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Making Engineering Relevant and Making Our Community a Better Place with Service-Learning

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William (Bill) Oakes, P.E. is a Professor of Engineering Education and the Director of the EPICS Program at Purdue University having held courtesy appointments in Mechanical and Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He was the first engineer to win the Campus Compact Thomas Ehrlich Faculty Award for Service-Learning. He is a fellow of the ASEE and NSPE.

WORKSHOP PROPOSAL FORM

2015 Annual ASEE K-12 Workshop on Engineering Education
"Authentic Engineering: Representing & Emphasizing the E in STEM"
Presented by Dassault Systems

Saturday, June 13, 2015
8:00 A.M. – 5:00 P.M.
Sheraton Seattle | Seattle | WA

Please complete this form, save it as a PDF file *only* and upload it through the ASEE Paper Management system as shown in the K12 Workshop Presenter's Kit.

All notifications will be by email from the ASEE Paper Management system.
NOTE: To ensure that emails are not obstructed by spam blockers, please make sure to WHITELIST the email addresses: monolith@asee.org and conferences@asee.org and s.harrington-hurd@asee.org.

Direct questions to Stephanie Harrington-Hurd, ASEE K-12 Activities Manager, at s.harrington-hurd@asee.org. Additional workshop details are available at: http://www.asee.org/K12Workshop. Thank you!

Deadline

Friday, January 23, 2015 by 5:00PM EST
Presenters will be notified of acceptance status by March 14.
Late submissions will not be accepted.
Advanced Workshop Registration will open December 6, 2013.

SUBMISSION INFORMATION

Provide the first and last name of each presenter, including affiliations. If there is more than one presenter, designate one person as the organizer and provide only that person's contact information. The organizer is responsible for communicating to co-presenters.

Number of Presenters: 1

Presenter Name(s):
1) Last Oakes First William Affiliation Purdue University EPICS

2)

Contact Person's Name: William Oakes

Contact Person's Email: oakes@purdue.edu

Contact Person's Phone: 765-494-3892

Contact Person's Alternate Phone: 765-418-8029

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Please provide a one-paragraph bio for each presenter (in the order listed above). The bio should not exceed 70 words and should be written as you would want it to appear on the ASEE website and program materials.

1) William (Bill) Oakes, P.E. is a Professor of Engineering Education and the Director of the EPICS Program at Purdue University having held courtesy appointments in Mechanical and Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He was the first engineer to win the Campus Compact Thomas Ehrlich Faculty Award for Service-Learning. He is a fellow of the ASEE and NSPE.

WORKSHOP INFORMATION

Proposed Title:

Making Engineering Relevant and Making Our Community a Better Place with Service-Learning

Abstract: Please provide a concise description that includes the workshop's learning objectives (maximum 750 characters). The abstract is used on the ASEE website, program materials, and otherK-12 Workshop promotional activities.

Many schools engage in community service or service-learning but these are not often connected to the engineering, math or science. Linking these offers a multitude of opportunities to change the conversation about STEM, engage the next generation of leaders and make our own communities a better place to live. It can also impact the diversity in our classrooms. This interactive workshop engages participants in developing a plan for linking service-learning and STEM. The Learning Objectives are:

1: Describe at least 1 STEM community project

2: List at least 3 standards that could be enhanced through service-learning

3: Describe how to use reflection to enhance learning

4: Describe at least 3 examples of engineering service-learning

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Workshop Description- Please provide a detailed description of the proposed workshop that, at minimum, explicitly addresses the following (maximum 4,000 characters):

a. Learning objectives
b. Hands-on activities and interactive exercises
c. Materials that participants can take with them
d. Practical application for teachers and outreach staff

Many schools engage in community service or service-learning but often miss an enormous opportunity by not connecting service to engineering or STEM topics. Linking community service with engineering or STEM can *change the conversation* about engineering and increase interest for students, their parents and the community. Service opportunities are a way to introduce early engineering into classes from math, science or technology without the cost of equipping a lab or purchasing expensive equipment. It is also a way to easily engage practicing engineers from the community.

This interactive workshop will guide participants through the development of a customized plan to make such connections in their own classrooms. It will move rapidly between short presentations, readings, small group discussions, plan creations, demonstrations and reflections. The workshop will use reflection as a vital activity and demonstrate its power in STEM related service-learning. The facilitator has conducted over 100 presentations and workshops on engineering and service-learning.

Small and large group discussions will be used to generate and refine ideas that can be tried at their own schools. Each participant will leave with a set of resources and ideas for service-learning projects and sample lesson plans to implement within their own classroom. Participants should be ready for active engagement to cover a lot of material in our brief session.

The four Learning Objectives for the workshop include:

1: Describe at least 1 community project related to STEM

2: List at least 3 standards that could be enhanced through service-learning

3: Describe how to use reflection to enhance student learning

4: Describe at least 3 examples of engineering service-learning

Agenda

- Introductions and overview
- Service-Learning Defined
- Teacher activity - where is the engineering?

- Debrief
- Engineering Applications
- Mapping to their own schools
- Small group discussions
- Reflection Activity
- Debrief
- Filling in the gaps
- Conclusion

Participants will be given access to online resources through the EPICS K12 that includes curriculum to introduce service-learning into any STEM classroom and a full year-long curriculum of service-learning design.

Standards

ITEEA Technological Literacy:

- Standard 8: Students will develop an understanding of the attributes of design
- Standard 9: Students will develop an understanding of engineering design
- Standard 10: Students will develop and understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

NGSS

Engineering Design

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

National for ELA

ELA/Literacy – SL.11-12.1d- Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
ELA/Literacy – SL.11-12.3- Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

National - Mathematics

Mathematical Practices
MP.2 Reason abstractly and quantitatively
MP.4 Model with mathematics

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Authentic Engineering Connection- Identify and describe how you will explicitly address the ways in which your lesson or activity is representative of the processes, habits of mind and practices used by engineers, or is demonstrative of work in specific engineering fields.[i] At least one of those must be within the first four listed, below; i.e., do not only check "other". Check all that apply:

- ☐ Use of an engineering design process that has at least one iteration/improvement
- ☒ Attention to specific engineering habits of mind
- ☒ Attention to engineering practices (as described in the NGSS/Framework and as practiced by engineers)
- ☐ Attention to specific engineering careers or fields related to the lesson/activity
- ☒ Other (please describe below)

Provide a description of how you will explicitly address these aspects of authentic engineering in your workshop (maximum 2,000 characters):

Service-learning engages students in real needs for real people. The workshop will address these approaches and link engineering with service-learning. While service-learning is not traditional engineering, there is a rapidly growing awareness of how engineering can impact communities globally (e.g. EWB-USA) and locally (e.g EPICS). Participants will be engaged in exploring these connections and how to make them in their own classrooms. The workshop will equip teachers to engage students authentically in the engineering processes (e.g. NGSS framework) while they develop solutions to local or global needs. The materials will allow teachers to take back their approach and impact their own classrooms.

The engineering habits of the mind will be used and linked with developing solutions to local needs within a school's own community. This adds dimension of people and the environment to any design solution, which adds authenticity to the design experience.

There is an opportunity to continue to nurture teachers and students to create programs where engineering is used to address real needs locally. Links will be provided for additional resources if they teachers desire to further develop their programs. Within a single session, it is not realistic to equip them to develop real solutions to local needs. However, that is the opportunity. Participants will be given access to materials and networks of practicing engineers who can help facilitate this process.

Diversity- This year is the American Society for Engineering Education's "Year of Action on Diversity." It is essential that we have a diverse engineering workforce to solve diverse problems. To do that and to have an engineering-literate public, it is essential that we reach *every*

preK-12 student with high-quality engineering education, drawing on issues of access and equity in the classroom and in the curriculum. Reviewers would like to know how your proposed workshop will address diversity.

Provide a description of how you will explicitly address diversity – e.g., diversity with respect to gender/sex, ethnicity or race, special education inclusion, socio-economic status, or LGBT status – in your workshop (maximum 2,000 characters):

This workshop addresses a consistent theme of the research on diversity over the last two or three decades, the context of engineering. Service-learning places the learning explicitly within a context of the local community. A first step in the service-learning process is a community needs assessment. This asks the students to identify what matters to them and their families. This approach puts engineering into a context that they care about. It has the opportunity to connect with underserve populations within urban and rural communities. It can also help connect to their families and support networks. Addressing needs within a community in a tangible way through an engineering class can send positive messages to the entire community about the students, schools and our profession. Additionally, service-learning has the potential to help communities increase their own capacity. For example, a high school engineering class can be designing and building hands-on science activities for a feeder elementary school to enhance the science education in elementary school. The approach of service-learning explicitly engages students in underserved communities and the reflective components address both technical and human aspects of their experiences. These integrate opportunities to address issues of diversity within the context of the engineering design.

Data from these approaches have shown significant impact on diversity. The EPCS High Program had over 40% female and more participants of color than Caucasian in 2013. Purdue's EPICS Learning Community had 54% female participation in 2014.

Are there any online components to the proposal or presentation? (Note that these online components may only be available to presenters or those who have their wireless subscriptions, since wireless may not be available during the workshop sessions.)

☒ No
☐ Yes

Please describe:

Grade Level Target Audience (check all that apply):
☐ Primary (EC–2)

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☐ Elementary (3–5)
X Middle School (6-8)
X High School (9-12)

Maximum Number of Participants:
25

If this number is greater than 25, please describe how your workshop will equally engage all participants.

All Seating is Classroom (tables and chairs).

Audio Visual Equipment Requests:
Note: *An LCD projector, screen and podium with attached microphone are provided. Requests for additional equipment or resources (e.g., internet connection or laptops) will incur extra charges. If you do not have additional requests, please indicate with "Not applicable."*

Reminder:
Presenters must register and pay the registration fee to support their workshop attendance and audio/video costs.

Thank you for completing this proposal form!
Please review this document prior to submitting it to ensure that all items are complete.

ASEE USE ONLY

Date Received:

Received By:

Proposal ID Number: