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NEWS

A PROJECT OF THE NEW ENGLAND BOARD OF HIGHER EDUCATION (NEBHE)

Located in Boston, Mass.

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AM 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).

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www.ampbl.org

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NEBHE Receives Third Grant in PBL

In September 2012, the New England Board of Higher Education (NEBHE) 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 (AM PBL)*. 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.

Each is improving engineering technician education by infusing PBL instructional materials, focused on real-world issues, into existing

curricula. PBL is an instructional approach that challenges students to "learn how to learn" through collaborative problem-solving. NEBHE's experience with PBL shows that compared to traditional lecture-based instruc-

"Advanced manufacturing has been defined as manufacturing that entails rapid transfer of science and technology into manufacturing products and processes."

tion, 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.

[Project Launch continued on page 6](#)

Recruiting Educators for PBL Professional Development

The New England Board of Higher Education (NEBHE) will begin recruiting New England secondary and postsecondary in-service STEM educators, as well as

teacher education faculty, to participate in the Advanced Manufacturing PBL (AM PBL) project during the fall of 2013. Participant slots are limited.



Co-PI Judy Donnelly (standing) guided a team of secondary and postsecondary STEM educators through the solving of a PBL Challenge during an educator recruitment workshop at Rhode Island College in January 2013.

If selected, participation will include:

- Introductory webinars to introduce participants to PBL pedagogy and the PBL Challenges.
- A comprehensive one-week summer institute (2014) for STEM educators and teacher education faculty to develop proficiency in PBL pedagogy and to learn how to create PBL Challenges for use in STEM and advanced manufacturing technology classes.
- Field-testing the new AM PBL Challenges in their classrooms.

[Educator Recruitment continued on page 4](#)

Help Wanted! The Growing Need for Advanced Manufacturing Technicians

By Michael Reopel

Advanced Manufacturing has moved to the top of the national agenda since President Obama launched the Advanced Manufacturing Partnership (AMP) in June 2011 to promote workforce development across advanced manufacturing industry sectors. The need for skilled technicians in advanced manufacturing continues to impede growth in the industry as companies throughout the nation prepare to lose seasoned employees to retirement over the next several years, with little to no replacements.

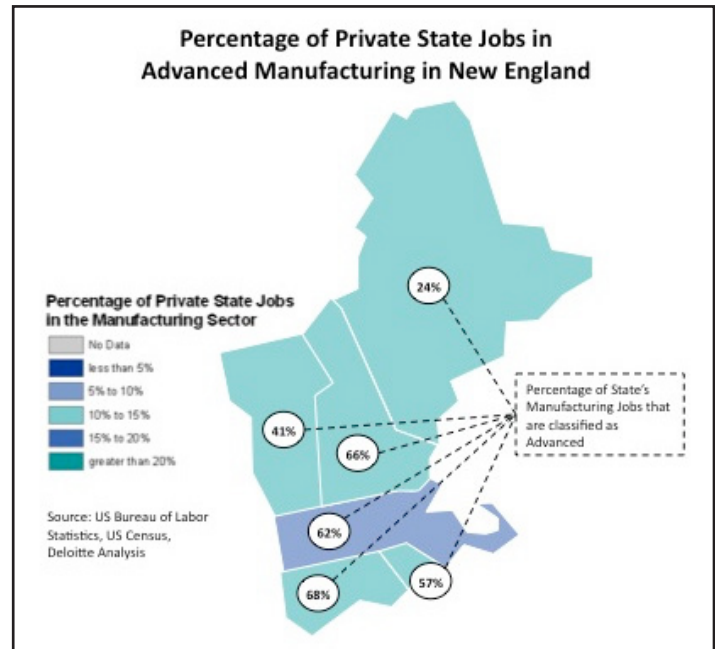
A 2011 Manufacturing Institute report conducted in collaboration with Deloitte Consulting, entitled “Boiling Point? The Skills Gap in U.S. Manufacturing,” indicates that 600,000 manufacturing jobs continue to go unfilled throughout the U.S. According to the report, 80% of manufacturers interviewed anticipate an increase in unfilled skilled production jobs in addition to vacancies in senior level staffing due to the upcoming widespread retirement of baby boomers. Skilled production jobs include machinists, operators, craft workers, distributors and technician positions.

The report also indicated that problem-solving ability remained the primary skill deficiency among current manufacturing employees, affecting companies’ abilities to adapt to an ever-changing industry. Furthermore, those interviewed for the report felt the U.S. public education system is not producing graduates with the skills needed to enter the manufacturing workforce.

The New England region, not unlike the rest of the country, is also suffering from a lack of qualified candidates available to enter the advanced manufacturing workforce. According to the 2009 report, “Reexamining Advanced Manufacturing in a Networked World: Prospects for a Resurgence in New England,” released by Deloitte Consulting and the New England Council, between 7,500 and 8,500 advanced manufacturing jobs in New England remain vacant due to a lacking skill base. The report identified the following advanced manufacturing sub-sectors and the New England states in which those sub-sectors are most prevalent, indicated by the state abbreviation in parentheses, as poised for growth:

- Signal processing, navigation, optics and measurement tools, most notably developed by defense electronics contractors (N.H.).
- Aerospace (Conn.) and defense, including shipbuilding and submarine building (Conn., R.I., Maine).
- Medical devices (Mass., R.I., Conn.).
- Semiconductors (Vt.) and related high-end electrical components and assemblies, including photovoltaic cell production (Mass.).
- Material sciences (N.H., R.I.).

Education will continue to be a key player in not only preparing graduates to enter into advanced manufacturing careers, but in correcting the public misconception that manufacturing is dark, dirty and dangerous, when in fact it is often conducted in bright,



The above graphic showing the percentage of private state jobs in advanced manufacturing in New England was taken from the 2009 report, “Reexamining Advanced Manufacturing in a Networked World: Prospects for a Resurgence in New England.”

open spaces, many of which require clean rooms. The report describes advanced manufacturing careers as highly skilled yet flexible and innovative positions requiring advanced technology and problem-solving skills.

“When you say ‘occupational vocation,’” said Stan Shoun, president of Ranken Technical College in St. Louis, Mo., in an October 2012 Portland Press Herald article, “the technology of the ‘60s, ‘70s and ‘80s comes to mind. The reality is that it’s all high technology now. We need to do a better job of showing not only kids but their parents as well what it means to be a machinist or an automotive technician – that it’s just as complex as being an engineer.”

Although the success of the U.S. advanced manufacturing industry will depend largely on the collaboration of private, public and education stakeholders, educators have a clear role in preparing students to enter into rewarding and gainful careers in the industry. Integrating critical thinking, problem-solving and teamwork skills into science, technology, engineering and mathematics curricula, such as that being developed by the Advanced Manufacturing PBL project, will address the advanced manufacturing skills gap in New England, thereby contributing to the national workforce development agenda and the U.S. economy as a whole. ■

Michael Reopel is principal of Deloitte Consulting and a member of the AM PBL Advisory Committee. He can be reached at mreopel@deloitte.com.

NEBHE is Recruiting Industry Partners in Advanced Manufacturing to Develop Secondary and Postsecondary PBL Curriculum

NEBHE is currently recruiting six advanced manufacturing businesses in New England to be partners in the development of Advanced Manufacturing Problem Based Learning (PBL) curricula. The resulting multidisciplinary web-based instructional materials, called Challenges (multimedia case studies), will showcase real-world problems solved by companies in advanced manufacturing fields such as aerospace, composite materials, medical devices, nanotechnology, optics, precision measurement and semiconductors. Using field-tested problem-solving tools, students develop their problem-solving and critical thinking skills. The project team will provide professional development opportunities for secondary and postsecondary in-service STEM educators, as well as teacher education faculty, in the use of the Advanced Manufacturing PBL Challenges. For examples of the existing STEM PBL and PHOTON PBL Challenges, please visit www.pblprojects.org.

Advanced Manufacturing PBL Project Team

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What does it mean to be an industry partner?

Participation in this project will contribute to a more competitive New England workforce and provide an opportunity for New England advanced manufacturing businesses to showcase their products and services.

Selected industry partners will work with the project team to:

- Identify a previously solved technical problem.
- Video-record the reenactment of how the corporate team solved the problem.
- Review a draft of the Challenge scripts and videos.
- Assist with locating instructional resources for students and teachers.
- Approve the final version of the Challenge for inclusion on the project's website and subsequent use in secondary and postsecondary institutions across New England.

Though the Challenge development process varies by organization, the entire time commitment expected of industry partners typically does not exceed two or three business days, including visits from the project team to the partner's facility, recording of the reenactment of the problem-solving process and review of the final product.

Industry partners from NEBHE's previous STEM PBL and PHOTON PBL projects have indicated that the Challenge planning and development processes were not only easy to accommodate, but also important to the growth and strengthening of their organization, as well as their industry as a whole.

"Collaborating with STEM PBL is an investment in the future," said a STEM PBL Challenge partner. "As these students complete their education and enter the workforce, their ability to critically think and solve real-world problems will be an asset for any company."

For further information, please contact Principal Investigator Fenna Hanes (contact information in the table at left). ■

NEBHE Launches Khan Academy Developmental Mathematics Demonstration Project

NEBHE recently launched a three-year \$356,200 grant from the Lumina Foundation to support a developmental mathematics demonstration project. The initiative involves pilot community colleges in five of the six New England states. Results from the project will benefit students and colleges nationwide.

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

- Ongoing technical support and mentoring.
- An online learning community for participants, PBL practitioners and mentors.
- A capstone showcase in 2015 to disseminate best practices and exchange ideas for future collaboration in PBL.

As a result of taking part in the AM PBL summer institute and the follow-up activities, participating secondary STEM in-service teachers will:

- Learn how the web-based Advanced Manufacturing PBL Challenges can be used in the classroom.
- Practice with web-based Advanced Manufacturing PBL Challenges developed through the Advanced Manufacturing PBL project.
- Learn student assessment strategies for PBL.
- Learn to design their own PBL Challenges.
- Gain free access to curricular materials developed by the AM PBL, PHOTON PBL and STEM PBL projects.
- Receive stipends for field-testing AM PBL Challenges.
- Become part of a nationwide network of PBL educators dedicated to sharing knowledge with fellow project participants.
- Share implementation stories with other project participants in a capstone showcase in 2015.

Participating STEM teacher educators will learn how to:

- Introduce the *Teaching Technology and Engineering Education* pre-service undergraduate PBL course in place at Central Connecticut State University (CCSU) into their own institution's teacher education programs.
- Implement the *STEM PBL Applications for Science and Technology Teachers* graduate course in place at CCSU into their own institution's teacher education programs.

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 - Management & Engineering for Manufacturing
 - Manufacturing Engineering Technology
- Graduate Degrees**
 - Manufacturing Engineering



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Upcoming Recruitment Workshops

The Advanced Manufacturing PBL project is hosting introductory PBL recruitment workshops for secondary and postsecondary STEM educators throughout New England. A calendar of upcoming PBL workshops is as follows:

April 26, 2013

Problem Based Learning in the Classroom Using STEM Topics
EASTCONN Conference Center, Hampton, Conn.

9 a.m. – 3 p.m.

Registration Ends April 15, 2013

Register at: <http://rs.registereastconn.org/courses/view/id/10335>

May 16, 2013

Problem Based Learning in the Classroom Using STEM Topics
EASTEC, West Springfield, Mass., 10 a.m. – 3 p.m.

Contact: nschepker@nebhe.org or 617-357-9620 x113

June 1, 2013

Problem Based Learning in the Classroom Using STEM Topics
Keene State College, Keene, N.H., Time TBA

June 26, 2013

Problem Based Learning in STEM Education: Bringing Real-World Industry Problems into the Classroom — Pre-conference Workshop
Massachusetts Association of Vocational Administrators (MAVA) Annual Conference, Upton, Mass., Time TBA

Contact: Peter Dewar at dewar@tri-county.tc

June 28, 2013

Problem Based Learning Implementation Strategies for STEM Courses — Conference Session

Massachusetts Association of Vocational Administrators (MAVA) Annual Conference, Upton, Mass., Time TBA

Contact: Peter Dewar at dewar@tri-county.tc

Past Workshops, Events & Dissemination

Please see page 3 for a list of project team members.

March 7, 2013

Problem Based Learning in Pre-service Teacher Education
International Technology and Engineering Educators Association (ITEEA) Conference, Columbus, Ohio

Co-PI DeLaura conducted a presentation entitled, "Problem Based Learning in Pre-Service Teacher Education" at the International Technology and Engineering Educators Association's 75th annual conference in Columbus, Ohio. The 30 attendees included technology and engineering education teachers and teacher educators from throughout the country.

January 30, 2013

An Introduction to Using STEM PBL Challenges and Methods — A Professional Development Workshop for Secondary Instructors
Middletown High School, Middletown, Conn.

Members of the science department representing general science, biology, chemistry, physics and earth science at Middletown

High School, a comprehensive high school, participated in a professional development workshop led by Co-PI DeLaura on the implementation of the PBL Challenges in STEM courses. Teachers were given the opportunity to practice using the “Teachers’ Resources” toolbox and developed “Whiteboards,” a problem-solving tool used by students solving a PBL Challenge.

January 19, 2013

Problem Based Learning in the STEM Classroom — A Professional Development Workshop for Higher Education & High School Teachers
The RI STEM Center, Rhode Island College, Providence, R.I.

PI Fenna Hanes and Co-PIs DeLaura, Donnelly and Massa engaged 24 secondary teachers and administrators from 14 secondary institutions as well as two postsecondary faculty members and one instructor from an informal education institution in an introduction to PBL workshop. The educators worked on one of two STEM PBL Challenges depending on their STEM discipline and were encouraged to consider participating in upcoming AM PBL professional development activities.

January 18, 2013

The First Annual AM PBL Project Advisory Committee Meeting
NEBHE, Boston, Mass.

Please see page 7 for an overview of the AM PBL Advisory Committee meeting.

November 16, 2012

An Introduction to Using STEM PBL Challenges and Methods — A Professional Development Workshop for Secondary Instructors
Pathways Academy of Technology and Design, Hartford, Conn.

Co-PI’s DeLaura, Dischino and Massa delivered a presentation on the PBL Challenges and their implementation in STEM classrooms to faculty of the Pathways Academy of Technology and Design (grades 9-12). The presentation was well received and several faculty members expressed interest in continuing to work with NEBHE’s PBL Challenges.

October 26, 2012

Problem Based Learning Implementation in STEM Disciplines — Breakfast Roundtable
The National Science Foundation’s (NSF) Advanced Technological Education (ATE) National Principal Investigators Conference
The Omni Shoreham Hotel, Washington D.C.

This session discussed the design, implementation, field-testing and pedagogical attributes of the PBL Projects, including the PBL Challenges and both pre- and in-service PBL pedagogy courses developed and field-tested at CCSU. April Mitchell-Edmonds, a student at Springfield Technical Community College (STCC), was selected to attend the conference as the PBL Projects’ ATE Student/Alumni Scholar. Mitchell-Edmonds participated in the roundtable by describing the impact of the PBL Challenges on student learning. Attendees expressed interest in working with NEBHE to implement the PBL Projects into STEM courses at their institution as a result of attending the breakfast roundtable.

October 19, 2012

Planning Meeting for the Advanced Manufacturing PBL Project
Quinsigamond Community College (QCC), Worcester, Mass.

More than 30 professionals representing industry, industry associations, government, and secondary and postsecondary institutions in New England joined the AM PBL project team for a planning and development meeting to discuss recruitment of New England secondary and postsecondary institutions for participation in the project and on which advanced manufacturing sectors and core competencies the instructional materials should focus.

QCC President Gail Carberry and PI Fenna Hanes welcomed the group at the meeting’s onset. Hanes then introduced attendees to the project, followed by an introduction to PBL from the project team (please see the project team box on page 3). Michael Reopel, principal of Deloitte Consulting, introduced attendees to the region’s advanced manufacturing industry in the presentation, “Reexamining Advanced Manufacturing in a Networked World: Prospects for a Resurgence in New England.” Please see page 2 for a closer look at the report.

October 12, 2012

Professional Development Workshop for Post-Secondary Instructors
Three Rivers Community College, Norwich, Conn.

Co-PI Donnelly introduced the PBL Projects and Challenges to 50 faculty members in the Academic Division at Three Rivers Community College in October 2012. Faculty members expressed interest in learning more about PBL methodology and the PBL Challenges.

Questions about upcoming workshops?

Please check the AM PBL project website Events page at www.ampbl.org for upcoming professional development opportunities, or contact Project Coordinator Nicole Schepker at nschepker@nebhe.org or 617-357-9620 x113. ■



L to R: STCC student and PBL Projects’ ATE Student/Alumni Scholar, April Mitchell-Edmonds, with project team members Massa and Schepker, spoke during a breakfast roundtable discussion at the NSF-ATE National Principal Investigators Conference in October 2012.

Project Launch continued from page 1

Including PBL in STEM curricula 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 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 that was conducted by Deloitte Consulting. The study showed that in New England, nearly 60 percent of manufacturing jobs are classified as advanced manufacturing. In the Deloitte study, interviews with New England-based advanced manufacturers revealed

concerns that manpower shortages were constraining growth prospects, estimating that between 7,500 and 8,500 jobs remain vacant due to a lacking skill base.

To address the shortage of skilled workers in New England, the project will develop six authentic AM PBL Challenges (multi-media case studies) in advanced manufacturing in collaboration with regional industry partners. These instructional materials will focus on sustainable practices in advanced manufacturing fields such as aerospace, composite materials, medical devices, nanotechnology, optics, precision measurement and semiconductors.

The project team is currently conducting introductory PBL pedagogy workshops with secondary and postsecondary STEM instructors. The PBL workshops introduce instructors to PBL and the AM PBL project and will recruit 24 instructors to participate in the project's professional development activities beginning fall 2013. The first workshop was held on January 19, 2013 at Rhode Island College. See page 4 for a complete schedule of upcoming PBL pedagogy professional development

workshops. Participation in the project includes a one-week summer 2014 workshop, field-testing the PBL instructional materials, technical assistance and a capstone showcase workshop in the third year of the project.

NEBHE will continue to collaborate with Central Connecticut State University to develop additional instructional materials in PBL pedagogy for pre-service undergraduate and in-service graduate courses. Six postsecondary teacher educators will be recruited to participate in the project's professional development activities. Research will again be conducted to measure the impact of using PBL as a teaching strategy.

NEBHE is also recruiting advanced manufacturing businesses to collaborate in development of the PBL instructional modules. See page 3 for the full article on industry partner recruitment.

Since 1955, NEBHE has promoted greater educational opportunities for the residents of New England. NEBHE's core functions include programs and services focused on cost savings, affordability, college access and success. NEBHE also provides policy leadership on key issues related to education and promotes dialogue, research and analysis, and best practices related to education and the New England economy. ■

<i>The PHOTON PBL Challenges</i>		<i>The STEM PBL Challenges</i>	
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 <i>STEM PBL and PHOTON PBL Challenges</i> , please contact PBL Projects Coordinator, Nicole Schepker, at 617-357-9620 x 113 or nschepker@nebhe.org .	
Thermal Imaging	Penn State Electro-Optic Center		

Please visit www.pblprojects.org to view the *STEM PBL and PHOTON PBL Challenges*, and www.photonprojects.org to learn more about the *AM PBL, STEM PBL and PHOTON PBL* projects of the New England Board of Higher Education.

NEBHE Hosts First Annual Meeting of the AM PBL Advisory Committee

The Advanced Manufacturing PBL (AM PBL) project held its first Advisory Committee meeting at NEBHE's office in Boston, Mass. on January 18, 2013. AM PBL Advisory Committee members have an opportunity to influence curricula and the resulting education of the future workforce, to meet and work with other professionals interested in building a sustainable pipeline of graduates entering into advanced manufacturing and other STEM-related fields, and to bring their own organization's products and services to the attention of AM PBL educators and their students.

The Advisory Committee will assist the project team by:

- Reviewing and commenting on technical/scientific curriculum content.
- Assisting in connecting the project team with potential Challenge partners.
- Reviewing and commenting on the pedagogical soundness of the Challenge case studies.
- Assisting in disseminating the Challenges and related instructional materials.
- Providing guidance with obtaining additional funding for the project and/or participating schools.

AM PBL project PI Fenna Hanes and Advisory Committee Chair Marijke Kehrhaan together welcomed the committee and presented members with an introduction to the project. Advisory Committee member Michael Reopel, principal at Deloitte Consulting, opened the meeting by presenting the influential 2009 Deloitte report "Reexamining Advanced Manufacturing in a Networked World: Prospects for a Resurgence in New England" to committee members (see page 2 for a detailed look at the report). This presentation was followed by an in-depth group discussion on advanced manufacturing in the region, workforce development, skills shortages and the role of both industry and education in re-branding advanced manufacturing as a rewarding and viable career path.

Members of the project team (please see the project team box on page 3) presented the Advisory Committee with an introduction to the AM PBL project, PBL pedagogy, advanced manufacturing core competencies, PBL Challenge development, evaluation and research strategies, and pre- and in-service teacher education courses in PBL pedagogy developed by the project at Central Connecticut State University. The project team and the Advisory Committee then engaged in a dialogue on education's role in meeting the region's and nation's challenges in preparing a skilled workforce, PBL Challenge and educational partner recruitment for the project, and reflections on the advisory committee meeting and the AM PBL project as a whole.

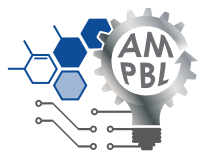
The project team will continue to engage the Advisory Committee in project activities and looks forward to working with this dedicated group of regional stakeholders throughout the grant cycle. ■



AM PBL Advisory Committee members engaged in a group discussion on the roles of industry and education in promoting advanced manufacturing, PBL and workforce development in the region.

Advanced Manufacturing PBL Advisory Committee

Don Bossi CiDRA	Jay Paterson Vermont Technical College
Zenagui Brahim New Hampshire Manufacturing Extension Partnership	Bill Rawlinson Boston Private Industry Council
Diane Dostie Central Maine Community College	Michael Reopel Deloitte Consulting
Heather Graham Department of Labor, USDOL ETA Region I	Judy Resnick CBIA Education Foundation
Lisa Hix Keene State College	Larry Robinson Maine Manufacturing Extension Partnership
Sandra D. Inga Hartford Public Schools	Eugene Roundtree Madison Park Technical Vocational High School
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Dale Miller IBM Systems & Technology Group	Douglas Webster Vermont Department of Education
JoAnn Mitchell Sandvik Coromant USA & Society of Manufacturing Engineers	Karen Wosczyzna-Birch Regional Center for Next Generation Manufacturing & The College of Technology, Connecticut Community Colleges



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Announcing the 48th Annual NAWI Conference — *Engaging Minds for 21st Century Learning and Innovation: STEM Education in an E-Blended World*

NEBHE and the Advanced Manufacturing PBL team are excited to announce the 48th Annual National Association for Workforce Improvement (NAWI) conference hosted in collaboration with the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI) at the Omni Severin Hotel in Indianapolis, Ind., from May 21-22, 2013.

NAWI is dedicated to program improvement in Career and Technical Education (CTE) in secondary and postsecondary institutions. The NAWI conference will bring together national, state and local leaders in CTE, including administrators, teachers, career and curriculum development professionals, as well as business, industry and governmental partners. ■

Conference Focal Points:

- Defining Success in an E-World
- Developing the Next Generation of Makers
- Growing Innovation Entrepreneurs
- Innovative Ways to Fund STEM Education
- iSTEM (Integrative STEM)
- MOOCs & OERs
- Problem-Based and Experiential Learning
- Bridging Art and the Sciences in the 21st Century

Registration closes on May 3, 2013. Please visit <http://nawiregistration.eventbrite.com/#> to register.
You can learn more about NAWI at <http://www.nawionline.org/conference/index.html>.

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