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Engineering problems are not naturally restricted to artificial discipline-oriented boundaries (Ertas et al. 2003). To solve such complex problems, future engineers need to collaborate with both (academic) experts and non-academic stakeholders from different fields and backgrounds and take various perspectives into account. Societal stakeholders can contribute valuable input to support the creation of engineering solutions. Addressing big challenges (as the 14 grand engineering challenges formulated by the National Academy of Engineering) demands a joint effort of diverse teams, different disciplines, different companies, people viewing and tackling the problems from different perspectives and angles. The students we are educating now are likely to be part of such teams, which are not separated from the economic, societal and political aspects of our society. One of the main questions that we thus need to ask, whether we are educating students now to be part of such inter- and transdisciplinary teams and whether they can navigate in the societal trends.

As a result, in any engineering development, future engineers must consistently be aware of the size and extent of the impact. The fact that this comes with major uncertainties implies that future engineers should not only be educated in the “hard” technique and management of stakeholders but also in how to deal with uncertainty. Technical and social systems in society have become complex or wicked; consequently, a planned and control-focused approach will invariably fail. Even when not designing them themselves, engineers need skills to cope with unanticipated events, values and stakeholder positions.

This requires students to learn how to anticipate the social, technical, societal and environmental impact of their actions. For this, they need skills that transcend the ‘hard’ scientific and technical skills related to disciplinary education and focus also on e.g. transdisciplinary skills. Tan et al. (2019) listed systems thinking, metacognition, empathy, and open-mindedness as essential for reaching transdisciplinarity.

Much has been written about the necessity of such skills, but less about how these could be translated to effective learning and teaching strategies for specific, dedicated and desired learning outcomes fitting to the development level (1st to 5th year students) of the students within their respective programs (BSc, Minor, Master) that are also assessable in an educational context.

In this session, we will briefly discuss the necessity of an approach to dissecting transdisciplinary tools into their basic concepts, collecting already existing pedagogical methods, and designing new ways to practice these skills. Then, we will ask the audience to participate in a quick brainstorm session to generate ideas for how systems thinking, metacognition, empathy, or open-mindedness could be incorporated in educational programmes. After sharing the results of the brainstorming, our panel will discuss some important aspects of transdisciplinary education we came across during or university-wide research on teaching practices, led by statements and dilemmas.

Panel sessions setup

• 10 minutes impulse talk by the session leaders

• 30 minutes interactive format with input from the audience (brainstorming in small groups of participants facilitated by the contributors, with materials brought by the session leaders)

• 20 minutes panel discussion by involving the audience, asking for choosing from dilemmas and agreeing or disagreeing with statements, with a panel of available experts in engineering education, to be invited later.

1–3 key readings

• Ertas, A., Maxwell, T., Rainey, V. P., & Tanik, M. M. (2003). Transformation of higher education: The transdisciplinary approach in engineering. IEEE Transactions on Education, 46(2), 289-295.

• Tan, T., Nesbit, S., Ellis, N., & Ostafichuk, P. (2019). Crossing Boundaries: Developing Transdisciplinary Skills in Engineering Education. Proceedings of the Canadian Engineering Education Association (CEEA).

• Wolff, K. (2018). A language for the analysis of disciplinary boundary crossing: insights from engineering problem-solving practice. Teaching in Higher Education 23(1): 104-119., 23(1), 104-119.

Session Details:

Designing educational methods to incorporate transdisciplinary skills (such as systems thinking, metacognition, empathy, reflexivity and open-mindedness) into educational engineering programmes

Time: 07/Nov/2024: 8:30am-9:30am · Location: Restauratiezaal