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Workshops

51st Annual Conference of the European  
Society for Engineering Education (SEFI)

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2023-10-10

## Practical Toolkit For Embedding Ethics In The Engineering Curriculum

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### Recommended Citation

Hitt, S. J., Fowler, S., Junaid, S., & Rich, J. (2023). Practical Toolkit For Embedding Ethics In The Engineering Curriculum. European Society for Engineering Education (SEFI). DOI: 10.21427/DZ1H-WX60

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# PRACTICAL TOOLKIT FOR EMBEDDING ETHICS IN THE ENGINEERING CURRICULUM

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**Conference Key Areas:** *Embedding Sustainability and Ethics in the Curriculum, Curriculum Development*

**Keywords:** *Ethics, engineering, toolkit, teaching and learning, best practice*

## ABSTRACT

The need to embed ethics into the engineering curriculum is a collective imperative if we are to successfully navigate complexity, uncertainty and challenging ethical issues to build a sustainable society that works for everyone. To maximise positive impact, behaviours such as inclusivity and sustainability must become instinctive – golden threads running through everything that engineers think and do. Proactively, bringing engineering ethics to the fore in engineering programmes is one way UK

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higher education equips future engineers with the skills and mindset they need to succeed.

This workshop brings together best practice from expert practitioners across the UK, introducing a nationally curated 'Engineering Ethics Toolkit'. To help educators to know and use the toolkit the workshop offered an attractive translation of engineering ethics teaching theory to the practice of engineering education.

In this workshop, participants were introduced to a pragmatic approach to integrating ethics content into their teaching, using examples and a detailed and interactive curriculum map, which connects the elements of the toolkit.

Our aim is to ensure the toolkit becomes an ongoing, regular component of engineering teaching and highlighting excellence in integrating ethics. The workshop was as a seed to encourage further case studies to be developed and to also explore what can yet be done in this space to ensure the next generation of engineers are well-equipped to address the ethical issues they face.

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## **1. Motivation**

The need to embed ethics into the engineering curriculum is a collective imperative if we are to successfully navigate complexity, uncertainty, and challenging ethical issues to build a sustainable society that works for everyone. Proactively, bringing engineering ethics to the fore in engineering programmes is one way UK higher education equips future engineers with the skills and mindset they need to succeed. However, engineering educators without an expertise in ethics may lack confidence in integrating this content into their technical modules. The purpose of the session was to demonstrate how an internationally curated 'Engineering Ethics Toolkit' can enable educators to embed ethical context within their modules and programmes.

## **2. Background and rationale**

In the wake of high-profile events like COP-26 and disasters such as Grenfell, scholars, industry groups and advocacy organisations have increased their calls to make ethics a more visible, relevant, and essential component of engineering education and practice. For instance, a forthcoming handbook from SEFI on Engineering Ethics Education (to be published in 2024) and the recently published International Handbook on Engineering Education Research (Routledge, 2023) highlight new developments in research and pedagogy in this area, while recent updates to accreditation standards have explicitly called for students to gain knowledge and experience with ethical issues related to engineering (Engineering Council, 2020). Most notably in the UK, the Royal Academy of Engineering's Ethics Reference Group (2022) published a report calling for an improvement in the profession's engagement with all aspects of ethics.

In response to this call to action, an Engineering Ethics Toolkit has been produced by academics and engineering professionals from around the world. The Toolkit is intended to meet the need for a better understanding of the concept of ethics and support for issues surrounding its teaching, and to demonstrate where and how in the engineering curriculum ethics teaching can be embedded and provide teaching resources to support with this.

## **3. Workshop design**

This session used Socratic-style discussion, small and large group activities, and reflective learning approaches.

1. First, participants reported on their existing experience with ethics education and suggested a list of current ethical issues in engineering.
2. Next, workshop facilitators introduced and described resources found in the Engineering Ethics Toolkit that relate to the identified issues. We accessed the Toolkit's Ethics Explorer, demonstrating how users can find resources pertinent to their needs and can be equipped to apply them to different teaching contexts.
3. As a large group, we then considered ways in which different disciplines might make use of the Toolkit's practical case studies, supporting teaching materials

and guidance articles. Real-world examples of how these tools have already been used were described.

4. Following these examples, participants worked in small groups as they were coached through methods for embedding a Toolkit resource in their teaching.
5. Finally, attendees were given the opportunity to consider how they might adapt a resource or create a new one for their own discipline/programme.

#### **4. RESULTS OF THE WORKSHOP**

This workshop emphasised the need to embed ethics into the engineering curriculum, highlighted that behaviours such as inclusivity and sustainability must become instinctive – golden threads running through everything that engineers think and do – and posited that engineering programmes must be proactive in bringing engineering ethics to the fore in order to equip future engineers with the skills and mindset they need to succeed.

The workshop, in which over two dozen engineering educators from around the world participated, showcased the Engineering Ethics Toolkit and introduced a pragmatic approach to integrating ethics content into teaching, using examples and a detailed and interactive curriculum map, which connects the elements of the toolkit.

During the workshop, participants had the opportunity to:

- Consider the contemporary context of engineering ethics education amidst current issues such as AI, net zero, and inclusive design;
- Develop a practical understanding of new resources in engineering ethics education, namely case studies and relevant teaching activities, guidance articles and an interactive curriculum map;
- Reflect on examples of ethics teaching practice in a variety of UK university engineering programmes;
- Engage with pragmatic approaches to integrating ethics content into their teaching through sample activities; and
- Create a new engineering ethics resource suitable for inclusion in their module/programme.

To help educators to know and use the toolkit the workshop was an attractive translation of engineering ethics teaching theory to the practice of engineering education at a time when an ethical approach to engineering practice is essential to a more sustainable and just future.

Workshop participants took away high-quality open-source engineering ethics teaching resources and pedagogical strategies that enable engineering students to be able to identify ethical issues, exercise ethical thinking and use ethical judgement within their projects and coursework.

#### **5. CONCLUSIONS**

This is an ongoing piece of work to support the sector and the workshop helped to embed the Ethics Toolkit as a regular component of engineering teaching and highlighting excellence in integrating ethics.

The workshop acted as a seed to encourage further case studies to be developed and an exploration of what can yet be done in this space to ensure the next generation of engineers are well-equipped to address the ethical issues they face.

Additionally, the workshop bolstered an emerging community of practice that has been established to encourage, support and acknowledge good practice in engineering ethics education.

## **6. REFERENCES**

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## **7. ACKNOWLEDGEMENTS**

The Engineering Ethics toolkit was created by the Engineering Professors' Council with support from the Royal Academy of Engineering, and Ethics Ambassadors, a new community of practice aimed at championing the embedding of ethics within engineering.

The toolkit can be found at: <https://epc.ac.uk/campaign/engineering-ethics/>.