



## **Design Can/Should Be Fun, Easy, Affordable and Focused On People**

**Dr. William C. Oakes, Purdue University, West Lafayette**

William Oakes, P.E. is a Professor of Engineering Education and the Director of the EPICS Program at Purdue University. He was one of the founding faculty members of the School of Engineering Education. He has had courtesy appointments in Mechanical and Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. 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](mailto:monolith@asee.org) and [conferences@asee.org](mailto:conferences@asee.org) and [s.harrington-hurd@asee.org](mailto:s.harrington-hurd@asee.org).

Direct questions to Stephanie Harrington-Hurd, ASEE K-12 Activities Manager, at [s.harrington-hurd@asee.org](mailto: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 Bill          Affiliation Purdue University EPICS

2)

Contact Person’s Name: William Oakes

Contact Person’s Email: [oakes@purdue.edu](mailto: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 Oakes, P.E. is a Professor of Engineering Education and the Director of the EPICS Program at Purdue University. He was one of the founding faculty members of the School of Engineering Education. He has had courtesy appointments in Mechanical and Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He is a fellow of the ASEE and NSPE.

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## WORKSHOP INFORMATION

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### Proposed Title:

Design Can/Should Be Fun, Easy, Affordable and Focused On People

**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 other K-12 Workshop promotional activities.

Design offers opportunities to integrate STEM and other topics, engage students in high level thinking and to show real applications to academic topics. Too often design is looked at as a complex, expensive and technology-focused effort. This workshop introduces an easy and affordable approach using materials found in every classroom. Human-Centered Design places a focus on people and how to get information from users. This interactive session will engage participants in activities used to teach human-centered design.

The learning objectives are:

- 1: Describe Human-Centered Design
- 2: List at least 3 potential activities for Human-Centered Design in your classroom
- 3: Identify at least 3 ways students can learn how to design for users

**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

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d. Practical application for teachers and outreach staff

Design offers many opportunities to integrate STEM and other topics, engage students in high level thinking and to show real applications to academic topics. Too often design is looked at as a complex, expensive and technology-focused effort. This workshop introduces an easy and affordable approach using materials found in every classroom. Human-Centered Design places a focus on people and how to get information from users.

Modern design methods emphasize a human-centered approach where designers must understand the users of a product and those it may impact as well as the design itself. The kind of lessons and activities to teach human-centered design that will be demonstrated in this workshop can be developed with materials found in most classrooms or craft closets and without expensive equipment.

This interactive and fun workshop will guide participants through activities used to develop and teach human centered design skills including interviews and observations and the use of prototypes as communication devices. Participants will engage in a human-centered design activity that is based on authentic projects that have been implemented by students throughout the country. Prototypes will be developed using common materials including duct tape, Post-It notes, paper, cardboard and other materials from the classroom. The power of using everyday materials and interactions with real people as design tools will be experienced by the participants who will be guided through activities that they would lead in their own classroom. Instructions, lesson plan and support materials will be given to the teacher participants as well as on-line access to the full EPICS K12 curriculum.

Connecting engineering design and interacting with people to meet the needs of others can be an important tool in our arsenal to engage a more diverse student population into engineering. The HCD approach explicitly links people and design. Discussions will include how to use this connection to motivate STEM learning and encourage pathways into engineering.

The highly interactive workshop will use a varied instructional approach with brief presentations, large and small group discussions, building and testing prototypes and reflections included in the workshop. The facilitator has conducted over 100 presentations and workshops on STEM and engineering education. He is a professional engineering with industry experience in design and a faculty member in engineering education. Participants should be ready for active engagement to cover a lot of material in our brief session.

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The learning objectives for the session will include participants, at the end of the session, being able to:

- 1: Describe Human-Centered Design in a K-12 Context
- 2: List at least three potential student activities for focusing on Human-Centered Design in your specific course
- 3: Identify at least three ways students can learn how to design for users

<u>Time</u>	<u>Topic</u>
10	Introductions and overview
15	Defining Human Centered Design
10	Teacher activity – applying what they already do
75	Use of Scenarios to gain understanding of stakeholders (includes interviewing partners, prototype development)
15	Break (most likely this will be during the Scenario Activity)
10	Small group discussions
5	Reflection Activity
10	Debrief
10	Filling in the gaps
5	Conclusion

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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.<sup>1</sup> 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**):

The focus of this workshop is on design and will introduce participants to the iterative design cycle. The core concepts of this Human-Centered Design workshop are; gathering user data, designing prototypes to be used as communication devices and iterating on these designs based on user feedback. The workshop engages teachers in a design cycle. Workshop tasks will ask teachers to design for other teachers to provide authentic stakeholders and users for the experience. Participants will play alternating roles of designers and users. This approach places the teachers into an actual design scenario that will involve one cycle of iteration within the time constraints of the session.

Too often designs are done in a theoretical or academic setting. A human-centered design approach engages designers with a real person. It explicitly engages engineering habits of mind and adds the complexity that real users bring and the challenge of extracting real requirements from these users. This approach builds on work from Stanford’s D School, IDEO, the EPICS Program and others practicing authentic design and can be mapped into any design process.

Additionally, the Human-Centered Design approach opens opportunities to explore how engineering can make a difference in the lives of others. A “Change the Conversation” approach to engineering. Rather than focusing on technology or some abstract use of a design, the focus becomes design that makes a difference in someone’s life. This mindset introduces authenticity and promotes diversity.

The Next Generation Science Standards emphasize that the Engineering Design process envelop the skills of critical thinking, systematic analysis and problem solving, skills all students should develop and practice. These skills can only be developed and practiced through a design

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process that allows the students a framework that values iteration between stakeholders and peers to develop a project that meets the needs of the community.

**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):

Human-Centered Design explicitly addresses people and how they will be impacted by designs. It brings people to the front and center of the design process. This is a consistent theme of the research on diversity over the last two or three decades in the context of engineering. We need to understand others and how they will use or be impacted by the design. These very design methods can be used as springboard for discussions of diversity as they seek to understand diverse users and stakeholders. The design process specifically addresses the needs to understand others and gain their perspective. The workshop will include examples of teams working in cross-cultural communities internationally and with people with disabilities and explore discuss how these methods can lead to changes in the perspectives of the designers themselves.

Explicit reflections are included in the workshop to address how these approaches to design, while not traditional, align with current research and thinking about diversity and the opportunity to reduce or even eliminate the underrepresentation we currently see in engineering.

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

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Please describe:

Grade Level Target Audience (check all that apply):

- Primary (EC–2)
- Elementary (3–5)
- Middle School (6-8)
- 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.”*

## **Standards addressed (did not see where this was explicitly asked for)**

ITEEA’s Technological Literacy Standards:

- 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) National Generation Science Standards

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.



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**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 Standards for ELA related to Science and Technical Writing

**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 Standards related to Mathematics

### Mathematical Practices

**MP.2** Reason abstractly and quantitatively

**MP.4** Model with mathematics

### 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.**

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ASEE USE ONLY

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Date Received:

Received By:

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