Science • Technology • Engineering • Math
STEM PROBLEM BASED LEARNING for sustainable technology NEWS

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TABLE OF CONTENTS



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# Problem-based Learning in the Everglades

By Susan M. Mooney

At Stonehill College, every student is required to participate in a Learning Community (LC) course that engages a cohort of students in interdisciplinary study, ideally through experiential learning. *Swamp Walks and Roadside Shrines (*LC-279) is one such collaboration, merging indigenous, place-based religions with an introductory environmental science course. These two fall semester courses are followed by a spring LC course, co-taught by both professors, which begins in the Everglades of South Florida. (This is the second iteration of this particular Everglades LC; I have co-led another version four times.) From January 2 - 10, we tent-camped with 21 sophomores (from 14 different majors, few in science, technology, engineering and mathematics disciplines), building community while experiencing the human and biological diversity of this unique

*The water team presenting a moringa seed purification demonstration at Stonehill College.*

place. In addition to the intellectual, interpersonal and physical tasks of learning while living outdoors in community, students prepared themselves for the major challenge of the spring semester: redesigning south Florida to be more sustainable. We dared to pose such a large, unstructured and irreducibly multi-

*Field-testing continued on page 4*

# Transforming Learning in Rhode Island

Ponaganset High School in North Scituate R.I., is implementing problem-based learning (PBL) strategies across disciplines, ranging from the school's technical education programs to standard academics.

"We have put a major focus on blurring the instructional lines between tech ed and the academic programs," said Dr. Kay Wood, assistant superintendent of the Foster Glocester Regional School District. "One step in the challenge of shifting instructional practices is to increase the level of thinking skills in our tech ed program, and increase the level of problem-based learning in our academic programs," she said.

Ponaganset High School began this transition in 2010 when Wood approached woodworking technology instructor Steven Martin with an opportunity to participate in the STEM PBL project and the STEM PBL Summer Workshop on problem-based learning at Boston University. Since his involvement in the Summer Workshop, Martin has field-tested two STEM PBL Challenges. The multimedia STEM PBL Challenges, which are being field-tested by participating STEM instructors from high schools and colleges across the country, task students with researching, designing and presenting a solution to an authentic industry problem by taking on the role of an engineer, scientist or technician commissioned to solve a problem for a client.

*PBL Course continued on page 3*

# Preparing Teachers for STEM in Technology and Engineering Education

By Nicholas Massa, Ph.D.

The *STEM in Technology and Engineering Education (TE-599)* course at Central Connecticut State University was developed to help in-service Technology and Engineering Education (TEE) teachers develop the capacity to integrate science, technology, engineering, and math (STEM) content into their curricula using problem-based learning (PBL).

During the spring 2012 semester, 20 in-service teachers from Connecticut and Massachusetts enrolled in the graduate level course, in which PBL pedagogy is integrated through active engagement with the STEM PBL Challenges. The majority of students in the course are high school TEE teachers with a broad range of experience and skill levels. There are several science and math educators in the class, which allows for a diverse range of ideas and substantive discussions surrounding the integration of STEM topics into various curricula.

During the first two weeks of the course, students engaged in a review of the literature on PBL to develop a deep foundational knowledge of PBL principles and pedagogy. Students read John D. Bransford's "*How People Learn*" and discussed the study's principle findings and their implications for classroom practice, and how PBL aligns with and supports those findings.

In the third week of class, students were presented with their first PBL Challenge, Blinded by the Light. The Challenge was presented during a single 2 ½ hour class period using the *structured* approach to PBL. After being broken up into six teams of three to four students and presented with the Challenge Introduction, Organization Overview and Problem Statement videos, students were allowed one hour to work with their teams using the Whiteboards, a problem solving tool. Students were then presented with the Problem Discussion video and continued working on the Challenge. The teams' solutions were presented to the class the following hour.

After watching the Organization Solution video, a discussion ensued in which students reflected on the effectiveness of their problem-solving process and how their solutions compared to that of the organization. Students were assigned the Challenge's *Question Bank*, *Concept Mapping* exercise, and the *Final Challenge Report* for homework. They presented their concept maps using PowerPoint during the following class.

*In-service teachers in TE-599 working on a STEM PBL Challenge.*

The next week students were assigned their second PBL Challenge to be completed using the *guided* approach. Students chose to work on the FloDesign, Hiking 911, and the TTF Watershed Partnership Challenges, and they were given two class periods to complete an individual Challenge. The Problem Discussion video was presented at the end of the second class. Students presented their solutions during the third class period, and a classroom discussion was held to compare and contrast their results. The solutions presented were detailed, complete, and impressive. The students were again assigned the *Question Bank*, *Concept Mapping* exercise, and *Final Challenge Report* for homework.

At the time of this writing, the third and final PBL Challenge has been assigned and is currently in progress using the *open-ended* approach. Upon completion of the third Challenge, students will be presented with a PBL Challenge design template and will be asked to create a PBL Challenge of their own. The format of the Challenge design project will be scripted but without multimedia enhancement. These instructor-designed Challenges will be added to the pblprojects.org website for use by other teachers and will be expanded upon in subsequent classes in an effort to create a "living library" of PBL resources available to educators.

While the CCSU course is still in a pilot phase, teachers continue to be excited and motivated to apply what they have learned in class to their own curricula in order to develop students' problem-solving and critical thinking skills through real-world problem solving. ■

*Dr. Massa teaches in the Laser Electro-Optics program at Springfield Technical Community College in Springfield, Mass. He can be contacted at massa@stcc.edu.*

**Other Problem-Based Learning (PBL) Projects of Interest**

| Project Name | Contact |
|---|---|
| The Case Files: Making Learning Real | Dr. Ruth Loring, Senior Project Leader for Problem-Based Case Learning (PBCL), Nashville State Community College |
| Destination: Problem-Based Learning (D: PBL) | Jane Ostrander, Principal Investigator, Truckee Meadows Community College |
| National Center for Case Study Teaching in Science | Clyde F. Herreid, Director, University at Buffalo |
| Problem-Based Learning at University of Delaware (PBL@UD) | Prof. Stephen A. Bernhardt, the Kirkpatrick Chair in Writing and Director of PBL@UD |
| Project Based Learning for Sustainability Curriculum | Angela Wall, Principal Investigator, Wayne Community College |
| South Carolina Advanced Technological Education (SC ATE) National Resource Center | Elaine Craft, Director, SC ATE |

*Please see PBL Resources at **www.stempbl.org** for additional PBL projects and resources.

*Transforming Learning continued from page 1*

*Steve Martin's advanced junior and senior woodworking technology students building a solar shed at Ponaganset High School in preparation for field-testing the STEM PBL SPG Solar/City of Tucson Challenge.*

Challenges have been implemented in a variety of STEM disciplines across high schools, two-year and four-year colleges in classes ranging from 10 to more than 100 students. Instructors have the option to choose an implementation approach to PBL from the *structured* (entirely instructor led), *guided* (moderately structured) and *open-ended* (instructor as consultant) models developed by the project team. Field-testing began in fall 2010 and will continue through spring 2012.

Having participated in a summer workshop in 2010 and a subsequent distance-learning course over the 2010-2011 academic year, instructors are expected to field-test two or more of the six STEM PBL or eight PHOTON PBL Challenges developed during the PHOTON PBL project (2006-2009). Instructors must respond to a survey and write a narrative describing the field-testing experience. Students are also expected to complete a survey documenting their experience. Feedback from instructors and students is being analyzed and synthesized into formative reports that will inform current as well as future Challenges. Findings will be disseminated in conference presentations and with the National Science Foundation (NSF).

Martin has so far field-tested the Tookany-Tacony Frankford (TTF) Watershed Partnership Challenge with two groups of students: an advanced senior woodworking technology class and a mixed group of freshman through senior year woodworking technology students. The TTF Watershed Partnership Challenge requires students to determine how local communities can address the problem of urban stormwater without investing in huge infrastructure projects.

Martin has also field-tested the SPG Solar/City of Tucson Challenge with another advanced junior and senior woodworking technology class. The class tackled the Challenge after building a solar shed for the school's Alternative Energy Program, which helped to prepare them for the intensive problem solving needed to address the Challenge: the city of Tucson, Ariz. wants to put a solar array on a large city-owned building, but the roof is not strong enough to support a traditional panel array.

As an instructor of woodworking technology, Martin is accustomed to working with students who enjoy a more hands-on learning approach. What the school district is trying to promote, however, is the integration of higher order thinking skills, such as those developed through problem-based learning processes (e.g., performing in-depth research and developing solutions to big picture problems), into technology education programs, just as they intend to integrate real-world problems into the school district's academic programs.

"Martin understands what the PBL process really is," said Wood, adding that PBL "goes far beyond applied learning. He is very animated when talking about the process and is committed to making sure his students not only use it well, but see its value."

With modifications to the school's curricula and instructional methodologies underway (the superintendent's office expects new curricula based on PBL methodologies to be introduced in the fall of 2012), Martin is becoming a valuable resource for Ponaganset High School instructors beginning to implement PBL models into their classrooms, Wood explained. Martin has also expressed interest in developing Challenges that are specific to the content that he teaches, a philosophy that he shares with other STEM PBL participants across the country, and a testament to the effectiveness of problem-based learning.

"I am already trying to design a Challenge based on earthquakes," Martin said. "I think it will be about how to reinforce a structure that was built in an earthquake zone. I am looking forward to implementing some of these Challenges into my classes in the future." ■

PBL in the Everglades continued from page 1

disciplinary challenge based on our prior teaching experiences. We both believe that students are capable of so much more independent and sophisticated work than we faculty typically ask of them.

Both fall courses offered PBL experiences. In the religious studies course, my colleague, John Lanci, engaged the students in collaborative learning each day, seminar style, addressing major questions and problems in religion. In the science course, I implemented the STEM PBL Cape Cod Cranberry Growers' Association Challenge over two 75-minute class periods, with student teams of three and minimal guidance. Three-quarters of the students later reported that the methodologies they learned in the STEM PBL Challenge proved useful when faced with the larger challenge of designing a sustainable south Florida. One student noted, "We didn't have a set answer we were looking for. It gave us a chance to work with the other students in our class on an open-ended project and develop some techniques that we could use down the road on the sustainable south Florida project." Another highlighted that, "STEM PBL gave us practice communicating and working together as a small group [and] an outline on how to tackle problems."

After returning from the Everglades, the students began the interdisciplinary PBL in earnest. As one student reported, "The first step in attempting to create a design for a more sustainable south Florida was actually experiencing the environment and way of life in the Everglades … we were able to take notes on the different aspects of life that were not sustainable so that we would have major areas of focus once we returned."

*Students canoeing through mangroves with crocodiles and spiders.*

Upon their return, students had weekly meetings with the entire class and individual meetings within their groups to tackle issues related to climate change, water, community, agriculture, urban planning, and biodiversity. After seven weeks of such work, the students presented their solutions at a public event of their own design. In fact, the challenge of creating that effective learning experience was a PBL case in itself! The students settled upon offering a brief introduction from the podium, then dividing the audience into six groups, which rotated every 10 minutes through the students' project stations where participants learned about the students' solutions to each of the six challenge areas above. At the event on March 6, each station engaged the audience with bright posters, striking demonstrations, videos, and/or interactive games, as well as clear speeches followed by time for questions and conversation.

In addition to learning much about sustainability, the students reported growth in self-confidence, leadership and collaborative skills. While they recall some frustration during the PBL process, most students recognize that more structure from the professors would have diminished their learning. They take great pride in successfully responding with so little guidance to such a complex challenge and feel best about those aspects in which they have the strongest sense of ownership. In fact, one student expressed dismay that the class accepted the professors' suggestion about possible focal areas too readily: "I almost feel like the class missed out on a learning opportunity there."

Compared to my previous attempts to teach via interdisciplinary PBL, I believe most of these student teams conducted more thorough research, especially into the scientific aspects of each problem. It seems likely that this is due to the STEM PBL Challenge experience, and as one student suggested, next time I plan to "have two or three more exercises like that to prepare the students." ■

*Professor Mooney is the environmental studies program director at Stonehill Community College in Easton, Mass. She can be contacted at smooney@stonehill.edu.*

# Promoting Career Pathways for STEM Students: A STEM PBL Instructor on Training Your Mind to Think

Participating STEM PBL instructor, Vincent DiTaranto, Ph.D., of Quinsigamond Community College in Worcester, Mass., has been a proponent of problem-based learning in STEM education for more than 20 years.

DiTaranto was first exposed to PBL when he graduated from Northeastern University with an MS in civil-environmental engineering. With a focus on public health (DiTaranto obtained a BS in biology and minored in chemistry at Northeastern), he was hired by an international corporation dealing with hazardous waste where he was asked to design a new heavy metals pretreatment system and to upgrade a plastics pretreatment system for a chemical production facility. Like many of his students today, who DiTaranto explained often come from the workforce in search of degrees that will offer them career advancement, he quickly realized there was no textbook, lecture, or professor to fall back on in the face of the task his company had asked him to undertake.

In this case, DiTaranto flourished. He designed a system that landed him a presentation at a conference in Las Vegas as a young professional and, most importantly of all, the system worked. What was far more valuable, however, was the life lesson that DiTaranto gained from the experience: that students need to train their minds to think. DiTaranto realized that what was lacking in his own education was the training to create and solve real-world problems, a realization that led him to want to develop programs in engineering in which students do just that.

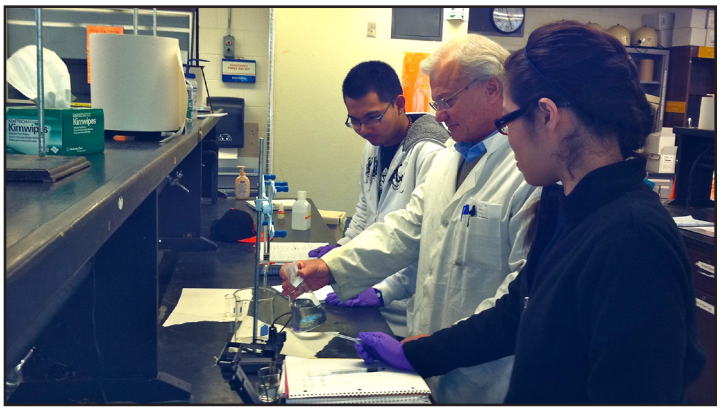
With a14-year background in industry, DiTaranto is now a professor of engineering, chemistry and mathematics, and having worked at Quinsigamond for 25 years, it is clear that DiTaranto loves what he does. His students are all challenged by DiTaranto's teaching methods, which task them with applying the STEM theories that they learn in class to the real world.

"I don't have my students memorize – I have them use their minds to think, create and solve a problem," he explained. "This prepares and trains them to be successful in the workforce."

DiTaranto's thermodynamics students, for example, are required to write a thesis according to the regulations of the University of Massachusetts, the same regulations applied to Masters and Doctoral theses. Students have to deliver a PowerPoint presentation and discuss their work. The project comprises about one-third of the students' overall grade.

"They have to do real research about what is going on in the world and other institutions, and they have to document their research formally," he explained. "This is preparing students for a university so they can go on to a school of higher education and receive a masters degree, and beyond, if they so choose."

This year, DiTaranto was selected for a 2012 National Institute for Staff and Organizational Development (NISOD) Excellence Award, both for his work in problem-based learning over the last 25 years, and his involvement in the STEM PBL project. Kathy Rentsch, dean of business and technology at Quinsigamond Community College, handpicked DiTaranto for the award.



*Professor DiTaranto assisting two Chemistry for Engineering students in utilizing the STEM PBL approach in the lab.*

"Professor DiTaranto was nominated and selected for this award due to his demonstrated teaching excellence, his exemplary leadership and his significant innovations and improvements in teaching," Rentsch wrote in her nomination.

Established in 1978, NISOD is a consortium of more than 700 community colleges around the globe. The annual Excellence Awards, which will be held in Austin, Tx., in May, 2012, will coincide with NISOD's annual International Conference on Teaching and Leadership Excellence.

This spring, DiTaranto will field-test the PHOTON PBL Challenge Watt's My Light?, which asks students to verify whether a 26-watt fluorescent light bulb has the same light output as a 100-watt incandescent bulb, with 10 students in his second year thermodynamics class. Most of these students will graduate in May 2012, and DiTaranto expects that their participation in the Challenge will provide them with additional preparation to enter the workforce or an institution of higher education.

"PBL is a real common-sense way of trying to prepare our students to be successful in industry," he explained. "I like to show my students what engineering is. I show them the amount of work it takes and the success that comes with being able to solve problems. This method is a training program for them, and it works. It absolutely does work." ■

**OSA Awards STEM PBL Co-PI in Science Education**

The STEM PBL team is pleased to announce that the Optical Society of America (OSA) has selected Co-PI Judy Donnelly, professor of physics/laser and fiber optics at Three Rivers Community College in Connecticut, as the winner of the 2012 Esther Hoffman Beller Award. Donnelly is the first community college instructor to receive the award, presented for outstanding contributions to optical science and engineering education.

# SkillWorks Panel on Green Collar Career Pathways

SkillWorks, a multiyear initiative to improve workforce development in Massachusetts, hosted a panel discussion on "Green Collar Career Pathways" at The Boston Foundation (TBF) in December 2011. Addressing workforce needs in clean energy, recycling, and drinking water/wastewater management in Massachusetts, the panel addressed stakeholders in workforce development, higher education and the green technology industry.

## CLEAN ENERGY

STEM PBL Advisory Committee member Kevin Doyle, of Green Economy and the New England Clean Energy Council, presented the findings of the *2011 Massachusetts Clean Energy Industry Report*. The report, prepared for the Massachusetts Clean Energy Center (CEC) by BW Research Partnership and the New England Clean Energy Council, found that the clean energy industry is growing faster than many other sectors in Massachusetts, having experienced a 6.7% growth rate from July 2010 to July 2011.

"The research finds that there are numerous growing occupations throughout the value chain of activities, such as research and development, manufacturing and sales. Talent development and supporting the pipeline of educated workers is critical to the success of clean energy companies," the report stated.

According to the report, Massachusetts has over 4,900 clean energy firms employing more than 64,000 workers. Key areas of employment included jobs in clean energy firms, the government and municipalities, and higher education institutions.

**Table 1: Clean Energy Firms and Employment By Value Chain Activity[8]**

| Primary Value Chain Activity | Number of Clean Energy Employers | Number of Clean Energy Workers |
|---|---|---|
| Manufacturing and assembly | 462 | 8,173 |
| Research and development | 868 | 11,019 |
| Sales and distribution | 881 | 18,686 |
| Installation | 2,052 | 20,709 |
| Other | 645 | 5,722 |

*"Clean Energy Firms and Employment By Value Chain" was published in the 2011 Massachusetts Clean Energy Industry Report.*

## RECYCLING

In a presentation of initial findings on a study of the recycling industry in Massachusetts, Amy Perlmutter of Perlmutter Associates and the Environmental Business Council of New England discussed current and future workforce needs. Perlmutter's study surveyed both private and public sector recycling organizations to identify where growth or contraction is expected, as well as issues employers face in finding qualified employees.

Initial findings indicate that the Massachusetts recycling industry, which comprises 2,000 establishments employing 14,000 people, is experiencing growth. The fastest growing occupational categories included general labor, sales and customer service, transportation and management. Although the study found that most training is done informally on the job, many firms reported that they would welcome leadership training.

Perlmutter recommended that in addition to forging partnerships with the workforce development community, the recycling industry should develop both economic and workforce strategies.

## DRINKING & WASTEWATER MANAGEMENT

Madeline Snow, from the Lowell Center for Sustainable Production, and Deborah Mutschler, of the Massachusetts Workforce Alliance, discussed career pathways in the drinking water and wastewater sectors. Research for this presentation was conducted in collaboration with the US Environmental Protection Agency (EPA), Massachusetts Department of Environmental Protection (DEP), wastewater and water operators, trade associations and training providers.

Despite job growth in green technologies, Snow and Mutschler found that the drinking and wastewater sectors have remained largely invisible. With 30% of the workforce eligible for retirement in the next five to 10 years, many waste and drinking water firms were concerned about future hiring needs. The primary obstacles to career entry included sector invisibility, changing prerequisites for certification and a lack of knowledge of basic math skills among job applicants.

Though the drinking and wastewater sector is changing, requiring technicians to employ new skill sets such as computer system competencies and an understanding of policy and climate change, it was found that once hired, career pathways and room for growth in the individual sectors were quite clear.

Findings from the SkillWorks panel come at an opportune time in the US economy. In February 2012, the President's Council of Advisors in Science and Technology (PCAST) released a report indicating one million STEM graduates are needed to fill expected jobs in science and math over the coming decade. Currently, fewer than 40% of students enrolled in STEM undergraduate degree programs complete college with a STEM degree.

Although the report offered strategies to increase retention rates of STEM undergraduates, it also cited uninspiring introductory courses, difficulty with the required math and an academic culture that was unwelcoming to women or minorities as reasons students gave for abandoning STEM majors.

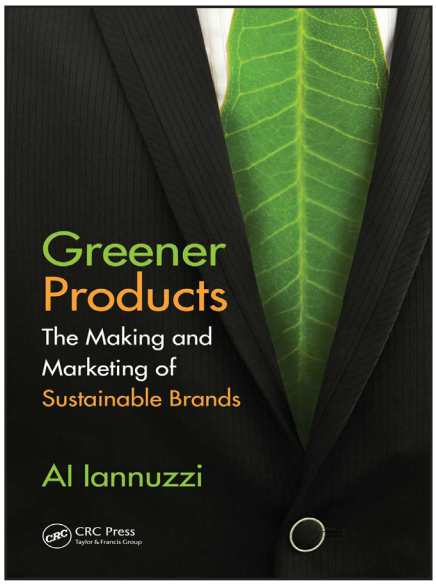
Based on the PCAST report, it is clear that although the SkillWorks findings are specific to Massachusetts, education will be the key to generating the skilled technicians needed to sustain the clean energy industry's growth in the United States. It will be the approaches to education — how we train students to think, learn and apply STEM skills — that determine students' future interest, preparation, retention, graduation and entry into STEM careers in this country, as well as the continued growth of the green economy. ■

# The Power of Green: STEM PBL Partner Publishes *Greener Products*

Al Iannuzzi, senior director of product stewardship at Johnson & Johnson, a STEM PBL Challenge partner, recently published *Greener Products: The Making and Marketing of Sustainable Brands*. Published by CRC Press, this book is well aligned with the STEM PBL project that is designed to engage students in STEM disciplines with a focus on sustainable technologies. The book was published in November 2011. The cost is $89.95 (ISBN 978-1-4398-5431-0).

"Today, developing greener products is no longer the right thing to do, but something you have to do," writes Iannuzzi in his new book. "One of the reasons for this new focus is the greater awareness of environmental issues related to things such as hazardous chemicals in our food and bloodstreams, glaciers melting and scarcity of resources and clean water," he notes.

Iannuzzi contends that when natural products like Method and Seventh Generation appear on the shelves of your local supermarket and magazines like *Sports Illustrated* devote entire feature articles to sustainability, it's a sign that times are changing. Companies like Clorox, with their Green Works® cleaning products, and GE, with Ecomagination™, are shattering the old stereotypes of greener products being ineffective and expensive. And they are showing that large multinationals can win in the marketplace with natural, organic, and "eco" products—even during tough economic times.




Iannuzzi believes that *Greener Products: The Making and Marketing of Sustainable Brands*, which offers practical advice on how to design and market greener products and services, would be useful in high school and college classes. In the book, he also shares best practices and lessons learned from companies such as Timberland, Philips, Apple Inc., Procter & Gamble, and BASF, as well as insights from guest authors Jim Fava and the Shelton Group. Outlining the market and regulatory drivers, Iannuzzi makes the case for greener products.

For more information please visit Mr. Iannuzzi's website at http://iannuzzigp.wordpress.com/. ■

# STEM PBL Challenges Aligned to the National Science, Mathematics and Technological Literacy Standards

In an effort to help assure that all schools provide high-quality STEM programs, national academic standards have been developed in all STEM disciplines for high school students. The standards provide a common foundation of knowledge and skills as well as a carefully organized system for assessing students' learning and programs' effectiveness.

All of the PBL Challenges have been aligned to national science standards developed by the National Research Council, mathematics standards developed by the National Council of Teachers of Mathematics, and technological literacy standards developed by the International Technology & Engineering Educators Association. A Standards Guide has been developed that provides an introduction to each of the standards, along with a matrix that shows At-A-Glance which standards are addressed in each Challenge and an overview for each Challenge that describes what subsets of standards are covered by each Challenge.

The Standards Guide is located on the STEM PBL website at www.stempbl.org and the PBLProjects website at www.pblprojects.org. ■

| Real-World Application | Industry Partner | The Challenge |
|---|---|---|
| Green Chemistry | Johnson & Johnson | Students are part of a team developing new treatment for eczema using active ingredients. |
| Lighting Design | RSL Fiber Systems | RSL Fiber Systems is designing an ergonomic and energy efficient lighting system for submarines. |
| Solar Power | SPG Solar/City of Tucson | The city of Tucson, Ariz. wants SPG Solar to put a solar array on a large building but the roof is not strong enough to support a traditional panel array. |
| Stormwater Management | TTF Watershed Partnership | Can the problem of urban stormwater be addressed by local communities without investing in huge infrastructure projects? |
| Sustainable Agriculture | Cape Cod Cranberry Growers' Association | Can technology be used to make a cranberry bog more energy efficient? |
| Wind Power | FloDesign | Students need to design a new way to extract electrical energy from a wind turbine. |

The STEM PBL project team has developed six problem-based learning Challenges focused on sustainable technologies in the fields of green chemistry, advanced lighting design, solar power, stormwater management, sustainable agriculture and wind power. To view the six STEM PBL and previously developed eight PHOTON PBL Challenges, please visit www.pblprojects.org.

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## *Pathways to Prosperity: Innovation for the 21st Century*
## Announcing the 47th NAWI Annual Conference

In collaboration with the National Association for Workforce Improvement (NAWI), NEBHE and the STEM PBL team are excited to announce the 47th NAWI Annual Conference at the Boston Park Plaza, May 24-25, 2012.

Dedicated to program improvement in Career and Technical Education (CTE), the NAWI conference is a convening of national state and local leaders in CTE, including administrators, teachers, and career and curriculum development professionals, as well as business, industry and governmental partners, all with an interest in learning about best practices and innovation in CTE education.

We encourage our readers to take advantage of this important professional development opportunity!

**Registration for this event closes May 18, 2012.**

To learn more or to register, please visit www.nawi.online.org, or contact Nicole Schepker, Project Assistant for the STEM PBL project, at nschepker@nebhe.org. ■

"Pathways to Prosperity: Innovation for the 21st Century" Conference Themes

* Sustainable and Interdisciplinary Product Design
* Igniting Student Interest in STEM and Engineering
* Creating a Culture of Innovation in Teaching and Learning
* New Models in High School and CTE Integrated STEM Career Pathways
* Successes in Industry–Education Collaboration and Work-Based Learning
* NSF ATE Program Dissemination
* Workforce Initiatives in Emerging Technologies/Fields