context relevant to the lives of youth. Each workshop will include exploration of key science concepts as well as engineering lessons from the [Engineering is Elementary](#) (EiE) curriculum developed by the Museum of Science, Boston where the science concepts are applied through an engineering design challenge. EiE is standards-based, research-based, classroom-tested curriculum that aligns with many national science curricula, including FOSS, STC, GEMS, and Insights. Teacher Guides for the EiE units can be provided to participants. It includes: Lesson Plans, Story Book, and Evaluations. **Two units should be combined for a full-day workshop.**

● **Weather**

Science Topics: **Weather**

NJCCC Standards: **Science 5.4 EF Technology 8.2AB**

EiE Unit - Catching the Wind: Designing Wind Mills (Mechanical Engineering)

This unit guides students to learn about wind and the ways engineers design machines to capture wind energy. Students explore different materials and shapes conducive to catching the wind. For the design activity, students create their own windmills that can lift a small weight.

● **Electricity**

Science Topics: **Series Circuit, Parallel Circuit, Insulators, Conductors**

NJCCC Standards: **Science 5.1, 5.2D Technology 8.2AB**

EiE Unit - An Alarming Idea: Designing Alarm Circuits (Electrical Engineering)

This unit helps students to apply their knowledge of electricity, circuits, conductors, and insulators as they design and construct their own alarm circuits. The science concepts of electricity/energy transfer, conductors and insulators, and complete and incomplete circuits are reinforced; students are also introduced to schematic diagrams.

• Oil Spill

Science Topic: **Ecosystems**

NJCCC Standards: **Science 5.1, 5.3, 5.4 Technology 8.2 B**

EiE Unit- A Slick Solution: Cleaning an Oil Spill (Environmental Engineering)

In this unit , students explore the field of environmental engineering as they design a process to clean an oil spill in a model river. They learn how pollution can negatively impact the organisms in the ecosystem and how engineers must consider the effects of pollutants on the organisms in a given ecosystem.

• Life Cycles

Science Topics: **Animal Classification, Taxonomy, Life Cycles of Animals and Plants**

NJCCC Standards: **Science 5.1, 5.3ABC Technology 8.2B**

EiE Unit - The Best of Bugs: Designing Hand Pollinators (Agricultural Engineering)

This unit helps students connect their knowledge of insects and plants to a broader understanding of the natural system of pollination. Science concepts about insects, life cycles, pollination, and natural systems are introduced and reinforced, and different aspects of agricultural engineering are explored. For the design challenge, students design and improve hand pollinators to work with different model flowers.

• Forces

Science Topics: **Forces and Motion, Balancing Forces, Bridge Structure**

NJCCC Standards: **Science 5.1, 5.2E Technology 8.2B**

EiE Unit - To Get to the Other Side: Designing Bridges (Civil Engineering)

In this unit, students explore why bridges are shaped differently. Students distinguish between beam, arch, and suspension bridges and learn how bridge designs counteract and redirect forces and motion. In the culminating design challenge, students design, construct, and test their own bridges.

• Cultivating Students' 21st Century Skills Through STEM Activities

Science Topics: **Physical, Biological, Earth/ Environmental Science**

NJCCC Standards: **Science 5.1, 5.2, 5.3, 5.4 Technology 8.1, 8.2**

Learn and engage in STEM activities/lessons that facilitate the integration of engineering and technology in elementary and middle school science. Participants will learn how to use the engineering design process to foster students' 21st century skills, such as creativity, innovation, problem solving, critical thinking, communication and collaboration. During this workshop, participants will have the opportunity to explore a variety of free online resources that house K-12 lesson plans, activities, and projects in STEM.

• Using Children's Literature to Introduce the Engineering Design Process

Science Topics: **Animal Characteristics, Habitats, Properties of Matter**

NJCCC Standards: **Science 5.1, 5.3AC Technology 8.1E, 8.2B**

Teachers will learn how to enrich their primary students' understanding of science concepts through the integration of quality literature coupled with related engineering activities. During this session participants will design, create and test solutions to practical problems presented in children's stories.

• Science Inquiry in Grades 3-8

Science Topics: **Phases of the Moon, Earth's Seasons**

NJCCC Standards: **Science: 5.1, 5.4A**

In this workshop you will experience and learn about the different kinds of models that you can use in your classroom to teach science concepts, promote scientific practices, and monitor students' learning throughout the lesson. We will review current reports in science education; specifically those that pertain to students' learning and teaching through inquiry, development of model-based inquiry lessons, and evaluation of students' work.

• Internet Projects for 21st Century Learning

Science Topics: **Life Science, Earth Science, Environmental Science**

NJCCC Standards: **Science: 5.3, 5.4 Technology 8.1CE**

Learn about free Internet-based projects that can be used to enhance the K-5 science curriculum. Explore CIESE sponsored and designed interdisciplinary projects such as [Wonderful World of Weather](#), [Square of Life](#) and [Bucket Buddies](#). In addition, other projects and resources will be recommended. All CIESE projects are standards based and have a language arts/literacy component, including suggestions for using children's literature to introduce or reinforce science concepts.

Workshops for Middle School Teachers

• Integrating Art, Engineering & Science

Science Topics: **Kinetics, Physical Science**

NJCCC Standards: **Visual Arts 1.1, 1.2, 1.3 1.4 Technology 8.2 Science 5.2**

Bring together art and science teachers to explore connections that blend engineering design and artistry to engage students in creative and innovative pursuits. During this hands-on workshop the teachers will work together to model classroom ready activities such as mobiles and other pieces of kinetic art that blend science, engineering design and artistic creativity.

Design Squad Workshops

(pages 11 - 12)

Unleash your students' ingenuity and get them thinking like engineers with [Design Squad](#) challenges. Design Squad, a PBS TV series, is one of the few places on TV where kids can learn about engineering. Viewers see Design Squad teams take raw materials and with very little adult intervention, transform them into workable solutions. As a resource for educators, PBS developed the Design Squad Educator's Guide which can be downloaded for free from the Internet. The guide has four units, divided into 10 engaging, hands-on challenges that emphasize teamwork and creative problem solving. Join us as we explore these units in depth.

• It's Electric

Science Topics: **Inquiry, Problem Solving, Technological Design, Electricity, Energy Transformations**

NJCCC Standards: **Science 5.2CD Technology 8.2AB**

Participants will design and wire two devices and put them through some rigorous (and fun) testing. Clips from a related TV episode, *Bodies Electric*, will be shown.

• Cars, Cars, Cars

Science Topics: **Inquiry, Problem Solving, Data Analysis, Technological Design, Motion and Forces, Energy Transformations**

NJCCC Standards: **Science 5.2CDE Technology 8.2AB**

Participants will design and build three cars, using the design process to turn their ideas into reality. Clips from a related TV episode, *The Need for Speed*, will be shown.

• **Blowin' in the Wind**

Science Topics: **Inquiry, Problem Solving, Technological Design, Motion and Forces, Energy Transformations**

NJCCC Science Standards: **Science 5.2CDE Technology 8.2AB**

Participants will design and build two tall towers and discover what makes structures strong and stable. Clips from a related TV episode, *Blowin' in the Wind*, will be shown.

• **Kick Start**

Science Topics: **Inquiry, Problem Solving, Technological Design, Motion and Forces, Energy Transformations**

NJCCC Standards: **Science 5.2CDE Technology 8.2AB**

Participants will design and build two machines that can reliably carry out some challenging tasks. Clips from a related TV episode, *Just for Kicks*, will be shown.

• **On the Moon**

Science Topics: **Inquiry, Problem Solving, Technological Design, Motion and Forces, Energy Transformations**

NJCCC Standards: **Science 5.2CDE Technology 8.2AB**

NASA and Design Squad have teamed up to develop a series of new activities related to NASA's goal of returning Americans to the moon by 2020. This workshop will cover three design challenges:

- **Touchdown:** Design and build a shock-absorbing system to protect astronauts when they land.
- **Roving on the Moon:** Design and build a vehicle to drive across the moon's surface.
- **Heavy Lifting:** Design and build a crane that astronauts can use for digging and moving heavy objects.

Building Math Workshops (page 13)

Building Math is an innovative modular curriculum developed by the Museum of Science, Boston and Tufts University for grades 6-8 mathematics studies that integrates math concepts, algebraic reasoning and engineering through an engineering design challenge in a realistic story context. Teacher Guides can be provided to participants.

• Stranded!

Math Topics: **Numbers and Operations, Measurement, Algebra, Geometry, Data Analysis, Problem Solving, Communication**

Math Common Core State Standards: **6-7.RP, 6-8.NS, 6-8.EE, 8.F, 6-8.G, 6-8.SP; F-LE, G-SRT, G-C, G-GPE, G-GMD, G-MG, S-ID, S-I**; NJCCC Standards: **Technology 8.2B**

Participants will take a journey of a lifetime battling to survive on a deserted island after a plane crash. This workshop will cover three design challenges:

- **A Storm is Approaching:** Design a shelter to protect you and your team from a storm.
- **We Need Water:** Design a water collector with enough capacity for you and your team.
- **Balancing Act:** Designing a loading plan that can keep people and objects balancing in a canoe.

• Everest Trek

Math Topics: **Numbers and Operations, Measurement, Algebra, Data Analysis, Connections, Communication**

Math Common Core State Standards: **6-7.RP, 6-8.NS, 6-8.EE, 8.F, 6-8.G, 6-8.SP; F-LE, G-SRT, G-C, G-GPE, G-GMD, G-MG, S-ID, S-IC**; NJCCC Standards: **Technology: 8.2B**

Participants will join a project adventure team on the trek of a lifetime, battling extreme climate conditions, as they journey to the top of the world. This workshop will cover three design challenges:

- **Gearing Up:** Design a coat to protect your team from Everest's year-round harsh, frigid weather conditions.
- **Crevasse Crisis:** Design a light-weight bridge to safely cross a dangerous ice crevasse.
- **Sliding Down:** Design an emergency zip-line transportation system to safely and quickly bring your sick teammates down the mountain.

• Amazon Mission

Math Topics: **Numbers and Operations, Measurement, Geometry, Algebra, Probability, Data Analysis, Connections, Communication**

Math Common Core State Standards: **6-7.RP, 6-8.NS, 6-8.EE, 8.F, 6-8.G, 6-8.SP ; F-LE, G-SRT, G-C, G-GPE, G-GMD, G-MG, S-ID, S-IC**; NJCCC Standards: **Technology: 8.2B**

Participants will join a community service team on a mission to the Amazon Rainforest to investigate, and hopefully solve, the problems of the indigenous people group known as the Yanomami. This workshop will cover three design challenges:

- **Malaria Meltdown:** Design a medicine carrier that can safely transport malaria medicine while keep it cool in a tropical climate.
- **Mercury Rising:** Design a water filter system to remove mercury from a river.
- **Outbreak:** Design a virus intervention plan to contain the spread of the flu.

Workshops for Middle & High School Teachers

A World in Motion Workshops

(page 14)

Designed by the Society of Automotive Engineers International (SAE), AWIM® seeks to make math and science exciting by introducing authentic engineering design experiences in the classroom. Developed for 4th – 10th grade students.

- **Motorized Toy Car**

Science Topics: Force and motion, Friction, Simple Machines, Electronics
NJCCC Standards: **Science 5.1, 5.2** **Technology 8.2**

In this workshop, teachers will explore the concepts, nuances and details to make this *AWIM* project a classroom success. Find out how to provide an opportunity for students to develop new designs for electric gear driven toys writing proposals, drawing sketches, and working with models to develop a plan to meet a specific set of design requirements.

- **Glider**

Science Topics: Forces and Motion, Flight
NJCCC Standards: **Science 5.1, 5.2** **Technology 8.2**

In this workshop, teachers will explore the concepts, nuances and details to make this *AWIM* project a classroom success. Find out how to provide an opportunity for students to explore the relationship between force and motion and the effects of weight and lift on a glider, the relationship between data analysis and variable manipulations, and the importance of understanding consumer demands. The glider activity culminates in a book-signing event where each design team presents its prototype and the class presents its manuscripts to Mobility Press "representatives" and members of the local community.

• Earth Science & Engineering Connections - Earthquakes

Science Topics: **Earthquakes, Volcanoes, Latitude & Longitude, Plate Tectonics**

NJCCC Standards: **Science 5.4CD Technology 8.2B**

[Musical Plates: A Study of Earthquakes and Plate Tectonics](#) has four core activities that teach students how to access and interpret real-time earthquake and volcano data and how to use the information to solve a real-world problem. Participants will engage in a guided exploration of this project and then investigate how to build a structure to withstand liquefaction. They will also design an earthquake resistant structure.

• Physical Science & Engineering Connections - Properties of Water

Science Topics: **Properties of Water, Water Quality**

NJCCC Standards: **Science 5.2B, 5.4G Technology 8.2B**

In the *[International Boiling Point Project](#)*, students discover which factor in the experiment (room temperature, elevation, volume of water, or heating device) has the greatest influence on boiling point. After conducting the boiling point experiment, students submit their results to a world-wide online database. Then, students analyze all of the data to reach an answer to the question: What causes a pot of water to boil? Participants in this workshop will engage in a hands-on exploration of this experiment and practice analyzing archived data. In addition, participants will design a mechanism to collect and condense the steam from boiling "polluted" water to create pure, clean water.

• Cultivating Students' 21st Century Skills Through STEM Activities

Science Topics: **Physical, Biological, Earth or Environmental Science**

NJCCC Standards: **Science 5.2, 5.3, 5.4 Technology 8.1, 8.2**

Learn and engage in STEM activities/lessons that facilitate the integration of engineering and technology into elementary and middle school science. Participants will learn how to use the engineering design process to foster students' 21st century skills, such as creativity, innovation, problem solving, critical thinking, communication and collaboration. During this workshop, participants will have the opportunity to explore a variety of free online resources that house K-12 lesson plans, activities, and projects in STEM.

• **Wind Power: Energy and Engineering**

Science Topics: **Inquiry and Problem Solving, Technological Design, Electricity and Energy Transformations**

NJCCC Standards: **Science 5.2CD Technology 8.2B**

This workshop will introduce teachers to an innovative energy education project that engages students in affordable wind power activities. Workshop participants will be introduced to information about wind energy, lesson plans and experience the engineering design process while using an educational wind turbine to lift weights, pump water and generate electricity.

• **Science Inquiry in Grades 3-8**

Science Topics: **Phases of the Moon, Earth's Seasons**

NJCCC Standards: **Science: 5.1, 5.4A**

In this workshop you will experience and learn about the different kinds of models that you can use in your classroom to teach science concepts, promote scientific practices, and monitor students' learning throughout the lesson. We will review current reports in science education; specifically those that pertain to students' learning and teaching through inquiry, development of model-based inquiry lessons, and evaluation of students' work.

• **Algebra and Graphing Calculators**

Math Topics: **Patterns, Functions and Relationships, Modeling, Procedures**

Math Common Core State Standards: **6-8.EE, 8.F, A-SSE, A-APR, A-CED, A-REI, F-IF, F-BF, F-LE, F-TF; CCSS Mathematical Practices 4, 5; NJCCC Standards: Technology 8.1**

This workshop will focus primarily on algebraic concepts and pedagogical strategies for teaching algebra. This workshop emphasizes key concepts identified in the Common Core State Standards for Mathematics and provides participants with TI-Nspire CAS or TI-84 graphing calculator lessons that support the teaching of those concepts. Emphasis will be placed on using the calculators in a wireless TI-Navigator network for maximum classroom collaboration to help students achieve the NCTM benchmarks of moving seamlessly from data in tables, to visual graphs, to symbolic expressions. Linkages will be made throughout each workshop to district curricula including Algebra I and Transition Math.

• **SCRATCH Computer Programming**

Math Topics: **Algebra Variables, Logic**

Math Common Core State Standards: **1-8** NJCCC Standard: **Technology 8.1**

This workshop will introduce teachers to *SCRATCH* – a visual, intuitive computer language developed by MIT and designed to be a student’s first foray into computer programming. Students quickly learn to construct working computer programs out of the basic building blocks and operations inherent in all computer code. Universal concepts such as algebraic variables; sequential and repeating steps and loops; logic and conditional decision- making; are all learned within a game-like interface. In this hands-on workshop, teachers immediately create programs; and are shown how students can post their work, presentations, games, and animations online within the *SCRATCH* open source social network.

• **Real World Problems in Earth Science**

Science Topics: **Weather, Earth’s Motion, Measurement, Earthquakes, Plate Tectonics, Engineering Design**

NJCCC Standards: **Science 5.4ACD Technology 8.1CE, 8.2AB**

The real time data and collaborative projects that will be introduced in this workshop include:

- [*Weather Scope*](#) - Study factors that affect weather and climate.
- [*Musical Plates: A Study of Earthquakes and Plate Tectonics*](#) - Explore the relationship between earthquakes and plate tectonics using real time earthquake data.
- [*The Noonday Project: Measuring the Circumference of the Earth*](#) - Measure the circumference of the earth using a method that was first used by Eratosthenes over 2000 years ago.

• **Real World Problems in Life Science & Biology**

Science Topics: **Genetics, Water Quality**

NJCCC Standards: **Science 5.3D, 5.4G Technology 8.1CE**

The real time data and collaborative projects that will be introduced in this workshop include:

- [*Genetics Project: Is the Dominant Trait Most Prevalent?*](#) - Let's ask a lot of people all over the world which traits they have. Then we can analyze the collected data to see if the dominant trait occurs more frequently than the recessive trait.
- [*The Global Water Sampling Project: An Investigation of Water Quality*](#) - Compare the water quality of your local river, stream, lake or pond with other fresh water sources around the world.

• Real World Problems in Physical Science, Physics & Chemistry

Science Topics: **Properties of Water, Measurements (Time, Distance, and Speed), Vectors**

NJCCC Standards: **Science 5.4G Technology 8.1CE**

The real time data and collaborative projects that will be introduced in this workshop include:

- [*The International Boiling Point Project*](#) - Discover which factor in the experiment (room temperature, elevation, volume of water, or heating device) has the greatest influence on boiling point.
- [*The Stowaway Adventure: Adventures on the High Seas*](#) - Use real time data from the Internet to track a real ship at sea, determine its destination and predict when it will arrive.
- [*Navigational Vectors*](#) – Track a real airplane in flight and learn how vectors and trigonometry are used for aviation navigation

• Real World Problems in Environmental Science

Science Topics: **Experimentation and Measurement, Water resources, Air Quality, Pollution**

NJCCC Standards: **Science 5.4EFG Technology 8.1CE**

The real time data and collaborative projects that will be introduced in this workshop include:

- [*Down the Drain: How Much Water Do You Use?*](#) - Collect data on water usage and determine what you might do to use less water.
- [*Air Pollution: What's the Solution?*](#) - Use data and animated maps from the internet and monitor for the presence of ground level ozone.
- [*The Global Water Sampling Project: An Investigation of Water Quality*](#) - Compare the water quality of your local river, stream, lake or pond with other fresh water sources around the world.

• Internet Projects for 21st Century Learning

Science Topics: **Life Science, Earth Science, Physical Science and Environmental Science**

NJCCC Standards: **Science 5.2, 5.3, 5.4 Technology 8.1CE**

Learn about free Internet-based projects that can be used to enhance the 6-12 science curriculums. Explore CIESE sponsored and designed interdisciplinary projects such as [*Musical Plates: A Study of Earthquakes and Plate Tectonics*](#), [*The International Boiling Point Project*](#), [*Genetics Project*](#) and [*The Global Water Sampling Project: An Investigation of Water Quality*](#). In addition, other Internet-based projects and resources will be recommended.

• *Google Tools for Educators*

NJCCC Standards: **Technology 8.1**

Integrate 21st century communication skills into your curriculum in a just few weeks! Discover innovative internet tools that can enhance the learning and teaching environment.

- Learn and use blogs and wikis with your students
- Learn to set up data collection projects that simplify the classroom experience
- Create documents that you can access anywhere you have an internet connection
- Create quizzes and surveys students can access on the internet and you can evaluate in seconds
- Create a functional web site so you can have your schedule, lessons, mailbox accessible for students and teachers at anytime
- Generate project websites to archive information and create a web-based interface for students to use at school or at home
- Create collaborative projects with your students or the local community to solve real world problems

Workshops for High School Teachers

Engineering the Future: Designing the World of the 21st Century (page 20)

Engineering the Future (EtF), developed by the Museum of Science Boston's National Center for Technological Literacy, is a full-year engineering and technology education course designed for students at approximately the 9th grade level. However, it may also be successfully implemented with students in higher grades, depending on their level of experience with engineering and science concepts. The course provides a strong foundation in physics and prepares students to explore the social, historical, and environmental contexts of emerging technologies. Through four projects, students learn about engineering design; manufacturing; cost/benefit analysis; communication and energy systems (fluid, thermal, and electrical). The four projects may be implemented sequentially as in the full-year course or may be implemented as stand-alone units. The course is intended for all students, not solely those pursuing engineering or technical disciplines. A teacher guide, engineering notebook, and text book can be provided to participants.

● **Design the World's Best Organizer**

Science Topics: **Engineering Design Process**

NJCCC Standards: **Technology Standard 8.2AB**

Participants learn how to make engineering drawings of their cell phone designs, conduct marketing surveys to find out what kinds of organizers people would like to purchase, construct models of their organizer concepts, redesign, and build a prototype for testing.

● **Design a Building of the Future**

Science Topics: **Forces, Balance, Energy**

NJCCC Standards: **Science 5.2DE Technology Standard 8.2AB**

Participants learn about the “new urbanization” movements in which city planners, architects, and engineers work together to design structures that serve a variety of functions. Tools of science and mathematics are applied to solving such problems as improving the structural integrity and thermal efficiency of the designed structures.

● **Improve a Patented Toy Boat Design**

Science Topics: **Energy Transfer, Behavior of Compressible Gasses. Non-compressible Fluids, Conduction of Thermal Energy**

NJCCC Standards: **Science 5.2 CDE Technology 8.2AB**

Participants build a “putt-putt boat” that is powered by a fluid/thermal engine. The design challenge is to apply fundamental concepts of matter and energy to understand how the boat works and then redesign it.

● **Power to Innovate**

Science Topics: **Electricity, Generators, Alternative Energy Sources, Communication Systems**

NJCCC Standards: **Science 5.2 CDE Technology 8.2AB**

Participants find out how ammeters and voltmeters work and how to generate an electrical current. The design challenges are to create a scoreboard code, design a mouse detector, a communications system, and a fan control system.

Systems and Global Engineering (SAGE)

(pages 21-22)

This workshop series focuses on the four instructional modules of the [SAGE project](#) developed at the Stevens Institute of Technology. Systems engineering activities engage high school students in challenges that address key STEM concepts and assist students in making informed career decisions. Teachers will learn how to implement the modules within an individual classroom or in collaboration with other schools.

● Reverse Engineering

Science Topics: **Inquiry and Problem Solving, Technological Design**

NJCCC Standards: **Science 5.1 Technology 8.2AB**

Reverse engineering involves taking a product apart to develop an understanding of its parts, systems, subsystems and how it works. Participants will work in small groups to disassemble a single use camera and prepare reassembly directions. Then they will be challenged to use the directions provided by another group to reassemble a different brand camera than they initially disassembled. Teachers will provide feedback about the directions they received and discuss using the SAGE collaborative modules with students in grades 9-12.

● Integrating LED and Solar Technologies

Science Topics: **Inquiry and Problem Solving, Technological Design, Electricity, and Energy Transformations**

NJCCC Standards: **Science 5.1, 5.2CDE Technology 8.2AB**

More than two billion people living in developing countries do not have access to electricity for their homes. Participants will learn about the science behind two emerging technologies, LED lighting and solar power generation. Teachers will assemble series, parallel, and series-parallel circuits using LED's and solar cells. Each attendee will build a working LED/solar lighting system and learn how to implement the module within an individual classroom or in collaboration with other schools.

● Water Purification

Science Topics: **Inquiry and Problem Solving, Technological Design, Life Science**

NJCCC Standards: **Science 5.1, Technology 8.2AB**

Participants will explore the need for clean water and the issues related to contaminated water, including water treatment methods. Teachers will learn how to implement the activities in the classroom and how classrooms from around the globe can work together on the design and production of a water purification system which could be used in a developing country.

• **Biodynamic Farming**

Science Topics: **Inquiry and Problem Solving, Technological Design, Life Science**

NJCCC Standards: **Science 5.1, 5.3C, Technology 8.2AB**

Participants explore aquaponics (hydroponics + aquaculture) systems to learn about using appropriate technologies to combat global issues such as food shortages and sustainability. Teachers will learn how to implement the module which requires students to research biodynamic farming systems and engage in a series of design challenges leading to the design of a model aquaponics system that sustains plant and animal life.

Intensive Science, Technology, Mathematics and Engineering Programs Multi-Day Workshops, Grades K-12

CIESE offers a variety of intensive, science, technology and engineering programs focused on science, mathematics, engineering, and literacy that can be customized to meet your district's needs. Professional Development training for up to 20 teachers can be provided at your school or district computer lab, or on the Stevens campus. Workshops can be grade level and subject-area specific. Any of the individual workshops listed in this catalog or the long-term systemic programs described below can be delivered as described or customized to suit specific needs and times.

• **Integrated Science & Engineering Program for Middle School Earth, Life and Physical Science Teachers**

This 30-hour professional development program strengthens teachers' science content knowledge and pedagogy by preparing them to use online, award-winning curriculum resources developed by CIESE. These NJCCCS-aligned curricula engage students in science inquiry, engineering design and problem-solving through use of Internet-based, real-world data and technological design. Teachers participate in hands-on science investigations and team-based engineering design activities in life, earth, and physical science. Activities reinforce topics measured by the NJ ASK8.

• **Savvy Cyber Teacher® (SCT)**

This research and standards-based program was initiated through the U.S. Department of Education's Technology Innovation Challenge Grant (1998-2003) in which over 8,000 teachers in Arizona, Florida, and Ohio were trained in a two-tiered turnkey training program in partnership with community colleges. [Savvy Cyber Teacher](#), developed by CIESE, is a 30-hour graduate level professional development program to assist elementary, middle and high school teachers in implementing Internet-based resources that engage students in quantitative, inquiry-based activities in science, mathematics, social studies and language arts. SCT can be implemented on a weekly basis with after-school 3-hr workshops or as an intensive 5-day summer institute held on the campus of Stevens Institute of Technology or a computer lab in your district.

• **Technology in Mathematics Education (TIME)**

Technology in Mathematics Education is an 18-hour professional development program targeted to teachers of students in grades 6-8 and that capitalizes on the interactive nature of the Internet. With a focus on algebra, pre-algebra, number sense, geometry and trigonometry, lessons are designed to meet the curriculum standards that lead to improved student achievement on the New Jersey Assessment of Skills and Knowledge (NJ ASK) and the Grade Eight Proficiency Assessment (GEPA). Held on the campus of Stevens Institute of Technology, or at your district or school computer lab.

• **Using Technology to Enhance Literacy Instruction**

This 30-hour professional development program provides teachers, technology coordinators, and library media specialists with the skills and knowledge to use technology effectively to enhance the language arts literacy curriculum for younger students. Participants will be engaged in activities which meet technology and literacy core curriculum content standards while enhancing literacy instruction in the K-3 classroom. This institute can be implemented on a weekly basis with after-school 3-hr workshops or as an intensive 5-day summer institute held on the campus of Stevens Institute of Technology or a computer lab in your district.

• **WaterBotics™**

This goal of this new, innovative program is to catalyze student interest and achievement in engineering, science, and information technology. Appealing to a target audience of middle and high school students, WaterBotics™ employs an innovative design challenge — building *submersible* robots from LEGO and other parts that can perform a series of increasingly complex and sophisticated underwater tasks. The aquatic environment presents unique challenges that require students to problem-solve using successively deeper levels of science understanding, the iterative design process, teamwork and communication, and information technology. This 30-hour professional development program provides technology and science teachers with the skills and knowledge to implement this curricula in their classrooms.

• **Pro/ENGINEER (Engineering CAD)**

Pro/ENGINEER Schools Edition is an engineering computer-aided design (CAD) tool with fully associative capabilities spanning modeling, assemblies, drawings, animations, kinematic analysis and design optimization, renderings and more. The program was developed specifically to introduce middle and high school students to design technology and help them to become better problem solvers, critical thinkers and collaborators. Participants in this 2-day workshop will learn thorough multimedia tutorials and project-based activities. Honing skills from the first workshop will be combined with learning new skills, including blended, helical and variable sweeps. Included will be two real world learning projects you can use with your students right away. After completing the 2-day professional development workshop, each participant will receive 300 licenses of *Pro/ENGINEER* Schools Edition 3D design software.