



Hands-On Standards: Using an Engineering Mini-Challenge to "Bundle" Standards

Ms. Cheryl Farmer, University of Texas, Austin

Cheryl Farmer is the founding program director of UTeachEngineering. In this role she has led the successful development and launch of the design-based high school engineering course Engineer Your World and has overseen the creation of degree programs for pre-service and in-service teachers of engineering at The University of Texas. Ms. Farmer is co-leading ongoing national efforts to define standards for professional development for K-12 teachers of engineering.

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: 2

Presenter Name(s):

1) Last: Farmer First: Cheryl Affiliation: The University of Texas at Austin

2) Last Leslie First Arnie Affiliation Tesla STEM High School, Lake Washington

Contact Person’s Name: Cheryl Farmer

Contact Person’s Email: cheryl.farmer@mail.utexas.edu

Contact Person’s Phone: 512-471-6196

Contact Person’s Alternate Phone: n/a

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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) Cheryl Farmer is the founding program director of UTeach*Engineering*. In this role she has led the successful development and launch of the design-based high school engineering course *Engineer Your World* and has overseen the creation of degree programs for pre-service and in-service teachers of engineering at The University of Texas. Ms. Farmer is co-leading ongoing national efforts to define standards for professional development for K-12 teachers of engineering.

2) Arnie Leslie is an educator at the Tesla STEM High School in Lake Washington School District (Redmond, Washington). His 26 years of secondary teaching experience include traditional and project-based instruction in Physics, Environmental Science, and Engineering. In August 2015 he will graduate from The University of Texas at Austin with a Master of Arts in STEM Education with a special focus on Engineering.

WORKSHOP INFORMATION

Proposed Title:

Hands-On Standards: Using an Engineering Mini-Challenge to “Bundle” Standards

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.

Participants of this workshop will engage in activities from a project-based engineering curriculum by discussing how a class can plan and carry out an experiment to identify optimal solutions to a stated engineering problem, analyzing a provided data set from such an activity, and discussing tradeoffs between efficiency and accuracy. Following the activity, participants will divide into groups to explore alignment with different sets of standards, including Next Generation Science Standards and Common Core State Standards in both English/Language Arts and Mathematics. Groups will report their results and discuss implications for making such connections in their own curricula.

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

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Learning Objectives: Learning objectives may be divided into two categories: (1) engineering content, skills and practices; and (2) alignment across different sets of standards. In the former category, participants will learn about design of experiments, data analysis and interpretation, using computational and mathematical models as evidence to argue for a proposed solution, and tradeoffs. In the latter category, participants will practice aligning an engineering activity to multiple sets of standards, and will explore opportunities to create such connections in their own curricula.

Agenda and Hands-on Activities:

Introduction (10 min) – UTeach*Engineering* is a program at The University of Texas at Austin (UT Austin) that aims to create leaders in secondary engineering education. Design skills are important for future engineers and non-engineers alike, and this belief has fueled UTeach*Engineering* to develop *Engineer Your World*, a scaffolded, research-based high school course centered on the engineering design process. The contents of this workshop are based on this course.

The Design of Experiments (15 minutes) [Discussion] – Participants will view a video introducing the activity. They will then discuss how to design the experiment and explore challenges with this approach in the classroom.

The Data Analysis (15 minutes) [Hands-on Activity] – Participants will analyze a provided data set and discuss how students are required to use computational and mathematical models as evidence to argue for a proposed solution. Since multiple correct solutions exist, participants must consider tradeoffs between efficiency and accuracy.

The Standards Alignment (20 min) [Hands-on Activity] – Participants will work in small groups, with each group aligning the activity to a different set of standards (e.g., NGSS, CCSS). Groups will share out results.

Making Connections in Your Curricula (15 min) – Participants will work together to identify opportunities for making such cross-standards connections in their own curricula.

Materials for Participants to Take: Participants will leave the workshop with knowledge of engineering skills and practices as well as ideas for making cross-standards connections in their existing curricula. Additionally, they will leave with information about implementation support available to schools interesting in adopting the *Engineer Your World* program.

Practical Applications: Teachers, administrators and outreach staff can use the engineering skills in their own work. Teachers and administrators can use the experience to identify opportunities to bundle standards in their own curricula.

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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.¹ 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):

Engineering Habits of Mind and Practices: Participants will engage in design of experiments (how to design an three-factor experiment to gather data to brew the perfect cup of coffee), data analysis and interpretation (given a data set, how can one represent and interpret the data), the use of computational and mathematical models as evidence to argue for a proposed solution (to argue for their own chosen solution to the challenge), and an analysis of tradeoffs (to decide between multiple “right” solutions). These are all engineering practices or habits of mind.

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 activity is taught successfully to 3300 students in *Engineer Your World* classrooms at 77 schools. Among these, 28 percent are female, nine percent are Black, and 42 percent are Hispanic/Latino(a). The curriculum was designed expressly to engage underrepresented students in engineering.

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:
n/a

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:

36

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

We do this effectively with 36 teachers in professional development. Since the work is done actively in smaller groups, all participants are engaged at all points in the workshop.

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.”

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:

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