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Building a Better World: Engineering Disaster Proof Housing

Ms. Ann D Kaiser, ProjectEngin LLC

Ann Kaiser, CEO of ProjectEngin LLC, has extensive experience as both an engineer and an educator. A graduate of Columbia University's Schools of Engineering and International and Public Affairs, she is committed to developing global citizenship through K-12 engineering curriculum. Ann is a Fulbright Distinguished Teacher and has presented as a Top Overseas Teacher in Singapore and a keynote speaker at the 2015 Danish Big Bang National Science Teachers Conference. She has designed a full year project-based high school engineering curriculum and is currently working to develop a middle school STEAM curriculum.

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 Kaiser First Ann Affiliation ProjectEngin LLC

2) Last First Affiliation

3) Last First Affiliation

Contact Person's Name: Ann Kaiser

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Contact Person's Phone: 401-578-8281

Contact Person's Alternate Phone: 401-245-5817

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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) Ann Kaiser, CEO of ProjectEngin LLC, has extensive experience as both an engineer and an educator. A graduate of Columbia University's Schools of Engineering and International and Public Affairs, she is committed to developing global citizenship through K-12 engineering curriculum. Ann is a Fulbright Distinguished Teacher and has presented as a Top Overseas Teacher in Singapore and a keynote speaker at the 2015 Danish Big Bang National Science Teachers Conference.
2)

3)

WORKSHOP INFORMATION

Proposed Title:
Building a Better World: Engineering Disaster Proof Housing

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.

The inclusion of Engineering Design in the K-12 classroom enables teachers to bring real world issue into the curriculum. Global imperatives, such as the need for adequate housing, access to clean water, reliable infrastructure, energy needs, and sustainability, will frame very real problems for the future citizens who are in today's classrooms. Engineering allows young people to actively pursue solutions, empowering them rather than simply informing them. The "Building a Better World" project is part of ProjectEngin's curriculum units centered on global issues. In this project, students focus on developing wind, flood, and earthquake proof housing, a problem confronting people in many parts of both the developed and the developing world.

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

"Building a Better World" is a design-based, multi-disciplinary STEM project. It is adaptable to a wide range of learners, classrooms, and instructor backgrounds. In addition, it can be modified

to fit time and resource constraints. It is designed to be somewhat modular, allowing for customization in terms of focus on process, product, needed skills, and concept inclusion.
The overall learning objectives are:
1. To explore the housing crisis caused by natural disasters, specifically flooding, high winds, and earthquakes.
2. To apply principles of appropriate technology as well as structural and fluid mechanics to design sustainable, disaster-proof housing.

The core ideas in various areas are listed below. These are easily tailored to reflect level of science ability.

Science

1. Fluid mechanics
2. Vibrations and waves
3. Forces, tension and compression; static and dynamic loading.

Engineering

1. Constraints and criteria
2. Strength of materials
3. Use of appropriate local materials
4. Construction issues
5. Design of testing
6. Prototyping/ scale models

Global Issues

1. Environmental issues
2. Population growth/distribution
3. Cultural empathy

Actual Classroom Implementation:

In the actual classroom version, students research disaster-prone parts of the world in order to select a suitable location for their project. Alternatively, student groups can be given developed design briefs specifying a scenario. This helps to shorten the number of classes required and can also be useful when working with younger students. A review or introduction of forces, fluid mechanics, and material properties is then conducted at an appropriate level based on the extent of the project and student knowledge. This includes some hands-on and simulation activities. Students will identify constraints, which are either instructor-specified or inherent to their project. They will use matrix decision making techniques to develop and rank criteria and to choose a final design. They then develop scale model prototypes of housing that is primarily locally sourced, sustainable, and able to withstand future disasters. Students also work to design appropriate scaled down testing parameters, using static and moving water, a compressor, a shake table, and lab masses to replicate loads and forces. In-process testing and design modifications will be used to optimize the structure.

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Workshop Activities:
Some key component parts of the overall project will be modelled in the workshop.

1. Brief discussion of overall problem; resources on disasters and housing
2. Quick Build Activity – groups of 2 or 3
   Participants will be given a "design scenario" consisting of a bag of simple materials, a description of location, and a possible natural disaster.
   They will have 15 minutes to build suitable housing.
   Housing will be tested for ability to float, withstand "downpours" and "wind".
3. Participants will also be given an opportunity to develop a criteria matrix in order to rank and weight criteria that they deem relative to a design. This will be done as a guided group activity in groups of 3 or 4.

Materials and Resources for Participants:
The participants will leave with a general set of lesson plans, detailing approaches that can be used for several levels of learners – from middle school to senior high school. The plans will also include possible modifications due to time constraints and will indicate which components can be omitted or shortened.
The following documents will also be provided to participants:
Internet Resource List, which includes some video resources
Materials List (basic and more extensive)
Design Briefs for Specific Country Locations
Student Worksheets

This project has a wide range of applications for educators and incorporates many of the practices and cross-cutting concepts of the NGSS. It is designed using a performance task approach. It can easily be tailored to become a true STEAM project with a focus on architecture and local design. Increased emphasis on local resources and constraints in terms of environmentally friendly materials enable an increased sustainability focus. It suitable for a capstone project in a first semester physics class. It can be used to create an interdisciplinary thematic unit across the curriculum. This is most effective in a middle school setting and is being piloted this fall. It truly brings the real world into the STEM classroom in a meaningful way. ProjectEngin will provide online implementation assistance to participants who implement the curriculum.

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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:

X☐ Use of an engineering design process that has at least one iteration/improvement
X☐ Attention to specific engineering habits of mind
X☐ 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):

This project focusses on many aspects of engineering design. In both the full classroom version and the abbreviated workshop summary, key engineering practices, as emphasized in the NGSS are stressed. The problem is defined by research or in a design brief and delimited by given and inherent constraints, as well as student developed criteria. Multiple solutions are generated and evaluated. The most reasonable one is modeled, tested, and modified. Students, as well as workshop participants, need to explain their design in terms of available resources, performance, and possible modifications. In addition, students are responsible for engineering their own meaningful tests.

Engineering "habits of mind", based on NAE and NRC references, are generally thought of as (1) systems thinking, (2) creativity, (3) optimism, (4) collaboration, (5) communication, and (6) ethical considerations. The "Building a Better World" project incorporates all of these. Housing solutions embody systems thinking since they are impacted by a complex mix of cultural imperatives, material resources, and natural events. Good design, particularly for a basic human need such as housing, must be creative in order to maximize quality of life. This project empowers young people by helping them to see a solution, not just a problem. Housing is a complex problem and, even in the workshop "quick build", participants cannot succeed without collaboration and communication. Most significantly, this project is based on the ethical issues surrounding the need for viable housing, often in under-resourced parts of the world. It is also based on the need to respect the end-user and the surroundings in order to develop an appropriate solution.

It is also worth noting that this projects allows for a strong focus on civil as well as materials and environmental engineering. Suggestions for more specific technical focus are included in curriculum materials that will be made available to participants.

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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):

The "Building a Better World" project developed out of a commitment to increase the global view and cultural sensitivity of young people. It also highlights the power of engineering to have a positive impact on the world. By maintaining a focus on diverse needs, along with different countries and people, the project itself embraces diversity. In practice, it consistently engages students who often don't consider themselves players in the traditional STEM world. In five years of using this project in class myself, and in coaching other teachers who use it in their classes, it is consistently the favorite of the girls in the class and of many of the students who think of themselves as "non-geeks". The demand for cultural empathy in order to achieve a good design exposes all young people to the idea that everyone's expectations about quality of life deserve to be met. The multi-faceted format of this project allows for all views, opinions, and talents and requires students to go beyond their own walls. There is room for many ideas in this project and success is rooted in the ability to empathize with those living under conditions, which most likely, are very different from your own. "Building a Better World" is about the need for appropriate housing and the commonality of our basic humanity. By making global diversity a focus in the classroom, it naturally attracts and engages a diverse group of students

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.)

X☐ No
☐ Yes

Please describe:

Grade Level Target Audience (check all that apply):
☐ Primary (EC–2)
☐ Elementary (3–5)

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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."*

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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