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STEM PBL is a project of the New England Board of Higher Education (NEBHE) and is funded in part by the Advanced Technological Education (ATE) program of the National Science Foundation (NSF).

Please visit our website:
www.stempbl.org

Program Staff:

Fenna Hanes
Project Principal Investigator
Sr. Director, Professional & Resource Development
617-357-9620 ext. 129
fhanes@nebhe.org

Nicole Schepker
Newsletter Editor & Project Coordinator
617-357-9620 ext. 113
nschepker@nebhe.org

NEBHE
45 Temple Place
Boston, MA 02111 USA



NEW ENGLAND
BOARD OF
HIGHER EDUCATION

NEBHE Receives Third Grant in PBL

The New England Board of Higher Education (NEBHE) has received funding for a new three-year grant from the National Science Foundation (NSF) for a New England-wide project titled *Problem Based Learning (PBL) in Advanced Manufacturing: Transforming 21st Century Technician Education*. Funding is provided through the NSF's Advanced Technological Education (ATE) program to improve science, technology, engineering and mathematics (STEM) education. The new project will build on the two previous ATE-funded PBL projects: PHOTON PBL, which focused on optics and photonics, and STEM PBL, which focused on sustainable technologies.

This new NEBHE project is the third in a series. Each is improving engineering technician education by infusing Problem Based Learning instructional materials, focused on real-world problems, into existing curricula. PBL is an in-

structional approach that challenges students to "learn how to learn" through collaborative real-world problem solving. NEBHE's experience with PBL shows that compared with traditional lecture-based instruction, PBL improves student understanding and retention of ideas, critical thinking and problem-solving skills, motivation and learning engagement. It also fosters students' ability to adapt their learning to new situations. This strategy will produce more graduates prepared to fill the demand for workers in New England's advanced manufacturing companies.

The focus of the new grant is advanced manufacturing, which has been defined as "manufacturing that entails rapid transfer of science and technology into manufacturing products and processes," by the Science and Technology Policy Institute. It relies on skilled labor, creativity, and innovation to produce

Project Launch continued on page 5

Field-Testing Across the States: How PBL Leads to Student Success

The multimedia STEM: PBL (science, technology, engineering and mathematics: problem-based learning) Challenges, which have been 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.

Field-testing began in 2010 and completed in spring 2012. The STEM PBL Challenges have been implemented in a variety of STEM disciplines across high schools, and two- and



College students from Central Methodist University hosted secondary students from the Columbia Area Career Center to solve the J&J and TTF Watershed Challenges.

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

Field-Testing continued on page 6

STEM PBL Capstone Showcase Held at HI-TEC Conference in Denver

By James DeLaura, Ed.D. and Nicole Schepker

The STEM PBL team hosted a Capstone Showcase on July 24, 2012 at the annual High Impact Technology Exchange Conference (HI-TEC), sponsored by the NSF-ATE program, held from July 25-26, 2012 in Denver, Colo. Participation in the Capstone Showcase was offered as a pre-conference workshop to any STEM PBL instructor who field-tested a STEM PBL or PHOTON PBL Challenge in its entirety. To complete a field-test, participants are expected to implement a STEM PBL or PHOTON PBL Challenge. Instructors must also submit completed student surveys as well as an instructor survey and narrative. This data is being used to evaluate the project and to generate reports for NSF and other research institutions.

The STEM PBL Capstone Showcase brought the grant full circle for participating instructors who were required to attend a Summer Workshop at Boston University in 2010. Of the 32 participants recruited and trained in the Summer Workshop, 14 participants completed the field-testing process. Field-testing participants represented high schools, community colleges and four-year universities hailing from the New England region, Maryland, Michigan, Missouri, Louisiana, Texas, California and even Romania. The following STEM PBL participants were able to join the project team for the Capstone Showcase in Denver, Colo.: Vincent DiTaranto, Quinsigamond Community College, Mass.; Deborah Lesko, South River High School, Md.; Alexander Pancic, The English High School, Mass.; Christine Roberson, Columbia Area Career Center, Mo.; and Nathan Usrey, Taft Union High School, Calif.

During the Capstone Showcase, instructors presented their implementation stories to the project team and their peers. During this session, participating instructors had a chance to learn from one another's experiences and to ask questions of each other and the project team. The instructor feedback generated by the session will serve to inform this and future projects.

On July 25th, instructors also presented their experiences implementing the STEM PBL and PHOTON PBL Challenges into their classrooms during a panel presentation at the general conference. The panel was moderated by STEM PBL Principal Investigator (PI) Fenna Hanes. More than 50 HI-TEC participants attended the panel session. This was followed by a poster session where participants and project team members networked with conference attendees. Participants later visited the Denver Botanical Gardens to tour the facility's green roof and learned about green roof implementation, horticulture and climate, and local policy regarding rainwater runoff. The following day Co-PIs Judy Donnelly and Nick Massa demonstrated the RSL Fiber Systems Challenge during a general conference session. When not presenting, Capstone Showcase participants were encouraged to attend other conference sessions.

Two Central Connecticut State University (CCSU) undergraduate students, Joseph Amarante and Elizabeth Chatis, currently seniors, also attended the conference, having participated in



CCSU students Joseph Amarante and Elizabeth Chatis in front of their Challenge poster, a part of the STEM PBL poster at HI-TEC.



The STEM PBL team at the Denver Botanical Gardens. L to R: C. Roberson, J. DeLaura, J. Amarante, N. Massa, E. Chatis, V. DiTaranto, A. Pancic, F. Hanes, N. Schepker, J. Donnelly, D. Lesko and N. Usrey.

a pre-service PBL pedagogy course developed by the project. A course assignment required students to develop their own Challenge. For their assignment, Amarante and Chatis created a real-world Challenge focused on redesigning a congested highway in Connecticut, involving the Connecticut Department of Transportation. Amarante and Chatis were selected to attend the conference based on their work. They presented their Challenge both to the project team during the Capstone Showcase and to conference attendees as a part of Donnelly and Massa's presentation on July 26th. The students worked under the guidance of project collaborator Dr. James DeLaura, chair of the Technology and Engineering Education Department at CCSU, and Co-PI Massa.

STEM PBL participants unanimously agreed that holding the Capstone Showcase at an existing conference was a valuable professional development opportunity that should be repeated in future grant cycles. Top takeaways included: discussing PBL implementation strategies with peers, building camaraderie with others in the project, networking with industry members and educators at the conference, and learning about green roofs. ■

James DeLaura is chair of the Technology & Engineering Education department at Central Connecticut State University in New Britain, Conn. He can be contacted at delaura@ccsu.edu.

What's Next? Taking a Closer Look at a Graduate of the STEM PBL Program

As a student in participating instructor Nathan Usrey's Integrated Science class, Katie Burrows has completed a total of three STEM PBL and PHOTON PBL Challenges at all three levels of instruction. Katie completed the TTF Watershed Partnership and Cal Poly Pomona (energy conservation) Challenges her freshman year, followed by the Johnson & Johnson Green Chemistry Challenge her sophomore year. She is currently a junior at Taft Union High School in Taft, Calif.

Katie has always wanted to become some kind of scientist, but found the prospect intimidating, despite her love for the subject. When Instructor Usrey offered his students a chance to participate in the STEM PBL program as an extra-credit activity outside of the curriculum, Katie was one of a handful of students who jumped at the opportunity, participating in the program during her lunch period and after school.

Like many high school and college students, Katie has a rigorous schedule, especially as an athlete. When asked why she chose to participate in the STEM PBL Challenges as an extracurricular activity, Katie answered matter-of-factly that she loves science and figuring out everyday problems.

"I liked that STEM PBL made you figure out problems by yourself, without any help from your teacher," she explained, recognizing that if she wants to solve unanswered questions as a scientist she needs to develop her STEM skills and the ability to solve problems on her own.

"Before participating in STEM PBL, I kind of doubted myself as a scientist," she said. "I recognized that many people wanted to become scientists but failed for a variety of reasons, and that made me wonder why I would be any different. After my experience with PBL I decided that I can do it and that I will succeed against all odds."

STEM PBL made science fun, Katie said, and more enjoyable.

It is no secret in STEM education that students often find it difficult to correlate STEM subjects with their applications in the real world, finding lecture-based instruction, note-taking, and end-of-chapter exercises boring. Common questions echoed across STEM classrooms are: "Why do I have to do or know this? Why does this matter?" In contrast, problem-based learning enables students to apply STEM subjects to the real world and to see first-hand how STEM is employed in the workplace.

Katie's favorite Challenge was the Johnson & Johnson Challenge, which asks students to develop a new treatment for eczema using plant-derived active ingredients. Using chemistry to determine what ingredients would work with the given parameters, and going through the trial and error process of how they would affect one another, made Katie feel like a real scientist. She developed her own moisturizer by researching ingredients and ordering them online. The one downside was that because Katie did not know anyone with eczema, she was unable to test her product to determine its effectiveness.



Katie Burrows creating a moisturizer to treat eczema as part of the J&J Challenge at Taft Union High School in Taft, Calif.

"Before STEM PBL, I didn't really think about the people who make medicine," Katie said. "It just didn't occur to me that someone had to figure out what ingredients to mix together to fight off a certain sickness. Through the PBL process I found out that I really like doing that, and I am thinking about doing it as a career."

Katie is interested in a few career paths, most notably pharmacology and computer engineering.

When asked to give her overall impression of PBL, Katie had a few things to say:

"PBL was a very rewarding experience for me. It was way different from normal learning. So it was very exciting for me to get a chance to do that. I think if [PBL] was an every day or weekly activity it would help students a lot, because when you are just sitting at a desk and people are giving you information it's really boring, but when I have to find the information myself, it sticks with me.

"I would totally recommend this program to another student," she said. "I would warn them that at times it can seem a little intimidating but that they should push through because, in the end, you will have much more confidence in yourself and in your own learning ability."

Katie plans to attend a four-year college with hopes of being accepted to her top-choice school, California Polytechnic State University in San Luis Obispo. In the meantime, she is continuing to pursue extracurricular activities in STEM. She participated in nearby Taft College's Summer of Innovation, Inspiration, and Invention, a STEM program, in 2011, where she made submarines and boats, and has joined a STEM club at Taft Union High School.

We look forward to seeing where STEM takes Katie as she transitions from high school to college and into her career! ■

Disseminating STEM PBL

The project PI and Co-PIs continue to disseminate STEM PBL project materials and research findings throughout the United States. They have presented the multimedia Challenges at conferences, workshops and teacher trainings, published articles, and attended conferences to reach a variety of stakeholders. The table below details the conferences STEM PBL Co-PIs, advisory committee members, participants and colleagues participated in the last year. Papers, presentations and appearances can be found at the following links on the STEM PBL homepage. ■

Conference Papers: <http://www.nebhe.org/programs-overview/professional-curriculum-development/about-stempbl/stem-conference-papers/>



L to R: STEM PBL participants Christine Roberson, Alexander Pancic, Nathan Usrey (speaking), Deborah Lesko, and Vincent DiTaranto with STEM PBL PI and panel moderator Fenna Hanes at the HI-TEC conference in Denver, Colo., July 25, 2012.

What's New: <http://www.nebhe.org/programs-overview/professional-curriculum-development/about-stempbl/whats-new/>

Conference Title	Title of Paper/Presentation and Presenters
NSF-ATE Annual Conference: Overcoming Barriers and Boundaries October 26-28, 2011, Washington, DC	<i>Student Success and Professional Development Using Multimedia Problem Based Learning</i> Co-PI's Judy Donnelly and Nick Massa in collaboration with Dale Rogers M.Ed., Program Coordinator & Assistant Professor, Multimedia Design at NSCC
ITEEA 74th Annual Conference March 15-17, 2012, Long Beach, Calif.	<i>Bringing Problem-Based Learning into Teacher Preparation Programs</i> James DeLaura, Central Connecticut State University, and Co-PI Nick Massa
NSTA Forum & Expo: Tools for STEM Education Preparations and Applications for Elementary and Middle School Educators May 17-19, 2012, Atlantic City, N.J.	<i>Increasing the STEM Pipeline with Problem Based Learning</i> Co-PI Judy Donnelly
ASEE – Spurring Big Ideas in Education June 10 – 13, 2012, San Antonio, Tex.	<i>Assessing the Effectiveness of a Problem-Based Learning Professional Development Model in STEM Education</i> James DeLaura, Central Connecticut State University, and Co-PI Nick Massa
UConn Teacher Certification Program for College Graduates: Summer Workshop May 23, 2012, Storrs, Conn.	<i>Introduction to Problem Based Learning</i> Co-PI Nick Massa
NSTA - STEM Forum and Expo May 17 – 19, 2012, Atlantic City, N.J.	<i>Increasing the STEM Pipeline with Problem Based Learning</i> Co-PI Judy Donnelly
NAWI – Pathways to Prosperity: Innovation for the 21st Century May 24 – 25, 2012, Boston, Mass.	<i>Active Learning in Technician Education: The PBL Challenges</i> PI Fenna Hanes and Co-PI Nick Massa
SREB – 26th Annual High Schools that Work Staff Development Conference: Engaging Students Intellectually, Emotionally, Socially and Behaviorally in Learning July 11- 14, 2012, New Orleans, La.	<i>Blinded by the Light: A PBL Challenge in Laser Safety</i> <i>Submarine Lighting: A PBL Challenge in Fiber Optics</i> <i>Energy Conversion in Wind Turbines: A Problem Based Learning Challenge</i> PI Fenna Hanes and Co-PI Judy Donnelly
HI-TEC: Educating America's Technical Workforce July 23 – 26, 2012, Denver, Colo.	<i>STEM PBL in the Classroom: High School and College Implementation Models</i> PI Fenna Hanes and STEM PBL participants Alexander Pancic, The English High School, Jamaica Plain, Mass.; Vincent DiTaranto, Quinsigamond Community College, Worcester, Mass.; Nathan Usrey, Taft Union High School, Taft, Calif.; Christine Roberson, Columbia Area Technical Center, Columbia, Mo.; Deborah Lesko, South River High School, Edgewater, Md. <i>Active Learning in Technician Education: The Problem-Based Learning PBL Challenges</i> Co-PI Judy Donnelly, Co-PI Nick Massa; and James DeLaura with students Joseph Amarante and Elizabeth Chatis, Central Connecticut State University, New Britain, Conn.
The New England Campus Sustainability Forum (NECSF) September 21, 2012, Boston, Mass.	<i>Problem-Based Learning (PBL) For Sustainable Technology</i> PI Fenna Hanes; James DeLaura, Central Connecticut State University; Susan Mooney with student Gabriella Gobiel, Stonehill College, Mass.
CT STEM Conference September 24, 2012, Hartford, Conn.	<i>STEM PBL: Problem Based Learning for Sustainability</i> Co-PI Nick Massa and Marijke Kehrnhahn, PhD., Associate Dean, Neag School of Education, University of Connecticut, Conn.

The STEM PBL team would like to thank our industry partners, the Cape Cod Cranberry Growers' Association, FloDesign, Johnson & Johnson, RSL Fiber Systems, SPG Solar/City of Tucson, and the Tookany/Takony Frankford Watershed Partnership for their commitment to the project.

Project Launch continued from page 1

highly specialized and complex products, requiring engineers, business developers, entrepreneurs, scientists, financiers, machinists and other experienced professionals to collaborate and apply their collective knowledge and problem-solving skills to produce innovative customer solutions to manufacturing challenges.

In 2009, the New England Council commissioned a study conducted by Deloitte Consulting, which showed that nearly 60 percent of manufacturing jobs in New England are classified as advanced manufacturing. Interviews with New England-based advanced manufacturers revealed concerns that manpower shortages were constraining growth, estimating that between 7,500 and 8,500 jobs remain vacant due to a lack of skilled workers.

To address this shortage in New England, the project will develop a series of authentic multimedia case studies in advanced manufacturing in collaboration with regional industry partners. These instructional materials will focus on sustainable practices in fields such as aerospace, optics, precision measurement, medical devices and nanotechnology. Additionally, the project will provide professional development activities for high school and college in-service STEM educators that include webinars, a summer 2014 workshop, technical assistance and a capstone showcase.

NEBHE will continue to collaborate with Central Connecticut State University to develop additional instructional materials for pre-service undergraduate and in-service graduate courses. Research will again be conducted to measure the impact of using PBL as a teaching strategy.

NEBHE is recruiting advanced manufacturing businesses to collaborate in the development of PBL instructional modules, called Challenges, as well as high school and college STEM educators to participate in the professional development activities.

			
The PHOTON PBL Challenges		The STEM PBL Challenges	
Real-World Application	Industry Partner	Real-World Application	Industry Partner
Laser Safety	International Laser Display Association	Green Chemistry	Johnson & Johnson
Precision Laser Micromachining	PhotoMachining, Inc.	Lighting Design	RSL Fiber Systems
DNA Testing	Boston University Photonics Center	Solar Power	SPG Solar/City of Tucson
Manufacture of High Power Lasers	IPG Photonics	Stormwater Management	TTF Watershed Partnership
Phototherapy	Drexel University, Southern Methodist University, Photodigm Onsite Neonatal Partners	Sustainable Agriculture	Cape Cod Cranberry Growers' Association
Energy Conservation/Lighting	California State Polytechnic University at Pomona	Wind Power	FloDesign
Non-contact Precision Measurement	McKay Orthopaedic Research Laboratory, University of Pennsylvania	For more information on the STEM PBL and PHOTON PBL Challenges , please contact PBL Projects Coordinator, Nicole Schepker, at email address nschepker@nebhe.org .	
Thermal Imaging	Penn State Electro-Optic Center		

The PBL Projects team has developed a total of 14 problem-based learning Challenges focused on optics and photonics (PHOTON PBL) and sustainable technologies (STEM PBL) in the fields of green chemistry, advanced lighting design, solar and wind power, stormwater management, and sustainable agriculture.

To view the previously developed STEM PBL and PHOTON PBL Challenges, please visit www.pblprojects.org. ■

The STEM PBL team would like to thank the following Advisory Committee members for their commitment to the project:

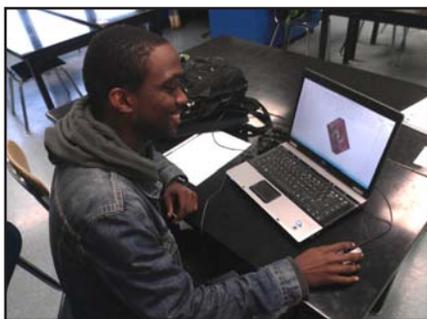
Karen Birch, Regional Center for Next Generation Manufacturing (RCNGM), Connecticut Community Colleges
Amy Cannon, Beyond Benign
Barbara Darnell, ScinTech
Kevin Doyle, New England Clean Energy Council, Green Economy
Robert Douglas, Zygo Corporation
Arthur Goldstein, Bridgewater State College
Wes Golomb, Lakes Region Community College
G. Groot Gregory, Synopsys Inc.
Mark Kahan, Synopsys, Inc.

Marijke Kehrhahn, University of Connecticut
Stanley Kowalski III, FloDesign
Jake Mendelsohn, Greater Hartford Academy of Math and Science
Daniel K. Moon, Environmental Business Council of New England
Dwight Peavey, U.S. Environmental Protection Agency
Sheryl K. Rosner, U.S. Environmental Protection Agency
Scott Soares, Cranberry Marketing Committee
Curt Spalding, U.S. Environmental Protection Agency
Douglas Webster, Vermont Department of Education
Eitan C. Zeira, Konarka Technologies, Inc.

instructor led), *guided* (moderately structured) and *open-ended* (instructor as consultant) models developed by the project team.

For students, especially those in high school, one of the most challenging aspects of participating in PBL is often the simple fact that they are being pulled out of their traditional lecture-based learning environment. Yet, based on the results of candid and confidential student field-testing surveys, it is clear that taking students out of their learning comfort zone through participation in PBL Challenges is what not only enables students to grow as learners, but what gives them greater confidence in their own problem-solving and team-working abilities. This sentiment rings especially true for two groups of rather dissimilar students who field-tested STEM PBL Challenges in spring 2012.

The English High School, Mass.



A student at The English High School in Mass. working on the FloDesign wind turbine Challenge.

Alexander Pancic, a science teacher at The English High School in Jamaica Plain, Mass., ran his 10 seniors through a *structured* version of the FloDesign STEM PBL Challenge. This Challenge asks students to develop a new way to extract electrical energy from a wind turbine, as part

of a renewable energy curriculum developed for his Principles of Engineering course in the spring of 2012. After Pancic's students watched the Introduction, Organization Overview and Problem Statement videos, however, Pancic was confronted with a class of students unused to being responsible for their own learning.

"I tried to give my students free reign when it came to how to approach the topic, but they quickly became upset because they didn't know what to do and I wasn't telling them," Pancic said.

Realizing that his students were shutting down due to a lack of critical background knowledge in energy production, Pancic incorporated a series of lessons on turbine and generator mechanics, current, AC and DC, Betz Limit, and energy distribution in order to get his students up to speed. With his students armed with this preliminary knowledge, Pancic was free to proceed with the Challenge as planned.

The FloDesign Challenge, completed in two weeks, was ultimately incorporated into a larger unit on wind energy. Pancic paired students in teams, providing each team with one laptop computer, written documentation on the FloDesign wind turbine, news articles on the turbine and a listing of useful websites. Course materials on energy and alternative technologies were also provided. Students presented their solutions as a report and delivered a 10-15 minute presentation to the class in teams.

Team participation was assessed by teacher observation, and Pancic reported a few team problems in that students much preferred working with their friends than in assigned groups.

"It was hard not working with friends," said one student. "But I feel more confident about working with other people to solve problems [as a result of the Challenge]."

And despite the consensus that PBL was difficult, the majority of Pancic's students cited their favorite part of the Challenge as figuring out the solution, even when they got stuck.

Upon completion of the Challenge, students were taken on a field trip to Deer Island in the Boston Harbor to see the FloDesign wind turbine. This was a major reward, especially for those students who did not arrive at the same answer presented in the Organization's Solution video. Meeting the FloDesign staff, who were able to discuss the prototype and its evolution over time, including changes made to the design after the FloDesign Challenge was filmed, was invaluable to the students' understanding of the engineering design process. Discussing their design process and final solutions with the engineers at FloDesign enabled the students to walk away from the experience feeling heard, knowledgeable and intelligent, Pancic said.

As a result of the experience, Pancic realized that the students would have benefited from solving additional STEM PBL Challenges either pre- or post-completion of the FloDesign Challenge in order to become fully comfortable with the PBL process. This year, he is planning to implement the Cape Cod Cranberry Growers' Challenge in the fall, followed by FloDesign in the spring.

"I have also put in a couple of my own challenges (e.g., build a better paper airplane) to get them started using the engineering design process," Pancic said.

Columbia Area Career Center & Central Methodist University, Mo.

The STEM PBL project recruited participants as partners, called 'Alliances,' to support instructor professional development and build an academic pipeline from high school to higher education. Columbia Area Career Center (CACC) instructor Christine Roberson and Professor Gregory Thurmon from Central Methodist University (CMU), both in Missouri, brought their students together as Alliance partners in the spring of 2012, with CMU serving as the host institution.

The day began with participation in the Tookany/Tacony Frankford (TTF) Watershed Partnership Challenge, followed by the Johnson & Johnson (J&J) Challenge, both implemented at the *structured* level, and concluded with a tour of the laboratories at CMU for the CACC students. The Challenges were implemented as supplements to both the CACC and CMU curriculum. CMU students were offered extra credit in their biology course for participating in the Challenges. CACC students volunteered their participation and did not receive credit. This ensured that

Field-Testing continued from page 6

only students who were truly interested in the opportunity and who were doing well in their course work would participate, Roberson explained, as the Challenges were com-

pleted at the end of the semester. Thirteen sophomores, juniors and seniors enrolled in the Laboratory Technology Program at CACC participated in the Challenges, working alongside more than 20 CMU juniors and seniors majoring in biology, toxicology, anatomy and physiology.

During the TTF Watershed Challenge, taught at a *structured* level, student teams consisted of one CACC student and two CMU toxicology students. Students were shown the Introduction, Organization Overview, Problem Statement and Discussion videos and were given approximately 90 minutes to fill out the Problem Analysis, Independent Research, Brainstorming and Test Your Idea Whiteboards, a problem-solving tool. Each team presented their proposed solution before watching the Organization's Solution.

The J&J Challenge, taught at a *guided* level, teams consisted of one CACC student and two-to-three CMU anatomy and physiology students. As a class, the students watched the Introduction, Organization Overview, and Problem Statement videos. Students were then given 30-minutes to complete the Problem Analysis and Independent Research Whiteboards prior to being shown the Discussion video. After watching the Discussion video, students were given approximately 90 minutes to modify their previous work and to complete the Brainstorming and Test Your Solution Whiteboards. Students delivered PowerPoint presentations of their solutions during a working lunch.

Based on the results of confidential student field-testing surveys, the majority of CMU and CACC students reported that

their favorite part of participating in the Challenges was working in groups, performing research, and going through the creative process of finding a solution to a complex problem. Many students, both at the high school and college level, said that the PBL process helped them hone their questioning skills. When asked if they felt the Challenges were valuable, the CACC students said the exercise should be repeated the following year, and reported that they enjoyed the CMU campus and laboratory tours. CACC students also felt they had learned new content by participating in the Challenges. But what appeared to be most rewarding for both groups of students was working on a real-world problem.



Central Methodist University students worked alongside secondary students at the Columbia Area Career Center to solve the J&J and TTF Watershed Challenges.

"It made it seem like my time spent was worthwhile," said one CACC student.

Although Roberson and Thurmon are both experienced in implementing PBL in their classrooms, there are always lessons to be learned. When asked what she might do differently next year, Roberson explained that she would provide more time for each Challenge as well as ample resources for research, including one-to-one computing and reliable Internet access. She would also perform the exercise earlier in the year. When asked about merging high school and college students into groups, Roberson noted that she would assign groups in the future, and that she would pair the CACC students with college freshmen and sophomores so that there is a smaller gap in previous knowledge.

From this field-testing report, it can be observed that PBL is not a one-size-fits-all approach to education. In contrast, it is an effective pedagogical method that works with diverse groups of students, and, like any pedagogical method, it takes flexibility to work with various learners. It takes time, practice and patience for an instructor to perfect PBL implementation in order to achieve student success. Pancic, Roberson and Thurmon's implementation stories are two excellent yet different examples of how to make the STEM PBL Challenges work with diverse student populations. ■

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- Sustainability Studies
- Wind Power Technology

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NEBHE Launches Khan Academy Developmental Mathematics Demonstration Project

NEBHE launched a \$356,200 three-year grant from the Lumina Foundation to support a developmental mathematics demonstration project. The initiative will initially involve eight to twelve New England community colleges, but will ultimately benefit students and colleges nationwide. Pilot sites will be selected later this year.

For more information, please contact Stafford Peat, Senior Consultant, at speat@nebhe.org or 617-357-9620 x109.



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NEBHE is Recruiting for the Advanced Manufacturing PBL Project!

NEBHE is recruiting secondary and postsecondary STEM instructors in New England to participate in the Problem Based Learning in Advanced Manufacturing project described on page I. Slots for STEM educators are limited, and participants will be

selected through a competitive application process. Industry representatives and researchers are also being sought to collaborate in the development of Advanced Manufacturing PBL Challenges. If selected, participation of educators will include:

- * Introductory webinars to introduce participants to PBL pedagogy and the Advanced Manufacturing PBL Challenges.
- * A comprehensive one-week summer institute (summer 2014) to introduce participants to PBL pedagogy and how to create and use PBL Challenges in STEM and advanced manufacturing technology classes.
- * Field-testing the new Advanced Manufacturing PBL Challenges in participants' classrooms across New England.
- * A series of webinars to provide continuous technical support and mentoring.
- * An online learning community for participants, PBL practitioners and mentors
- * A capstone showcase workshop in year three (2015) to disseminate best practices and exchange ideas for future collaboration on PBL.

For further information, contact Principal Investigator Fenna Hanes at fhanes@nebhe.org or at 617-357-9620 x129 and visit the www.pblproject.org website to view Challenges developed for the two previous PBL projects, PHOTON PBL and STEM PBL. ■

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