FRAMING OF THE CBL CHALLENGE

In multi-, inter-, and transdisciplinary settings

Disclaimer: This document is work in progress! We welcome feedback.

In Challenge-Based Learning (CBL) education, the *framing of the challenge* refers to the identification, development and implementation process of the challenge within a CBL course in a way that it reflects real-world evidence, encourages student engagement and autonomy, and stimulates critical thinking. The framing of the challenge differs depending on whether the course is set up in a multi-, inter- or transdisciplinary setting.

In *multidisciplinary* education, the challenge is framed around clear indications on how individual disciplines contribute to its development. Specific guidelines are presented to the students, who understand where their disciplinary knowledge is needed and who can execute different tasks separately. In *interdisciplinary* education, the challenge is framed around the creation of joint understanding. It is students' responsibility to understand from a broad challenge how their disciplinary grounding contributes to the development of the challenge and specific time is allocated for the integration of knowledge. Framing and design of the challenge do not allow for separate execution of tasks, as a proper execution of work inquires team collaboration, translation of disciplinary language and integration of skills and competencies. In *transdisciplinary* education, framing of the challenge allows for deep understanding of the challenge itself, and is not aimed at the solving of the challenge. Understanding disciplinary contribution, sharing of competencies and skills and integration of knowledge represent the main factors in the framing of a transdisciplinary challenge.

Time allocation in current curriculum

The double-diamond structure of a CBL course identifies six key moments of development of the challenge, ranging from understanding of the challenge itself to the development of a solution (Kash et al., 2022). Depending on whether the course is set up as multi-, inter- or transdisciplinary, this may require different allocation of time (Visscher, et al., 2022). In an ideal scenario, transdisciplinary CBL courses are offered for the duration of at least one semester. Depending on the university where the CBL course is offered, standardized curriculum structures, or strict ECT's requirements might not allow for semester-long courses.

In the case of TU/e, where a large majority of courses offered take place in one period (=9 weeks) and are allocated 5 ECTs (=125-150 hours), finding space for semester-long projects is an ambitious endeavor, unless the students are working on their Bachelor End Projects or Master Theses. This means that for most CBL courses, choices need to be made and, as a result, different outcomes ought to be expected depending on whether the course follows a multi-, inter- or transdisciplinary format.

Below, we suggest three different scenarios of time allocation for the different steps in the double-diamond process for multi-, inter- and transdisciplinary CBL courses. Supposedly, the

challenge framing should contain indications of how the students might use the time they are provided. The visuals also help conceptualize the different kinds of outcomes to be expected from a multi-, inter- or transdisciplinary course. In the latter, for instance, a general exploration of potential solutions based on a deep understanding of the challenge is what might be awaited. In a multidisciplinary course, due to a clear design and framing of the challenge, as well as a determined allocation of roles to students from different disciplines, a more concrete solutions might be expected.

Table 1: Multi-disciplinary education

Table 2: Interdisciplinary education

Table 3: Transdisciplinary education

Table 4: Legend. Six steps of the double-diamond CBL design process

	Understanding the problem/challenge (diverging phase)
	Framing/scoping the problem/challenge (converging phase)
	Integration of knowledge
	Elaborating a research question (how may we question) guiding the solution
	Developing a solution (diverging phase)
	Developing a solution (converging phase)

Lastly, the visual below helps reflect on the broader question: *what engineers are we educating, and what challenges are we preparing them for?*. The table seeks to bring together literature on T, TT, and OT-shaped engineers with the concepts of multi-, inter- and transdisciplinary education that we have been exploring in this section.

Table 5: Relation between I, T, TT, and OT-shaped professionals and multi-, inter- and transdisciplinary education

I	Multi-disciplinary	Challenge is framed in a way that leaves space for contribution from individual disciplines. Engineers working on this challenge get a chance to further develop their disciplinary competencies irrespective of the other disciplines.
T, TT	Interdisciplinary	Challenge is framed in a way that the integration of knowledge is required to understand it and develop a solution. Own disciplinary knowledge of the student is further developed in relation to the other disciplines. Broader, transversal knowledge is also added.
OT	Transdisciplinary	Challenge framing is dependent on the broader societal context. Its understanding requires a broader recognition and acknowledgement of the systems that surround the challenge, and the complex interactions across systems. Students working on this challenge further develop their

		disciplinary knowledge in relation to other discipline, and are able to further contextualize it in the broader societal context. Ref: OT-shape (Koretsky & Wieczorek, 2026)

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References:

Kasch, Julia & Bootsma, Margien & Schutjens, Veronique & Dam, Frans & Kirkels, Arjan & Prins, Frans & Rebel, Karin. (2022). Experiences and perspectives regarding challenge-based learning in online sustainability education. Emerald Open Research. 4. 27. 10.35241/emeraldopenres.14664.1.

Koretsky, Z. & Wieczorek, A. (2026). Transformative education: New rules for educating OT-shaped engineers for sustainability transitions. *EIST.* [Submitted/Under review].

Visscher, Klaasjan & Johnson, Coralie & MacLeod, Miles & Veen, Jan. (2022). *Multi-, inter- and transdisciplinarity in challenge-based engineering education*. 1786-1794. 10.5821/conference-9788412322262.1176.