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Building Collaboration And Learning Mechanisms For Sustainable Development

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Building Collaboration and Learning Mechanisms for Sustainable Development – a workshop

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1 BACKGROUND AND MOTIVATION

The United Nations (UN)'s Sustainable Development Goals (SDG) goals provide a framework for action to achieve sustainability targets for 2030 [1]. Engineering plays an important role in the achievement of the goals through the development of innovative, sustainable solutions [2]. Said that, engineering education must prepare and educate its graduates accordingly, with knowledge and competences to act locally and positively impact globally [3]. Engineering education for sustainable development (EESD) calls for transformative, problem-oriented, contextual, collaborative (inter-and transdisciplinary), student-centred learning environments, where students and academic staff develop a deeper understanding of SDGs in relation to their own field, solve complex and ill-defined sustainability problems, possess anticipatory and systems thinking skills, and collaborate across different disciplines, institutions, and wider communities to engage in knowledge co-creation, change and transformation in order to contribute for a sustainable, fair, and peaceful future [4][5]. In sum, learning and acting for sustainability requires inter- and transdisciplinarity competence [6]. As many sustainability issues could not be resolved alone, they should be addressed in a more optimal and transformative way, namely practices, and worldviews [6]. In this sense, engineering education institutions, through their students, staff stakeholders and wider community, are required to engage in co-creative processes in order to address complex problems and provide sustainable solutions, using multiple sources of knowledge in order to challenge and transform current practices and facilitate the transition to a more sustainable future [3]. Said that, it is required that they are able to work with and across institutions, cultures and disciplines, i.e. have the competence needed to work transdisciplinarity. To do so, students need to be able to not only recognize what socio-cultural and socio-ecological charactrises them as well as the differences between them and other groups of people and their practices that impede learning and actions in relation to each other [7,8]. A good example is provided by Wanger [9] of his social theory of learning through informal community of practice (CoP). A CoP is defined as a group of people, who share an identity through a common interest in a subject, and collaborate through a period of time to share ideas, determine strategies, develop solutions, and achieve shared goals and views. CoP are learning communities composed by practitioners, who share a common "language". Collaboration across such communities requires extra and explicit support, as well as the development of competences [6]. Competence for inter- and transdisciplinary work is defined as the ability to work and communicate across different practices and become agents for transformation [10].

2 SIGNIFICANCE FOR ENGINEERING EDUCATION

The workshop is based on Guliker and Oonk's [6] learning mechanism for transdisciplinary learning: (1) Identification, (2) Coordination, (3) Reflection, and (4) Transformation [6]. These learning mechanisms are identified to serve as a leverage for learning and working across disciplines and co-create knowledge and practices for sustainable development. These four mechanisms include: 1) identification, obtaining

insight into current different practices around the boundary; 2) coordination, collaborating with other to address the problem; 3) reflection, learning to see the problem from each other's perspectives; 4) and transformation, co-development of new knowledge or practices [6].

Based on the four learning mechanisms proposed by Gulikers and Oonk [6], the workshop proposes an approach on how to address sustainability complexity by enabling participants to relate their discipline, teaching and/ or research with sustainability as a point of departure to build collaborations across different sectors and foster transdisciplinary learning, and consequently foster development of competences for sustainability.

3 LEARNING OUTCOMES

Participants in this workshop will collaborate with each other and use SDG as objects to cross disciplinary, cultural, and institutional boundaries, with aim to formulate problems and co-create new knowledge and solutions, working toward innovation or transformation for sustainable learning and practice.

By the end of the workshop, participants are expected to to be able to:

1. Identify to which SDG their research, or teaching, practices contribute
2. Use SDG as objects to cross 'boundaries' for collaboration and interdisciplinary learning
3. Negotiate about how SDG-relevant focus area may contribute to each other
4. Reflect on one's own practice and unfold potentials for curriculum innovation and integration of SDG

4 WORKSHOP DESIGN

The workshop utilizes small lectures in combination of groups discussions, and hands-on exercises. It targets a maximum number of participants, incl. students, academic staffs, and researchers in engineering education, who intend to integrate sustainability in their own studies and practice. This workshop comprises five sections as table 1 shows.

Table 1 Workshop structure and organisation

Part	Duration	Main activities
1. Introduction	10 minutes	Lect. 1: Welcome and overview of workshop goals (10 min)
2. Identify and coordination	10 minutes	Act. 1: Identify the challenges by individually and brainstorm on SDG-related challenges (3 min) Act. 2: Write down and relate challenges with one's disciplinary field by individually, and how does the disciplinary field address

		the social challenges that are brainstormed (3 min) Lect.2: Sum up in plenum (4 min)
3. Integration and reflection	25 minutes	Act. 3: Form the group, discuss the challenges and try to narrow it down considering the indicators of SDGs and formulate the potential challenge that could be presented (10 min) Act. 4: Mind map knowledge needed for one to be able to address that SDG-related challenge (10 min) Lect. 3: Sum up in plenum (5 min)
4. Transformation	10 minutes	Act. 5: Taking the point of departure in the previous exercise, discuss how learning environments could be transformed to integrate education for sustainability using these learning mechanisms (10 min)
5. Final remarks	5 minutes	

Different resources (e.g. literature, scripts and exercise guidelines) are provided to participants during the workshop.

5 WORKSHOP RESULTS AND FOLLOW UP ACTIVITIES

During the workshop, 20 participants from different universities formed three groups. They collaborated to cross disciplines as well as to integrate sustainability in their professional practice (e.g., teaching, research, etc.). First, they identified key challenges such as integration of sustainability in the curriculum, teacher development for sustainability, diversity, and civic engagement for student learning for sustainability, energy, internet of things (IoT), etc. Second, participants linked the challenges formulated with the 17 SDGs and their own disciplines, they collaborated with others by making a mind map in their own group to visualise such relations and connections. Their inputs were also gathered and shared in connection with Sustainability SIG group.

6 CONCLUSION

This workshop uses Guliker and Oonk's [6] learning mechanism for transdisciplinary learning as the guidance and aims to provide engineering staffs and researchers to cross their disciplinary, cultural and institutional boundaries on SDGs to foster collaboration and innovation. This workshop also reflects the current need on crossing boundaries on SDGs in the context of engineering education, which promotes engineering students, educators and researchers to solve problems in a holistic

manner, and develop their competences and knowledge on both sustainability and interdisciplinary learning.

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