

European Journal of Engineering Education

Special Issue - Call for papers

Theme: Sustainability in Engineering Education - Integration and Transformation Approaches

Planned Submission Process

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Instructions for authors

Extended abstracts are submitted here: <http://mc.manuscriptcentral.com/ceee>

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Aims and objectives

We invite contributions to a new special issue of the European Journal of Engineering Education on *sustainability in engineering education*. The focus is on how sustainability and sustainable development can be *meaningfully integrated* in engineering education, and how even more profound sustainability *transformations* can be achieved in, as well as through, engineering education.

The subject has developed rapidly in the fourteen years since this journal published a special issue on this topic (Mulder, Bretelle-Desmazieres, & Foxley, 2008). There is now abundant evidence of the unprecedented rate and global scale of human impact on the Earth System (e.g. Steffen et al., 2015; IPCC, 2018; WWF, 2020). Through the adoption of the UN's 2030 Agenda with the Sustainable Development Goals, and a number of other policies and instruments, the global society and governments all over the world have agreed on the urgent need for change (UN, 2015). As problem solvers and developers of new technology, engineers are considered crucial for sustainable development. However, according to UNESCO (2021), there are significant gaps between current engineering capability and the needs to meet the pressing challenges related to human well-being and health, clean water, food security, biodiversity, climate emergency, energy, urban development, and other vital challenges. It is also important to acknowledge that engineers have played contested roles in history and still do (Lucena & Schneider, 2008; Mathebula, 2018). Further, the emphasis in transition movements on social learning, dialogue and co-creation, and the recognition that transitions in the

context of wicked sustainability problems are inevitably iterative and reflexive and, in sense, cannot be engineered, calls into question the whole notion of engineering and, indeed, of engineering education.

In a recent review of the literature on sustainability in engineering education, Thürer et al. (2018) notice substantial progress during the last couple of decades. The major focus has, however, been on environmental aspects, whereas social, economic, political, and cultural dimensions of sustainability are given marginal attention. They further observe that the consideration of sustainability and sustainable development in the curriculum is still most commonly limited to a single stand-alone course, and in more rare cases it is embedded into several interacting disciplinary courses. Correspondingly, Sterling (2004) and Kolmos et al (2016) characterize four levels of response to the ‘new educational territory’ according to Table 1, which can also be seen as four consecutive stages for education to develop through over time.

Table 1. Levels of response to sustainability in education (adapted from Sterling, 2004; and Kolmos et al., 2016).

Sustainability transition	Response	State of education
1 Very weak	Denial or rejection	No change
2 Weak	Add-on	Education about sustainability
3 Strong	Integration	Education for sustainability
4 Very strong	Transformation	Sustainable education

According to Sterling (2004), the *add-on* level of response can only have a minor influence on students' sustainability capabilities. In the worst case it can even have a negative effect on students' engagement, hope, and agency. Reasons behind students' varying appreciation of sustainability courses are explored by Lundqvist (2016). *Integration* implies building in and contextualizing sustainability into the existing structure. According to Hanning et al. (2012), the integration of sustainability in curricula appears to be important for the students' perceived competences and appreciation for sustainability as well as for their understanding of the interrelations between sustainability and their professional work. Examples of integration change processes are described by Enelund et al. (2012), Holmberg et al. (2012), and Lundqvist (2016). The integration strategy requires substantial learning by all actors involved, teachers as well as managers and policymakers, which can be challenging. *Transformation* requires transformative, even transgressive, forms of learning that open up for questioning existing structures, methodologies, and values, and facilitate more fundamental changes of purpose and paradigm. Transformative learning is however rare and transformative change is still only at an emerging stage within engineering education (Tien et al., 2019; Kolmos et al., 2016). Lotz-Sisitka et al (2015) describe four streams of emerging transformative and transgressive learning research and praxis that can help in re-thinking learning and pedagogical development in higher education. One of these streams is concretized by Mathebula (2018) when using the capabilities approach for theorizing and analyzing the potential in sustainable engineering education. Traces of transformative learning and change in engineering education can also for example be found in some implementations of challenge-driven and challenge-based learning (e.g. Kohn Rådberg et al., 2018; Rosén et al., 2022). Further, the engineering education framework CDIO, which is originally designed to facilitate integrative reform, is through recent revisions opening the door to transformative learning and change (Rosén et al., 2021; Malmqvist et al., 2022).

To this special issue of the European Journal of Engineering Education, we call for papers that concern *integration* or *transformation* approaches to sustainability in engineering education. The following topics can be used as inspiration when considering contributions:

- Environmental aspects of sustainability beyond efficiency and optimization
- Social aspects such as well-being, diversity, equity, and justice
- Economic aspects such as inequalities and circularity
- Crossing and going beyond disciplinary and cultural boundaries and identities
- Knowledge, skills, attitudes, and key competencies for sustainability
- Contextualisation, breadth, depth, and progression, of sustainability learning
- Values, ethics, and virtues
- Emotions, care, and hope
- Transformative learning
- Wicked problems
- Challenge-driven, challenge-based, project- and problem-based, learning
- Community and stakeholder engagement and interaction
- Students' influence on education
- Student centered and student led learning
- Emancipation and empowerment
- Bildung
- Agency and impact
- Hidden curriculum
- Ontologies and epistemologies

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