2023-10-10

How To Use New Tools To Integrate Sustainability Into Engineering Teaching

Sarah Jayne HITT
NMITE, United Kingdom, sarah.hitt@nmite.ac.uk

Jonathan TRUSLOVE
Engineers Without Borders - UK, jonathan.truslove@ewb-uk.org

Cindy COOPER
Lemelson Foundation, United States, cindyc@lemelson.org

Recommended Citation

Hitt, S. J., Truslove, J., & Cooper, C. (2023). How To Use New Tools To Integrate Sustainability Into Engineering Teaching. European Society for Engineering Education (SEFI). DOI: 10.21427/GJCF-K047

HOW TO USE NEW TOOLS TO INTEGRATE SUSTAINABILITY INTO ENGINEERING TEACHING (WORKSHOP)

S.J. Hitt [1]
NMITE
Hereford, UK
0000-0002-0176-6214

J. Truslove
Engineers Without Borders - UK
London, UK
0000-0001-5671-0616

C. Cooper
Lemelson Foundation
Portland, OR USA
0000-0001-7253-4042

Conference Key Areas*: Embedding Sustainability and Ethics in the Curriculum, Curriculum Development*
Keywords*: Teaching Resources, Integrating Sustainability*

ABSTRACT

Recently, three projects have addressed the challenge that while many excellent resources on sustainability education exist, there aren't many that explicitly guide engineering educators to integrate these into their teaching, or indeed that are intended to upskill engineering academics to be able to deliver this teaching. These projects are the Reimagined Degree Map project undertaken by Engineers Without Borders UK (sponsored by the Royal Academy of Engineering), the Sustainability Toolkit project undertaken by the UK's Engineering Professors' Council (sponsored by Siemens and the Royal Academy of Engineering), and the Engineering for One Planet Framework and two companion guides, co-created by hundreds of engineering education stakeholders (sponsored The Lemelson Foundation). All aim to build the capacity of educators to embed sustainability knowledge, skills and

[1] *S.J. Hitt*
sarah.hitt@nmite.ac.uk

mindsets in their modules, courses or curriculum that will enable students to become competent in globally responsible engineering practice. In cooperation with academic, industry, and advocacy group leaders, these projects have resulted in the development of several educational tools that are presented in the workshop.

1 INTRODUCTION

1.1 Motivation

Have you wanted to embed sustainability in your engineering modules but are unsure how? Do you want to gain confidence in equipping and motivating your graduates to tackle the serious sustainability challenges facing the environment and society? This workshop will introduce new tools designed to help engineering educators more easily and effectively integrate the sustainability knowledge, skills, and mindsets that both students and employers are demanding and that are essential to the globally responsible practices society needs today. This session is relevant to engineering educators of all disciplines and backgrounds in higher education, as well as administrators and programme leaders responsible for accreditation and/or curriculum development.

1.2 Workshop Learning Outcomes

Following the workshop, participants will be able to:

- Access three new tools for integrating sustainability into engineering education and explain the relevance of these tools to their module/programme;
- Identify key sustainability competencies that engineering students should develop and understand methods for incorporating these into technical learning;
- Introduce these tools to their colleagues and advocate for their use.

2 BACKGROUND AND RATIONALE

The Institute of Engineering and Technology reported in 2021 that of 1,000 UK engineering companies with a sustainability strategy, only 7% have staff with the skills to fulfill it (IET 2021). At the same time, Surveys conducted by Siemens as well as the UK organization Students Organising for Sustainability have revealed that 79% of students want to see sustainable development incorporated and promoted in all their courses, and while students view real-world activities as most useful in learning about sustainability, only 22% had this experience in their first year engineering courses (Siemens 2023; Students Organising for Sustainability 2021).

Therefore, the need to integrate sustainability as an explicit and essential component of engineering education has never been more urgent. Global engineering education organisations, national accreditors, students, and many industry groups now advocate for sustainability learning to form a critical part of engineering curriculum (Engineering Council 2020; Students Organising for Sustainability 2021; Standish, Smyth, and Zambrelli 2020). Yet engineering academics themselves have not necessarily been trained in education for sustainability, and they may not feel they possess the experience or confidence to weave this learning into the modules that they teach (Savage et al. 2015). Additionally, it can be overwhelming to sort through the abundant guidance available on sustainability education and to determine what fits best in engineering education.

3 WORKSHOP SESSION DESIGN

This interactive workshop will introduce these new resources, giving attendees a chance to learn about them as well as to plan how they could be implemented in their own educational contexts.

First, workshop participants will engage in a facilitated large group discussion on the current context of sustainability in engineering education at the programme, institution, national, and global scales. This discussion will also address inputs from students (via outcomes from the Siemens Skills for Sustainability Student Survey) and industry (via engagement with professional engineering institutions and companies conducted by Engineers Without Borders UK). This activity will provide the background understanding for why these resources are important, and why engineering education must change in order to incorporate sustainability learning.

Second, participants will be prompted to consider how changes within engineering curricula can be enacted by module and programme leaders. The Reimagined Engineering Degree Map will be presented as a way to consider the broader purpose of strategies to deliver sustainability. Participants will explore interventions educators can make to learning journeys and design relevant learning opportunities that enable the integration of sustainability at different levels.

Next, participants will have the opportunity to learn about the core and advanced student learning outcomes found in EOP's "Tools for Teaching and Learning" (Engineering for One Planet) that are aligned with ABET accreditation standards, the UN SDGs, and Bloom's Taxonomy. Participants will learn how they can integrate and apply the learning outcomes into their own module or programme by leveraging two companion teaching guides that provide specific sustainability-focused teaching and learning materials available for free and online to everyone.

Finally, participants will be guided to reflect on existing good practice and where gaps remain in implementation. This reflection process will in turn inform other resources under development for the Sustainability Toolkit in the areas of understanding, integrating, assessing, and collaborating around sustainability skills and competencies.

4 RESULTS AND IMPACT

The hope is that the workshop will encourage and initiate uptake of these educational tools. This will in turn lay the groundwork for further research on the practice of embedding sustainability within engineering education, as well as provide guidance and support for educators in this process. Educational tools are only effective if they are implemented, iterated on, and continually improved, so another outcome for the workshop will be to discuss opportunities for establishing an

international community of practice dedicated to using, promoting, and further developing these resources.

REFERENCES

Engineering for One Planet. N.d. “Tools for Teaching and Learning.” Accessed May 5, 2023. https://engineeringforoneplanet.org/resources/

IET. February 2, 2021. “93% of Industry Without Skills to Meet 2050 Climate Targets.” https://www.theiet.org/media/press-releases/press-releases-2021/press-releases-2021-january-march/2-february-2021-93-of-industry-without-skills-to-meet-2050-climate-targets/

Savage, Emma, Tara Tapics, John Evarts, Jeffrey Wilson, and Susan Tirone. 2015. "Experiential Learning for Sustainability Leadership in Higher Education." International Journal of Sustainability in Higher Education 16 (5): 692-705. doi:https://doi.org/10.1108/IJSHE-10-2013-0132.

Siemens. 2023. “The Student Voice – Report for the Skills for Sustainability Survey.”

Standish, Jill; Cara Smyth, and Frank Zambrelli. 2020. Resilient Management in the Age of Responsible Retail. Accenture.

Students Organizing for Sustainability International (2021). Students, Sustainability and Education: Results from a survey of students in higher education around the world.