



Rehash Your Trash: An EngrTEAMS STEM Integration Recycling Curricular Module

Mr. James Holly Jr., Purdue University

James Holly, Jr. is a Ph.D. Student in Engineering Education at Purdue University. He received a B.S. from Tuskegee University and a M.S. from Michigan State University, both in Mechanical Engineering. His research interest is exploring formal and informal K-12 engineering education learning contexts. Specifically, he is interested in how the engineering design process can be used to emphasize the humanistic side of engineering and investigating how engineering habits of mind can enhance pre-college students' learning abilities.

Mr. Aran W Glancy, University of Minnesota, Twin Cities

Aran Glancy is a Ph.D candidate in STEM education with an emphasis in Mathematics Education at the University of Minnesota. He has experience teaching both high school physics and mathematics, and his research focuses on supporting mathematics learning, specifically in the domains of data analysis and measurement, through STEM integration and engineering. He is also interested in mathematical modeling.

Prof. Tamara J Moore, Purdue University, West Lafayette

Tamara J. Moore, Ph.D., is an Associate Professor in the School of Engineering Education and Director of STEM Integration in the INSPIRE Institute at Purdue University. Dr. Moore's research is centered on the integration of STEM concepts in K-12 and postsecondary classrooms in order to help students make connections among the STEM disciplines and achieve deep understanding. Her work focuses on defining STEM integration and investigating its power for student learning. Tamara Moore received an NSF Early CAREER award in 2010 and a Presidential Early Career Award for Scientists and Engineers (PECASE) in 2012.

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: 3

Presenter Name(s):

- 1) Last Holly, Jr. First James Affiliation Purdue University
- 2) Last Glancy First Aran W. Affiliation University of Minnesota
- 3) Last Moore First Tamara J. Affiliation Purdue University

Contact Person’s Name: James Holly, Jr

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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) James Holly, Jr. is a Ph.D. Student in Engineering Education at Purdue University. He received a B.S. from Tuskegee University and a M.S. from Michigan State University, both in Mechanical Engineering. His research interest is exploring formal and informal K-12 engineering education learning contexts. Specifically, he is interested in how the engineering design process can be used to emphasize the humanistic side of engineering and investigating how engineering habits of mind can enhance pre-college students’ learning abilities.

2) Aran W. Glancy is a Ph.D. candidate in STEM education with an emphasis in mathematics education at the University of Minnesota. He is a former high school physics and mathematics teacher and has also taught courses in mathematics for computer science. Aran’s research interests include STEM integration at the middle and high school level, K-12 engineering education, computational thinking.

3) Tamara J. Moore, Ph.D., is an Associate Professor of Engineering Education within INSPIRE at Purdue University. Her research is centered on the integration of STEM concepts in K-12 classrooms in order to help students make connections among the STEM disciplines and achieve deep understanding. Her work focuses on defining STEM integration and investigating its power for student learning. She is PI on two K-8 STEM integration focused NSF-funded projects.

WORKSHOP INFORMATION

Proposed Title:

Rehash Your Trash: An EngrTEAMS STEM Integration Recycling Curricular Module

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.

EngrTEAMS is a curricular project that strives to increase student learning of science and mathematics (data analysis and measurement), by using an engineering design-based approach for integrated STEM instruction. One example module is entitled “Rehash Your Trash,” using the context of waste management and recycling to engage students in learning math and science concepts. An engineering design challenge is presented to students asking them to design an automated sorting process for a recycling company. This workshop will provide participants with

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an in depth, hands-on introduction to this unit, and provide access to 20+ curricular units for grades 4-8.

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

EngrTEAMS is a NSF Mathematics and Science Partnership involving partners from higher education and K-12 schools. The overarching goal of EngrTEAMS is to increase learning of science and mathematics (data analysis and measurement), by using an engineering design-based approach to professional development and curricular design. This workshop will provide teachers with the opportunity to experience a model of STEM integration that an engineering design challenge to facilitate an integrated approach that emphasizes the connections between disciplines. The focus on engineering design and engineering thinking allows for a context in which students can explore the interdisciplinary nature of learning science and mathematics through engineering and within a real-world context. Through this workshop, we anticipate that teachers will gain a better understanding of STEM integration and making meaningful connections between STEM fields while setting the learning in a real-world context. Teachers will also learn about implementation strategies and some of the frameworks we used to help our teachers develop these curricular modules.

In this workshop, we will present a unit on recycling called Rehash Your Trash. In this unit, students are faced with an engineering design challenge in which they must develop an automated sorting process for a recycling company that is transitioning from manual sort to single-stream, automated sorting. To develop the tools necessary for this challenge, students must learn about intrinsic and extrinsic physical properties as well as chemical properties. Specifically, students learn how density can be used to separate different types of materials, and while investigating this concept, students collect and analyze real data and apply their knowledge of proportional relationships. During this hands-on experiential session, participants will have the opportunity to experience a model of STEM integration that uses the context of engineering to facilitate an integrated approach that emphasizes the connections between disciplines.

This hands-on session will highlight the middle school unit described above and participants will be engaged in the progression of activities with a focus on the meaningful integration of the science, math, and engineering lessons. Throughout the session there will be an ongoing discussion of the focus on engineering that allows for a context in which students can explore the interdisciplinary nature of learning science and mathematics through engineering and within a real-world context. Participants will also learn about implementation strategies, and be

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part of an interactive discussion about how these modules could be implemented in middle school classrooms or methods courses. Through this session we anticipate that participants will gain a better understanding of STEM integration and making meaningful connections between STEM fields while setting the learning in a real-world context. They will also be given access to a website where all 20+ units are available for free.

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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):

It is important that students’ exposure to engineering begins early and with that exposure students should be learning about engineers and engineering. This lessons provides students with opportunities to think and act in ways that are similar to engineers by involving them in an engineering design challenge. The engineering habits of mind listed below help to achieve the goal of teaching students about engineering thinking skills and the NGSS standards are integrated throughout the curriculum module that is being presented.

Creativity is explicitly addressed throughout the module as students are asked to brainstorm their own ideas and then come together to share ideas to come up with as many ideas as possible. In this workshop session, teachers will talk about how this module, and engineering, can be used as a space to facilitate students’ creativity in the middle school classroom. Systems thinking is at the heart of this unit’s design, here students (and in this case, their teachers) will be designing a systematic process of how to recycle, rather than a physical product. Students will develop skills in considering the interactive relationships between the various aspects of a system; as well as, the implications of modifications to the system.

Collaboration is another important part of this module and teachers will be presented with how cooperative learning components have been built into this unit to provide a structure that highlights the idea that Engineering is a “team sport.” These skills and the structure used in this curriculum to foster collaboration will be explicitly discussed as participants are working together throughout the engineering design challenge. Communication in engineering will be presented in a developmentally appropriate manner through the importance of helping students learn to share and listen to ideas in a respectful way. Furthermore, the development of communication skills is essential to effective collaboration and group planning.

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Finally, ethical considerations will be brought to the forefront through conversations about the trash in the ocean through the Great Pacific Garbage Patch, biodegradability, and being environmentally responsible.

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 provides a context for diverse students by using a relevant topic, recycling, as the focus of the engineering design challenge. Waste management and recycling has implications for all humans and awareness of the consequences of mismanagement is beneficial for students to learn at a young age. Additionally, students have the opportunity to contribute their unique perspective in developing a solution for a universal problem.

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

Maximum Number of Participants:
25

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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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