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# Bridging EU Ambitions and Local Practice in ECIU's Challenge-Based Learning

## Abstract

This study examines tensions and opportunities in implementing *Challenge-Based Learning* (CBL) within the ECIU University alliance, focusing on interdisciplinarity and internationality. Empirical data shows that CBL fosters competence development for interdisciplinary teamwork and international collaboration among students. However, there is a persisting gap between the EU's vision for innovative education and local implementation, as structural constraints impede sustainable integration. We argue that unlocking CBL's transformative potential demands pedagogical commitment and systemic changes in university governance and cross-border collaboration.

## Keywords

challenge-based learning, interdisciplinarity, internationality, higher education transformation, stem

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# **Brückenschlag zwischen EU-Ambitionen und lokaler Praxis im Challenge-Based Learning der ECIU**

## **Zusammenfassung**

Diese Studie beleuchtet die Herausforderungen und Chancen von *Challenge-Based Learning* (CBL) in der ECIU-Universitätsallianz – mit Fokus auf Interdisziplinarität und Internationalität. Die empirischen Ergebnisse verdeutlichen: CBL stärkt die für interdisziplinäre Team- und internationale Zusammenarbeit von Studierenden nötigen Kompetenzen. Zwischen EU-Bildungsvision und lokaler Praxis klafft jedoch noch eine Lücke – strukturelle Barrieren behindern eine nachhaltige Verankerung. Um das transformative Potenzial von CBL zu entfalten, braucht es nicht nur didaktische Kompetenz, sondern auch systemische Anpassungen in Hochschulsteuerung und grenzüberschreitender Kooperation.

## **Schlüsselwörter**

Challenge-Based Learning, Interdisziplinarität, Internationalität, Transformation der Hochschulbildung, MINT

# 1 Introduction

“*Upskill. Connect. Be part of the change.*” This is the slogan used by the ECIU University, which has been set up by an alliance of twelve European universities since 2018, to promote participation in its joint learning opportunities. What the alliance, funded by the EU as an Erasmus+ project, formulates in condensed form as an invitation and call to (future) learners is reflected in its guiding vision and education strategy. Firstly, *upskill*: The learning opportunities are deliberately aimed at advanced learners – usually master’s students or continuous learners who already have a certain foundation of specialist knowledge and/or professional experience. That is, learners who want to acquire additional qualifications and skills that would not be available in conventional education and training programs. The ECIU’s education philosophy and strategy aims to promote learning activities based on the didactics of *Challenge-Based Learning (CBL)* (Vilalta-Perdomo et al., 2020), inviting students to largely independently identify a socially relevant problem and acquire the knowledge and skills they need to work out a solution together. The desired high level of activity, independence, and creativity on part of the learners (Hendrickx et al., 2022) corresponds to a changed role for the teachers, who act more as facilitators and co-learners in CBL (Eldebo et al., 2022). Hence, getting involved with the demanding and, for many, novel format of CBL requires upskilling on part of the teaching staff, too. Secondly, *connect*: One of the core concerns of the ECIU is to bring together students and staff from the various partner universities – and thus from different regions and scientific communities. In addition, participants are invited to discuss and combine their expertise and different disciplinary perspectives as they work in teams to define and tackle their tasks. The connections across national and disciplinary boundaries should not only be virtual and cognitive, but also physical, spatial, and affective. Therefore, the alliance aims to promote international mobility, for example allowing participants to meet in person at kick-off or closing events of the Challenges. These exchanges are supported by the *Blended Intensive Program (BIP)* and *Collaborative Online International Learning (COIL)* of the Erasmus+ KA131 funding line and have been, for some partners, topped up by national funding. In addition to connections between academic institutions and learners themselves, CBL

also makes for contacts with external stakeholders, such as companies, NGOs or non-academic experts, and thus connections to the real world and possible fields of future careers or social engagement (Georgiou et al., 2025; Mayer et al., 2022). Thirdly, the call to “*be part of the change*” is polyphonic, too. On the one hand, the ECIU (2025, p. 2) has committed itself to promoting “learning for the green transition and sustainable development”, i.e., to participating in social and technological developments in a positive way. At best, this gives learners the chance to get directly, practically, and meaningfully involved in addressing pressing social challenges while they are still studying. On the other hand, the alliance is a driving actor within a transforming higher education landscape and (infra)structure; a process in which – following the EU Council’s recommendation (2022) – flexible learning paths, continuous learning, new learning units such as micromodules, and new certifications of learning outcomes such as micro-credentials are to be implemented and gain in importance. In its strategic orientation and educational vision, the ECIU aligns itself with the *European Universities initiative’s* (EUI) call to build “transnational alliances of higher education institutions, paving the way towards the universities of the future”<sup>4</sup>.

This article examines whether and to what extent two key elements of the ECIU’s brand core – internationality and interdisciplinarity – have been incorporated into the culture and practice of teaching and learning at the *Hamburg University of Technology* (TUHH), our home university. Given the importance of interdisciplinarity and internationality for the ECIU and, beyond that, for scientific collaborations in a complex and globalized world, we note that our university has had gaps in this area in the past in terms of didactic implementation. That being said, we reflect whether and how international and/or interdisciplinary collaboration have lately been addressed with regards to learning goals and outcomes of ECIU Challenges hosted by the TUHH. Our empirical data consists of the teaching concepts on the one hand and evaluation questionnaires completed by participants on the other. As we will show,

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<sup>4</sup> <https://education.ec.europa.eu/education-levels/higher-education/european-universities-initiative>

results suggest a rapprochement towards EUI objectives in teaching and learning attitudes as well as outcomes, especially when it comes to knowledge and skills related to collaboratively working out a solution. Nonetheless, as we argue in the discussion, measures at the federal and state levels in Germany – e.g., with respect to capacity and teaching obligation regulations or quality criteria for degree programs – need to be linked more smoothly and sustainably with the EU Commission’s aims.

The authors of this article are trained university educators and, in addition to other activities within and beyond the ECIU, are lead or members of its work package dedicated to developing *Learning opportunities based upon societal needs*. Given our own engagement in the alliance’s education team, our perspective is characterized less by detachment than by privileged access to the field, first-hand data, and a profound understanding of the subject matter. Our analysis places a strong emphasis on engineering and higher education pedagogy, as this represents both the context in which the data was generated and the authors’ sphere of activity. This leaves gaps in terms of alliance governance or curriculum development in general.

## 2 Method and sample

CBL is not based on a single, uniform concept. Instead, literature refers to various origins and definitions (Gallagher & Savage, 2020; Leijon et al., 2021; Membrillo-Hernández, 2021) whose didactic implementations and practices tend to be strongly influenced by local competencies, frameworks, and educational beliefs. Therefore, it is a challenge in itself to find a shared understanding of CBL amongst all twelve European alliance partners. Local variations concerning regulations, resources, and academic cultures require frameworks that support comparability without enforcing uniformity. In this regard, the conceptualization of CBL as offered by the *CBL Compass* (van den Beemt et al., 2022) has been a gamechanger. Building upon the CBL Compass’ two central dimensions, “Vision” and “Teaching & Learning”, the ECIU has adopted 19 indicators that correspond with the consortium’s definition

of CBL (Perzoli et al., in press) and form the basis for reflecting on everyday implementation practices in teaching and learning. The rubric-based scoring system (0–3, where 0 means indicator has not been implemented and 3 stands for full implementation) for each indicator was converted into a semi-structured interview guide in which the teachers of the Challenges hosted by the TUHH were asked to assess their implementation of the indicators. Each teacher was interviewed once and individually; one of them after providing their Challenge for the first time, another two after completing their second rounds, and a fourth teacher after a second repetition (see table 1).

The student perspective was assessed using the *Bielefelder Lernzielorientierte Evaluation* (Bielefeld learning objective-oriented evaluation, BiLoE). This instrument captures the shared responsibility of teachers and students by rendering stipulated learning objectives and thus teacher intentions explicit whilst encouraging students to reflect on their own goals and learning processes (Frank et al., 2019). In the questionnaire, students are first asked to formulate their personal initial learning objectives. They then assess the relevance and completion of each objective using a scoring system (1-4, with 1 indicating “achieved completely” and 4 “not achieved at all”). In addition, a free-text box provides space to reflect on perceived obstacles to achieving their objective(s). The subsequent three question sets address the learning goals set by the teachers. Students estimate the extent (range 1-4) to which they have achieved those predefined objectives and as to how listed learning activities were helpful in doing so. If applicable, students may also state reasons why they have not achieved a certain specified objective. Finally, they are invited to transfer their own experiences into recommendations for future Challenge participants. In all four Challenges discussed in this paper, the learning objective “Working in a team through interdisciplinary and international collaboration” was included in the BiLoE sheet alongside two subject-specific learning objectives. Additionally, a *Teaching Analysis Poll* (TAP) (Frank & Kaduk, 2017) served as a formative reflection tool in two Challenges but results have not been included to this paper.

The main features of the Challenges discussed here are listed in table 1. At the ECIU, learning opportunities are published on a web portal where master’s students from

all associated universities can search and apply for Challenges as well as micromodules by submitting their transcripts, resumes, and letters of motivation. As a matter of principle, all Challenges are open to all students, regardless of their degree program, field of study, or home university. Each Challenge investigated in this paper gathered – in addition to students from our home university – participants from at least two other partners and three different degree programs. Whereas three of those Challenges were featured in the elective catalog of non-technical courses (from which a total of 6 ECTS credits must be earned in the master’s program), one Challenge was located within a mandatory 6-ECTS module of the master’s program “Microelectronics and Microsystems” opened to students from ECIU partner universities.

Table 1: Characterization of the Challenges analyzed in terms of embedding, workload and student participation, as well as evaluation using BiLoE

<b>Course name</b>	<b>Embedded in</b>	<b>ECTS</b>	<b>Period</b>	<b>Number of students from TUHH / ECIU partners</b>	<b>Number of BiLoE forms analyzed</b>
<b>Creativity and Artificial Intelligence</b>	Non-technical elective courses	3	summer term 24	12 / 4	16
			winter term 24/25	16 / 9	17
			summer term 25	16 / 4	20
<b>Circular economy for office furniture</b>	Non-technical elective courses	3	summer term 24	10 / 2	12
			winter term 24/25	15 / 2	15
<b>Hydrogen – a relevant factor for tomorrows carbon-free aviation?</b>	Non-technical elective courses	6	summer term 24	19 / 7	15
			summer term 25	14 / 8	8
<b>Facing Climate Change with remote sensing</b>	Master “Micro-electronics and Micro-systems”	6	winter term 24/25	19 / 0	14
			winter term 25/26	13 / 2	11

### 3 Results

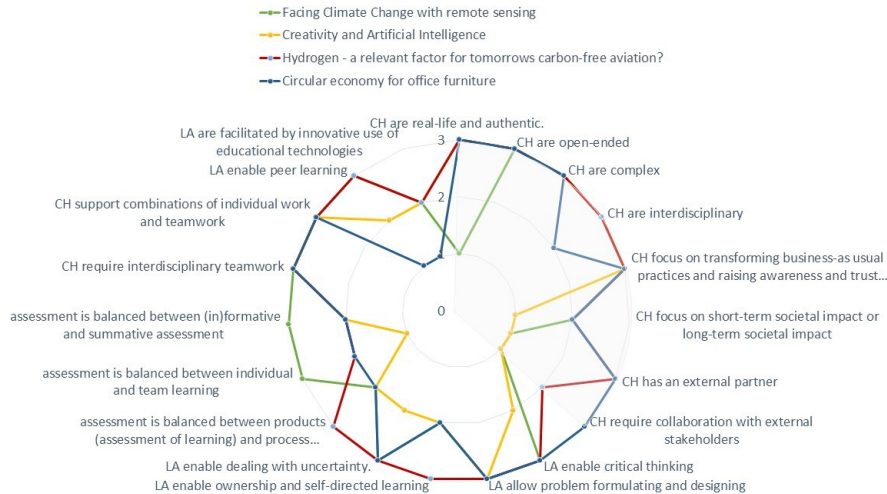


Figure 1: Radar chart from teacher perspective on four analyzed Challenges to which extend *Challenge* itself (CH), *Learning activities* (LA) or assessment fulfil indicators of Challenge-Based Learning adopted from (van den Beemt et al., 2022). Light grey part represents dimension “Vision” and white part dimension “Teaching and Learning”.

A radar chart visualizing the results of the teacher interviews on the correspondence between the Challenge, its learning activities and assessment, and the indicators for CBL (van den Beemt et al., 2022) shows that each Challenge has its own profile and focus. However, all four assessments do agree in that they view six of the 19 indicators as being fully met (being open, being complex, focusing on transforming common practices and raising awareness and building trust among stakeholders, requiring interdisciplinary teamwork, supporting a combination of individual and team work, and focusing learning activities on problem formulation and design). Another three indicators (being interdisciplinary, enabling critical thinking, training in deal-

ing with uncertainty) are considered to be fully met by three teachers, with the challenge “Creativity and Artificial Intelligence” standing out in particular. Overall, the pattern is consistent with an interinstitutional analysis comparing three alliance members and pointing to a strong collective commitment to authentic, real-world Challenges and interdisciplinary collaboration, as well as a shared CBL pedagogical DNA expressed through real-world relevance, team learning, and reflective assessment (Perzoli et al., in press).

It may not come as a complete surprise that the teachers’ statements clearly reflect the ECIU’s vision and educational strategy. After all, these have been intensively communicated and discussed, both through centrally organized didactic training sessions, CBL workshops, and alliance-wide network meetings, as well as locally, based on resources shared within the alliance. Moreover, teachers were supported by educational experts from the ECIU team in conducting their Challenges, as far as they desired so. More unexpected for us, however, were the insights we were able to draw from the comprehensive and positive comments provided by the students in the Bi-LoE: With no significant differences ( $p > 0.05$ ) across all four Challenges, results for the item “How important was it for you to achieve the learning objective ‘Working in a team by interdisciplinary and international collaboration?’” point to the overall high importance attached to this objective, which was also rated as (fully) achieved with a *mean value* (MV) ranging from 1.1 and 1.6. As the feedback from free-text boxes regarding team work shows, whilst recognizing the importance of team work, collaboration, and feedback, some students have encountered challenges in terms of ensuring equal participation, clarity of roles, and effective use of tools in hybrid learning situations. At the same time, comments such as “There is no one to blame, but we did not manage to have a proper delegation of the tasks.” indicate that participants are (or: have become) able to identify what it would have taken (that is, what it takes) to organize team work (more) successfully. According to the comments, many have realized how important it is to spend time on creating aligned goals and a supportive atmosphere in their team right from the start. Indeed, the written statements suggest a close link between an effective and open communication structure and the progress of cooperative work, some even bringing up enhancement

ideas. In regard to the comprehension and acceptance of CBL pedagogy, the free-text responses to the final question asking for recommendations for future participants are valuable, too. For instance, the statement

“This course will give you good exposure to both hardware & software knowledge along with a chance to do independent research & documentation. It will also value teamwork.”

refrains from practical advice but articulates subject-specific and interdisciplinary learning objectives, thereby acknowledging their very connectedness in CBL.

Further insights into students' perspectives on discipline-specific and transversal competencies and aspirations can be obtained from the BiLoE questions on the achievement, nature, and relevance of personally set learning goals. In response to the question, “To what extent have you achieved your personal learning objective?”, the MVs for three of the four Challenges are between 1.5 and 1.7, which means that students have achieved their personal learning goals. The “Circular Office Furniture” Challenge deviates significantly here when performing the t-test with a significance threshold of  $p = 0.05$  – statistically, a larger proportion of students deny achieving their personal learning goals than in the other Challenges. However, in terms of the type of learning objectives stated in the BiLoE forms, all four Challenges show great similarity: the most frequently mentioned objectives are interest in the topic (aviation, satellites, creativity, or circular economy) and the desire to learn more about it in a technical context. Transversal skills such as teamwork, project management, and communication in English are mentioned less frequently in this section. The discrepancy in the mean values for the question of whether the learning goal was important to them is significantly different in the t-test with a significance threshold of  $p = 0.05$ . This applies to the subject-specific learning goals in comparison to those for the learning goal of teamwork. In contrast to citing subject-specific interests as a personal learning goal, participants rate the learning goal of teamwork as more important to them personally. Additionally, students used free-text comments to share their thoughts on the learning outcomes they achieved. Here, they express positive

surprise at the results and the commitment shown by themselves and their teammates. A significant number of students states that they have derived great satisfaction from the experience of learning in a different environment that was closer to real-life problem-solving scenarios. One student, for example, explains that this experience has enabled him to acquire more knowledge than he would have through a conventional lecture and to develop a greater ability to read and understand texts outside his immediate study program.

Drawing from in the BiLoE forms of the Challenges ‘Circular Office Furniture’ and ‘Facing Climate Change with Remote Sensing’, students do recognize and appreciate the integration of interdisciplinarity into subject-oriented courses. Initial apprehensions voiced by pedagogues – that the desired level of subject knowledge might not be realized in a project with learners from disparate degree programs – have not been substantiated. Moreover, informal discourse with teaching staff has revealed a heightened sense of enthusiasm regarding their teaching content and research questions. This phenomenon may be attributed, in part, to students with more diverse knowledge bases and to questions contributed by learners from other disciplines, but also to the higher number of intrinsically motivated students compared to their compulsory courses. This delight is, however, to some extent in tension with comments made by some students, reporting situations of excessive demands caused by a perceived lack of crucial technical knowledge and the urge to acquire it. Given the fact that these situations of stress were addressed even stronger in the interim evaluation using TAP than in the summative BiLoE, they might have been partly overcome as the Challenges progressed. Even though this must remain a hypothesis for now since TAP was not used systematically across all four Challenges examined here, findings recently summarized in a scoping review (Pantzos et al., 2025) point in the same direction. In addition, MacLeod et al. (2022) resonate that students’ persistent tendency to revert to disciplinary roles might be a major source of the frustration observable up to the middle of a CBL course.

## 4 Discussion and future aspect

The European Commission's objectives with the European University Initiative (EUI) are not merely discursive in nature. Since the EUI was launched in 2018 its idea has been translated into concrete activities at the federal level in Germany, for example in innovation and pilot projects aimed at improving the labor market integration of international STEM students through projects funded by the Stifterverband<sup>5</sup>, DAAD<sup>6</sup> or the German Rectors' Conference<sup>7</sup>.

At the federal state level where the decision-making authority over educational issues resides, however, a less coordinated approach prevails. The number of study places, capacities and regulations governing teaching obligations, or quality criteria for degree programs are to be negotiated by the particular federal state with each individual HEI on the basis of a strategy broadly applicable to the respective federal state. As no federal state has all its universities belonging to one of the EU alliances, the EUI's strategy and objectives remain confined to have minor impact on planning and efforts of the federal states. In turn, the many activities of the various German universities linked to their European alliances continue to exist in parallel, as they are being coordinated with European partner universities but not sufficiently within their own federal state. At least at the TUHH, the European Commission's objectives have not yet become sustainably anchored goals in the structural and development planning with the Free and Hanseatic City of Hamburg. Nevertheless, the TUHH demonstrates its commitment to the EUI's goals on the macro level of teaching and

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<sup>5</sup> e.g. <https://zukunftsmission-bildung.de/mint-fachkraefte>

<sup>6</sup> e.g. <https://www.daad.de/de/der-daad/daad-journal/themen/2024/internationale-studierende-als-fachkraefte-fuer-deutschland/>

<sup>7</sup> e.g. press notification found [https://www.hrk.de/fileadmin/redaktion/hrk/02-Dokumente/02-01-Beschluesse/2024-05-14\\_HRK-MV\\_Entschliessung\\_Internationale-Studierende.pdf](https://www.hrk.de/fileadmin/redaktion/hrk/02-Dokumente/02-01-Beschluesse/2024-05-14_HRK-MV_Entschliessung_Internationale-Studierende.pdf)

learning through declarations of intent<sup>8</sup>, participation in EU-funded initiatives and projects, contributions of in-kind staff time, and efforts to obtain national funding.

Even so, the implementation of measures such as the further development of courses based on the principles of CBL as defined by the ECIU largely depends on the personal decisions and capabilities of individual lecturers or program directors. Unfortunately, this leads to the phenomenon that every second Challenge offered by TUHH teachers has been carried out only once. Plus, it is left to the teaching staff's goodwill and the persuasiveness of the Centre for Teaching and Learning staff at the TUHH whether lecturers agree to participate in our additional teaching evaluation featuring the BiLoE and the CBL checklist (in addition to the mandatory evaluation which does not cover CBL specifics). As a result, on the micro level of teaching and learning CBL didactics and further aspects of international and/or interdisciplinary teaching/learning scenarios have only been sporadically included into the counseling and continuous education catalog for teachers. At the meso level, introducing micro-credentials as proofs of learning<sup>9</sup> or recognizing teaching capacities in teaching institutions offered for or with international partners requires regulations at the state level that have not yet been introduced. Despite and against such ponderousness, in order to support the EUI and ECIU's call to promote not only innovative teaching and learning methods but also European values by connecting people and ideas, state-level policies, too, should incentivize cross-border collaboration, exchange, and interdisciplinary teaching.

Returning to the micro level, students who have experienced CBL state to have gotten much more out of their participation than mere subject knowledge. Through their activities, they get to learn how (not) to shape groups and communication processes. They gain concrete experience of how cooperation across organizational boundaries

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<sup>8</sup> TUHH declarations of intent <https://www.tuhh.de/tuhh/international/internationale-partnerschaften-und-strategien/strategie>

<sup>9</sup> Recommendation on a European approach to micro-credentials for lifelong learning and employability by the council of the European Union [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627\(02\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(02))

can be structured and accomplished. They feel empowered to tackle problems and create solutions outside the box. In and throughout all this, they discover and unfold their self-efficacy. Whereas CBL encourages students to collaborate across disciplines, our analysis shows that subject-specific expectations have not been fully met by and for some students while it was asserted that relevant knowledge has been acquired. To elaborate on the potential therein – that is, enabling students (and staff) to gain additional qualifications and skills unavailable in conventional education and training programs and to make use of inter-university campuses as sketched in Call ERASMUS-EU-2026-UNIV – joint teaching and learning experiences need to be geared more explicitly and purposefully toward multidisciplinary, interdisciplinary and/or transdisciplinary learning. CBL is usually labeled an interdisciplinary approach, but actual practices frequently yet unintendedly stretch to multidisciplinary on the one hand and to transdisciplinarity on the other.<sup>10</sup> Addressing and operationalizing their differences (and overlapping) didactically requires to initially separate those three teaching and learning modes from one another and to ask how CBL can or should be designed specifically for/with each of them: What kinds of learning activities seem particularly suitable to foster communication and understanding across disparate scientific languages and cultures? Which room furnishings promote (or impede) collaborative working methods? Can a timetable for courses be implemented that goes beyond a 90-minute rhythm? Are there role models and mentors

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<sup>10</sup> Following Toš's (2021) meticulous definitions, multi-, inter- and transdisciplinarity resemble each other in that they ought to engage all relevant practical professions and scientific disciplines needed for the respective task or purpose, but differ enormously in the way the work is done and the solutions created. Whereas in multidisciplinary actors co-operate in that they work parallelly and separately, interdisciplinarity "is a procedure of joint, collaborative and interactive explanation of phenomena, solving of problems, creation of products or introducing new questions" (Toš 2021, p. 69). Going even further, transdisciplinarity departs from interdisciplinarity in gathering, connecting, and merging even more actors and sources of ideas and skills, involving "relevant and interested participants from various fields of society, by employing interaction and the exchange of information and knowledge between all relevant participants, with the aim to reach deeper and more comprehensive solutions to problems in specific problem areas" (Toš 2021, p. 69).

for teachers on their way to acting as coaches, not just as experts in a particular subject area? How is the presence (or absence) of external stakeholders reflected in my didactic design? ... Good news is at least some of those questions can be addressed within the autonomy of universities itself as well as within the Community of Practice of higher educational developers active in the EU alliances and researchers in the diverse fields of educational sciences with a focus on universities.

In summary, we have demonstrated that the CBL facilitators and participants in our sample show a readiness to actually challenge their teaching and learning. However, the measures an individual partner university in a European alliance is able to implement and the key figures by which it is measured by the EU as a funding body tend to be in tension with the autonomy in its home federal state, the target agreements with the local authorities, and the basic funding provided by them. To resolve these incongruences, we would like to suggest that, firstly, institutional change is needed in order to align the upskilling of learners and faculties with the demands of CBL – especially regarding the further development and shaping of didactics of multi-, inter- or transdisciplinarity in international (and intercultural) teaching and learning settings. Secondly, we urgently need ensured connections between the micro, meso, and macro level of teaching and learning as well as between the local, the federal, and European scale (and beyond) to provide the sustained and systemic support necessary for enabling students to truly be part of the change.

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