Abstract – Sustainability principles in engineering are currently taught and promoted through graduate programs and professional engineering societies. It is appropriate that sustainability principles are also addressed in undergraduate engineering education. Retooling an existing undergraduate engineering curriculum to include comprehensive coverage of sustainability may be outside of the expertise or purview of an individual educator. However, sustainability principles can still be introduced to different degrees and at different class levels within an existing curriculum. This Special Session seeks to facilitate discussion of how to best incorporate sustainability in undergraduate engineering education and also seeks to build a cohort of engineering educators that join James Madison University in a desire to bring sustainability education into the engineering classroom.

Index Terms – sustainability, education, engineering

GOALS OF THE SESSION
Teaching about sustainability in engineering has been used more broadly and accepted more widely in countries outside the United States [1]. In the United States, sustainability teachings have often focused on the graduate student audience and not undergraduate education. The new School of Engineering at James Madison University (JMU), an undergraduate program that emphasizes multidisciplinary approaches in engineering, was given the charter to have sustainability as the program focus. We wish to discuss multidisciplinary approaches to including sustainability in undergraduate engineering education. We recognize that many engineering educators are not in a position to rapidly change entire curricula to one that focuses on sustainability even if they wanted to. However, many could incorporate sustainability elements into their existing courses if they had a clear idea of how to do so and were encouraged to do so by their peers.

One potential barrier to teaching about sustainability is the lack of a single accepted definition for sustainability that is readily applied to engineering. Definitions of the term “sustainability” are usually traceable to the definition in The Brundtland Report of the United Nations World Commission on Environment and Development:

“… a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [2].

Numerous definitions have branched out from the Brundtland definition, in part because sustainability requires different approaches from different disciplines. It is reasonable to assume that some educators may be hesitant to approach a topic that is both as dynamic and broad as sustainability. Rather than corporately develop a single definition of sustainability, we intend to help educators develop an idea of what sustainability means within the context of their specific program, course, or activity.

Specifically, the goals of this special session are to:

• Provide insights into the varying definitions of sustainability
• Discuss approaches to introducing Freshmen engineering students to sustainability
• Learn the preferred attributes of a new-hire engineer in the Facilities Management division of a large institution that is committed to sustainable practices. This will serve as an example of how entry-level engineers will encounter sustainability in traditional engineering careers.
• Generate a collection of peer developed ideas for lectures, exercises, or activities that could be used to introduce Freshman engineering students to sustainability
• Generate a collection of peer developed approaches to the introduction or incorporation of sustainability in an existing “traditional” upper division engineering course.

SESSION CONTENT
We propose to work with session participants to build an acceptable approach to bringing the topic of sustainability into the undergraduate engineering classroom. This will be accomplished in the following ways:

1. Group work in which participants discuss approaches to bringing sustainability into engineering education
2. Group work in which a definition of sustainability that is applicable to engineering is developed
3. A real-world example of sustainability knowledge that is considered attractive for an engineer to have in the context of a traditional engineering career within a progressive organization will be presented
4. Group work in which participants will have the choice to work in either groups that address the introduction of sustainability in a freshman engineering course or groups that address the introduction of sustainability into an existing upper division engineering course

SESSION AGENDA

This session will be primarily learner-based with a majority of the time spent working in groups of about five members. Short presentations will be made by session organizers to help guide discussion in the groups. Group discussions will focus on three topics over the course of the session; written deliverables will be required for each topic. Although groups will have the opportunity to share some of their results and to hear the results of others, session organizers will collect the deliverables associated with each discussion topic. The deliverables will then be assembled by the session organizers and disseminated to participants via email. The proposed agenda is as follows:

1. Welcome, introduction, and guide to first group discussion. (5 min)
2. Group discussion to outline any approaches that group members have considered or are currently using to incorporate sustainability into their engineering courses. Deliverable: a working set of sustainability approaches that are readily applicable to engineering. (15 min)
3. Group discussion to develop definitions of sustainability that apply to engineering solutions. (15 min) Deliverable: a set of peer-developed, engineering based, definitions of sustainability.
4. Open discussion (moderated by session organizers) in which each group will have the opportunity to briefly share their proposed sustainability definition(s). Session organizers will briefly share the approach adopted by the School of Engineering at James Madison University. (10 min)
5. Presentation to describe what sustainability related knowledge or characteristics are preferred in a new engineering hire that would be assigned to a traditional engineering role. This presentation will be made by Towana Moore whose purview at JMU includes Facilities Management. This will influence the curriculum development group work in item (6) by giving a glimpse of what real-world implementation of sustainable systems entails. Presentation will be followed by a brief Q&A. (10 min presentation, 5 min Q&A)
6. Group discussion for which participants choose to work in groups that are focused on one of the following topics (25 min):

- How to introduce sustainability to freshmen engineering students. Deliverable: an outline of at least one lecture, exercise, or activity that could be used in a freshman engineering course.
- How to introduce (or incorporate) sustainability in an existing “traditional” upper-division course. Deliverable: a general description of at least one approach that is applicable across engineering disciplines.
7. Brief presentation of task results and wrap up (5 min).

PARTICIPANT RESOURCES

Participants that wish to develop a basic knowledge of sustainability and how it relates across engineering disciplines should familiarize themselves with the materials in references [3]-[6].

REFERENCES


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