A3.3, O5: A Review of Challenge-Based Learning (month 36)

Beneficiaries

- Aalborg University, Denmark
- Dublin City University, Ireland
- Kaunas University of Technology, Lithuania
- Linköping University, Sweden
- Tampereen Korkeakoulusäätiö sr, Finland
- Hamburg University of Technology, Germany
- Universidade de Aveiro, Portugal
- Universitat Autonoma de Barcelona, Spain
- University of Stavanger, Norway
- Universita degli Studi di Trento, Italy
- University of Twente, The Netherlands

Abstract

The long-term goal of Activity 3.3 is to develop and harmonize educational offerings, structures and policies at the member universities in order to optimally facilitate Challenge-Based Learning (CBL) and to create a European educational network for all stakeholders involved.

This is the third deliverable report focusing on implementation on CBL between October 2021 and September 2022. Its objective is to review CBL, to connect our recent findings with our previous ones and to draw conclusions with regards to upcoming second funding phase. Based on empirical research, the report presents findings on motivation, goals and competencies of tea(m)chers[1] and students, followed by an overview of key factors that may affect the implementation of CBL. As a conclusion, the report summarizes key needs of tea(m)chers and students that should be considered in the further development of Challenge-Based Education and tea(m)cher support.

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[1] A teamcher is a facilitator who supports the student teams and their working process throughout the CBL learning cycle. In this report, the term *tea(m)cher* is used when referring to both roles/positions, teacher and teamcher, at once. This is the case when a single person holds both positions simultaneously or when teachers and teamchers are addressed collectively. If one specific role or group is meant, the respective term – either *teacher* or *teamcher* – is being used.

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Symbols, abbreviations and acronyms

AAU	Aalborg University, Denmark
CBL	Challenge-Based Learning
DCU	Dublin City University, Ireland
EC	European Commission
ECIU	European Consortium of Innovative Universities
IEL	Innovation of Education Lab
INSA	Institut National des Sciences Appliquées, France
KTU	Kaunas University of Technology, Lithuania
LiU	Linköping University, Sweden
PBL	Problem Based Learning
PjBL	Project Based Learning
TAU	Tampere University, Finland
TUHH	Hamburg University of Technology, Germany
UA	Universidade de Aveiro, Portugal
UAB	Universitat Autonoma de Barcelona, Spain
UiS	University of Stavanger, Norway
UNITN	Università degli Studi di Trento, Italy
UT	University of Twente, Netherlands

1 Introduction

The long-term goal of tasks in activity 3.3 is to develop and harmonize educational offerings, structures and policies at the member universities in order to optimally facilitate Challenge-Based Learning (CBL) and to create a European educational network for all stakeholders involved.

To do so, activity 3.3 encompasses three main activities. The one focused in this report is to identify structural and cultural obstacles for Challenge-Based Education as well as measures that can help to dismantle these barriers. This is being accomplished via qualitative and quantitative research as well as by workshops reflecting and elaborating on the research results (as documented in Simon 2022, Deliverable Report 3.2.O1 Review and Assessment workshop month 36).

Based on qualitative and quantitative research data, this report reviews CBL in the winter term 2021/22 (challenge round 3) and spring/summer term 2022 (challenge round 4) and draws conclusions regarding possible measures to support Challenge-Based Education. The expert interviews and surveys with tea(m)chers and students and the findings thereof present an extension of our previous review on CBL and teacher support of the challenge rounds 1 and 2 as documented in Ellinger/Mayer (2021).

The report is structured as follows: Chapter 2 summarizes the objectives of this deliverable. Section 3 introduces research methods and approaches and then proceeds with presenting results on motivational factors, goals and competencies (see chapter 3.1). The subsequent chapter discusses factors and actors that may support or be a barrier to the implementation of CBL and shows interrelations between these factors (chapter 3.2). The concluding chapter points out recommendations and ideas towards removing existing hurdles in the implementation of CBL (chapter 4).

2 Objectives

The Objective of this report is to document our empirically grounded evaluation activities and findings in challenge rounds 3 and 4 and to connect them with the insights obtained from the previous reports (Ellinger & Mayer 2021, Mayer 2022).

Based on qualitative and quantitative data, we aim to give an overview of:

- motivational factors, goals and competencies related to CBL (see chapter 3.1),
- key factors and actors that may support or hinder the implementation of CBL as well as interconnections between those factors (see chapter 3.2),
- needs and visions for overcoming existing barriers and improving CBL and teacher and teamcher support (see chapter 4).

The findings reported and conclusions drawn here will be further utilized for the second funding phase.

3 Challenge-Based Learning in Challenge rounds 3 + 4

Drawing from our explorative qualitative findings and our tea(m)cher survey from the first challenge round (Ellinger & Mayer 2021) and challenge round 2 (Mayer 2022), we conducted five additional semi-structured expert interviews (pair and single) with a total of six tea(m)chers and three interviews with four students, all of them being involved in either a Mini or Standard challenge in challenge round 3

and 4. The interviews were conducted in January, June and July of 2022. Our interview partners' affiliations are TUHH, UNITN, UT, INSA, TAU and KTU. The main aim has been to obtain a deepened insight into motivation, goals and competencies related to taking part in a challenge as well as into factors that support or hinder the implementation of CBL. The interview guidelines are attached to this report (Appendices 1 and 2). The interviews were conducted and recorded online in the format of a video conference. They were transcribed and analysed (coded) with the aid of the software MAXQDA.

In addition to the qualitative study, for challenge round 3 two ECIU-wide online surveys were launched. One addressed tea(m)chers and the second one addressed student. In the teamcher survey only four teamchers participated. Therefore, in this report, results are combined with those from previous surveys and have not been analysed separately. In the student survey, 23 students participated (from INSA, KTU, TUHH, UNITN and UT). After challenge round 4 only a student survey was conducted in which 19 students participated (from DCU, KTU, UA, UAB, UiS, UNITN and LiU).

Table 1 gives an overview of the number of participants in interviews and surveys as well as participation for all four challenge rounds.

Table 1: Participants and their affiliations in Challenge rounds 1-4

	Challenge Round 1 (autumn/winter term 2020/21)		Challenge Round 2 (spring/summer term 2021)		Challenge Round 3 (autumn/winter term 2021/22)		Challenge Round 4 (spring/summer term 2022)	
	teamcher	students	teamcher	students	teamcher	students	teamcher	students
Interviews	5 with 11 participants from UA, LiU, TAU and TUHH	Not conducted	3 with 6 participants from KTU, TUHH and UNITN	3 with 6 participants from KTU, TUHH and UT	5 with 6 participants from UA, LiU, TAU and TUHH	3 with 4 participants (all live long learner) from UT, UAB, TUHH	Not conducted	3 with 4 participants from UT and UNITN
Survey (number of participants and affiliation)	n=21 UiS, INSA, UNITN, UAB, UT, UA, KTU	Not conducted	n=25 TUHH, UT, TAU, UAB, KTU, UA, UNITN, UiS	n=40 UNITN, UiS, UAB, KTU, UA, UT, TUHH, DCU	n=4 TUHH, UNITN, UiS	n=23 INSA, KTU, TUHH, UNITN, UT	Not conducted	n=19 DCU, KTU, UA, UAB, UiS, UNITN and LiU
Number of teamchers[2]	21		38		38		21	
Number of students[3]		12		136		143		102

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[2] Ellinger (2022) Deliverable Report 3.3 O.3.: Conduct Teacher training (month 36) p 9 table 2
[3] Number of students accepted and finished a challenge, provided by Elena Tsigki on Oct 11th 2022

Number of chal-lenges offered[4]	23	28	47	12

The setup and dissemination of the student survey after challenge round 2-4 were accomplished in cooperation with WP4 (Micro-credentials), WP7 (Joint support-services and structures) and WP9 (Dissemination and sustainability). Question sets contributed by WP3 address supporting and hindering aspects in the CBL experience as well as learning goals and acquired competencies. Besides from closed-ended questions, the surveys contain a number of open questions, allowing participants to add and explain their personal perspectives and priorities. The survey structure used to evaluate challenge round 4 is attached to this report (Appendices 3). The results were processed with Excel.

The CBL review presented here also benefits from collaborations of Activity 3.2 and 3.3: Findings from challenge round 1 to 4 were presented and discussed at the Review and Assessment Workshop on September 13th 2022 (Simon, 2022: Deliverable Report 3.2 O.1.: Review and Assessment workshop, month 36) and summarized in a scientific publication.

3.1 Motivation, goals and competencies

This chapter investigates motivational factors related to teaching or taking part in a challenge (except for the strategic challenge that was launched in challenge round four for the first time), as well as goals and key competencies that (should) have been acquired through CBL.

3.1.1 Tea(m)chers

In accordance with our findings from challenge round 1 and 2 (Ellinger/Mayer 2021), the tea(m)chers remain generally positive about the concept of Challenge-Based Education. The interviews indicate that their personal intrinsic motivation to learn something new – especially their interest in gaining experience with unfamiliar yet promising new teaching methodologies and pedagogies – can be still seen as a major driving force to volunteer as a CBL teacher and/or teamcher. Although only four teamchers participated in the most recent survey, we assume that figure 1, combining the results of challenge rounds 1 to 4, concurrently accounts for the teamchers motivations. A second driving force still seems to be their curiosity about the topic.

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[4] Shahverdi (2022) Presentation WP3 meeting September 23th 2022, Barcelona
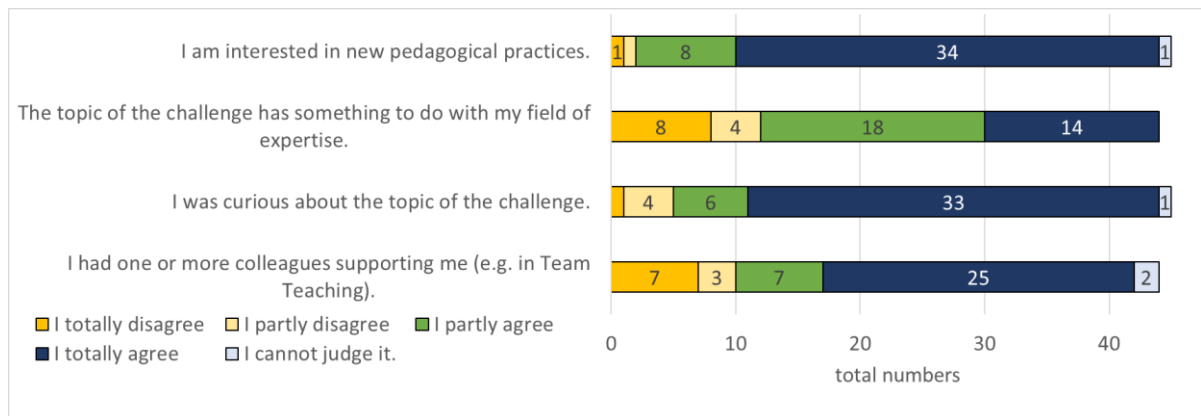
Figure 1: Results of teamcher survey summarizing challenge rounds 1-3 with n=50.

Besides from this, the interviews give insights into some hitherto unidentified aspects, not covered by the surveys so far. Interviewees talked more explicitly about external motivations when it comes to becoming active as a teamcher within the ECIU framework. They were requested by rectors, department or faculty dean, or by other colleagues who wanted them to join them in team teaching. Asked about the reasons for engaging with CBL, one interviewee's answer reads: "Okay so, everything started last semester [*challenge round 2, added by DE*], that I was working on the extra curriculum kind of workflow of CBL, [...], so it was the same last semester and now as well. So, and how I came to that, it was, well the one is the official one and the other is the actual one. So, the official one it's an interesting way of doing it and the actual one is I was offered and there wasn't even a choice, basically it is from our department. Everyone is like, yeah you should do it and then, okay. So basically, that is how it happened." (P3_Int3_T2). Another interviewee explains this shift with the need to enlarge the number of CLB teachers throughout the university: "But now we have the task of spreading this CBL to all of the faculties in the university." (P3_Int5_T1). To do so, recruiting seems to be practiced more systematically by some ECIU partners, as described by one professor: "Then when I joined the university, as a professor, I was part of this onboarding and there was a meeting together with [the head of teacher support unit, *name displaced by role by DE*] and [the Vice President Education, *name displaced by role by DE*] where they present the ECIU and I got really interested into the concept. So, I do agree with a lot of the objectives of ECIU and that's how I got integrated into Challenge-Based Learning. So yeah, that was it." (P3_Int1_T1)

In addition to their own personal motivation, a majority of teamchers believes that taking part in a challenge is relevant for students, as summarized in figure 2. In the one interviewee states as a goal, to make students understand waste problems and help to solve it (P3_Int2_T1). Further on, one states that he*she has wanted to foster students' learning by providing new, (inter-)active ways of learning: "So personally, I always try to make them do more, discuss less and basically do something." (P3_Int3_T2)
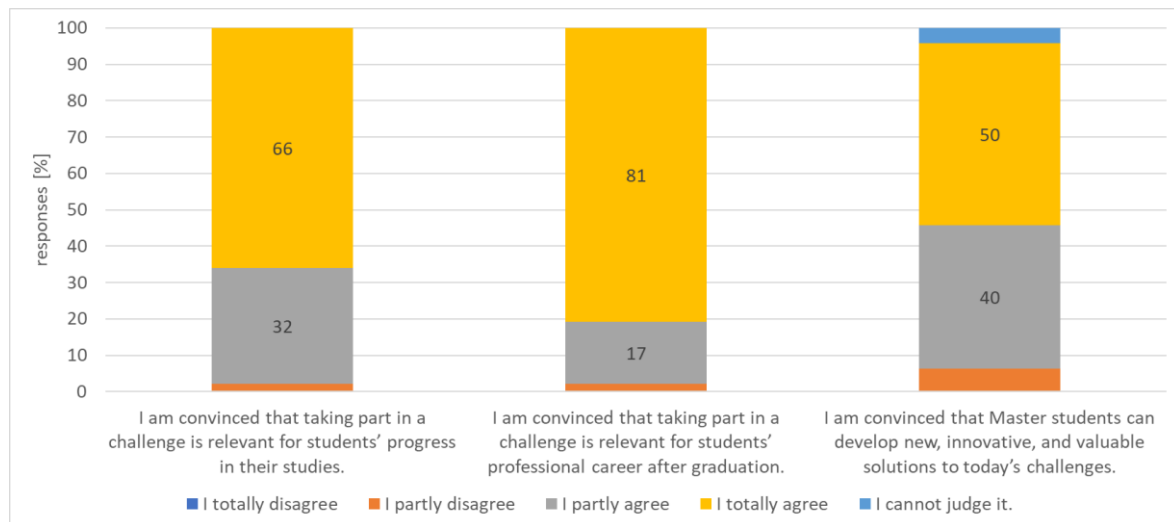
Figure 2: Tea(m)chers perspective on students in CBL in challenge round 1-3 with n=50

In CBL teachers have to adapt their way of teaching to the ambiguities that come along with this format. This means they have to set time and resources for coaching, feedback sessions and other types of support for the student teams. They have to guide and coach students who might find the way forward unclear, the criteria for grading vague, or the demands for subject-specific knowledge demanding. Eldebo et al., 2022 identified three main roles that are required in CBL to cope with these tasks: (1) the teacher role, which is knowledge-oriented; (2) the role of the coach, which is oriented toward skills; and (3) the role of the organizer, which is oriented towards the challenge.

Most surprisingly the teacher and knowledge-oriented role was not as important within the ECIU framework as indicated by the following statement: "For me as a professor, you tend to want to explain things, right? This is why you are good at your job. So, you have those natural or the majority of us at least has this natural tendency of explaining things, in the CBL, from what I learned, so I seek for further literature before I actually did my challenge. And there was always this, you should let them discover. You should let them investigate. You should let the team really work through to get to a solution. So, at several points during the meetings, I was holding myself and think, okay, now I should hold myself to not give the answer to that, right. I should just bring them to the process of finding the answer, but do not give the answer directly. And that was a big learning for me. And a lot of fun, really, a lot of fun. I really enjoyed this. (P3_Int1_T1). Instead, teamchers described themselves quiet often (19 times out of 71 when describing their personal role) as learners, meaning "that some students can learn me some things specific or can give me his point of view which is different from mine and sometimes he's right. I'm wrong he's right, so we reverse the pyramid. I am the student and he is the teacher. So, from this challenge it`s interesting to maybe change the way of communication between the professor, the teacher and the student. We can share the information. We can learn from each other" (P3_Int2_T1). The roles described on second places by ECIU teamchers were the facilitator or coach. One Interviewee told us: "We call ourselves coaches. It helps. I know within the ECIU that the term is Teamcher. So, as coaches, it's kind of the thing we do is providing the environment, is providing the tools, but then at the end of the day, letting them do what they think is best. (P3_Int4_T2)

All in all, CBL pedagogy puts a higher demand on teams being fully functional than other courses do. Because the learning approach requires that the teachers take on different roles it might be experienced as demanding for teamchers, too. In regard to the roles and the demand one interviewee mentioned: "You provide some tools, you explain certain things, but then you hope that a student will be

responsible adults and will take care of things. So, it is a bit of a letting go of the power. Which I think can be difficult to 10-year lecturers, for instance, or teachers that are doing mostly lecturing in large halls and so on. (P3_Int4_T2).
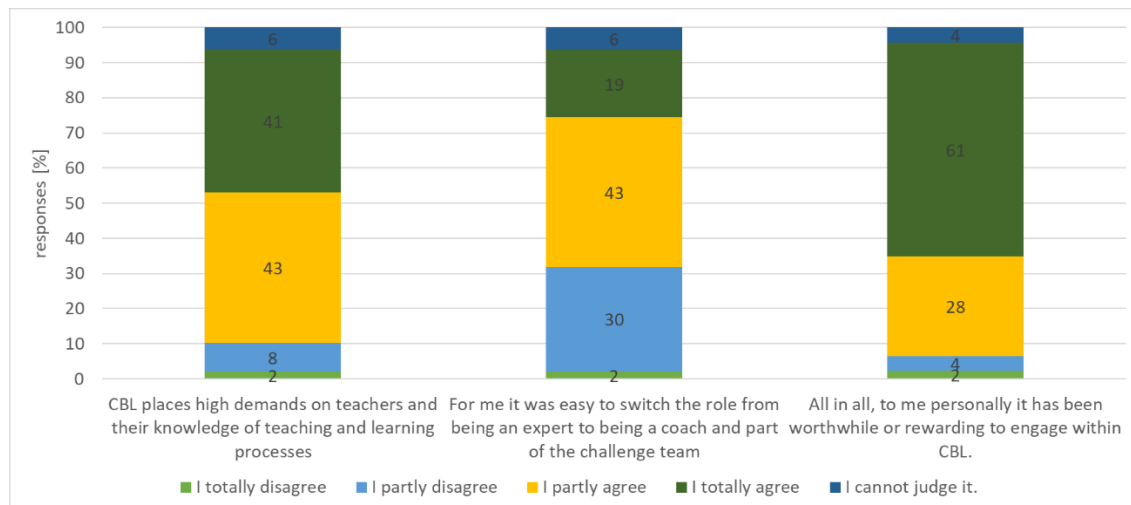
Figure 3: Personal perspective as member of the challenge team (with n=50 and all three pilots in sum)

At ECIU and in sum over three challenge rounds more than 80% of the teamchers agreed (1) that CBL placed high demands on them and their knowledge of the teaching and learning process but also (2) that it has been worthwhile or rewarding to them. Notably, two third agreed that it was easy to switch the role from being an expert to being a coach and one third does not agree with this statement as indicated in figure 3. In addition, 67 % of teamchers taking part in the survey after challenge round 1-3 (fully or partly) agreed with the statement that they got a helpful training but about 33 % did not agree. At least for some teamchers future trainings should prepare them better for the emotional load and the coaching role.
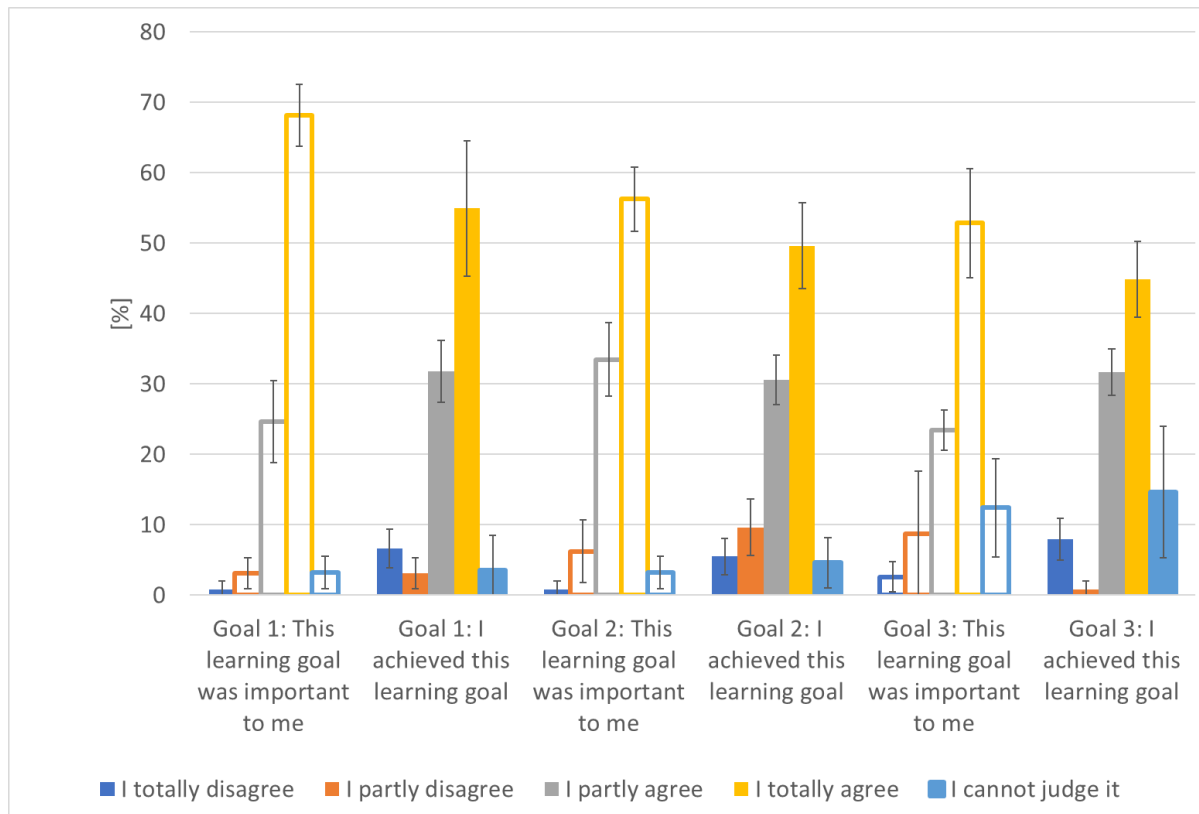
3.1.2 Students

As the teachers, the interviewed students show a high level of intrinsic motivation after four rounds of challenges. This applies to those whose CBL course was embedded in their curricula and rewarded with credit points but, of course, even more to those who voluntarily choose to work on an extra-curricular challenge and who received a participation certificate only. As an example, one told us about his/her motivation: "It is really interesting to meet people from lots of different universities with different backgrounds, doing different programs, different disciplines, so I'm in Humanities but meeting people from social sciences, engineering, computing. And then it all comes together in a team to use different skill-sets to meet the challenge. I thing that's my expectations, I didn't actually require any ECTS from my program. So, it was an additional thing (P4_Int1_S1)" The driving aim to deepen one's knowledge by tackling a task in a multi-disciplinary team and/or in an international context is underlined by the survey respondents. One stated very simply in the open text box: "I have participated in another challenge before and I had learned a lot.".

To gain a better understanding about learning objectives gained in CBL a literature review was done. We identified three key learning goals that can be considered as particularly linked to CBL (Membrillo-Hernandez 2019; Juárez 2020). These are:

- Goal 1: The participating students learned to **cooperate in a multidisciplinary team** in the sense that they learned from their project partners and actively contributed to the project work with their previous knowledge, skills and attitudes.
- Goal 2: The participating students learned to use **creative thinking methods** (e.g. structured brainstorming, 'shitty prototyping' or others) to develop their challenge, new ideas during the process or to improve the final product itself.
- Goal 3: The participating students learned to **communicate in written and oral form with an external stakeholder** of the challenge in an adequate manner.

In the survey, respondents were invited to indicate how important each of these three goals has been to them individually and whether they believe they were able to achieve it (as documented in Fig. 4).

Figure 4. Students responses about importance and achievement of CBL Learning Goals. For better distinguisha-bility, response distributions to question if learning goals were achieved were presented in filled bars and the dis-tribution of responses to question if learning goals were personally important in unfilled bars.

In addition, students were asked to describe their personal most important learning goal. The catego-ries in which the students' statements were clustered are displayed in figure 5. In consistence with students' motivation why to join an ECIU challenge, learning to work in an international team is men-tioned most often as a personal learning goal in all three investigated challenge rounds.
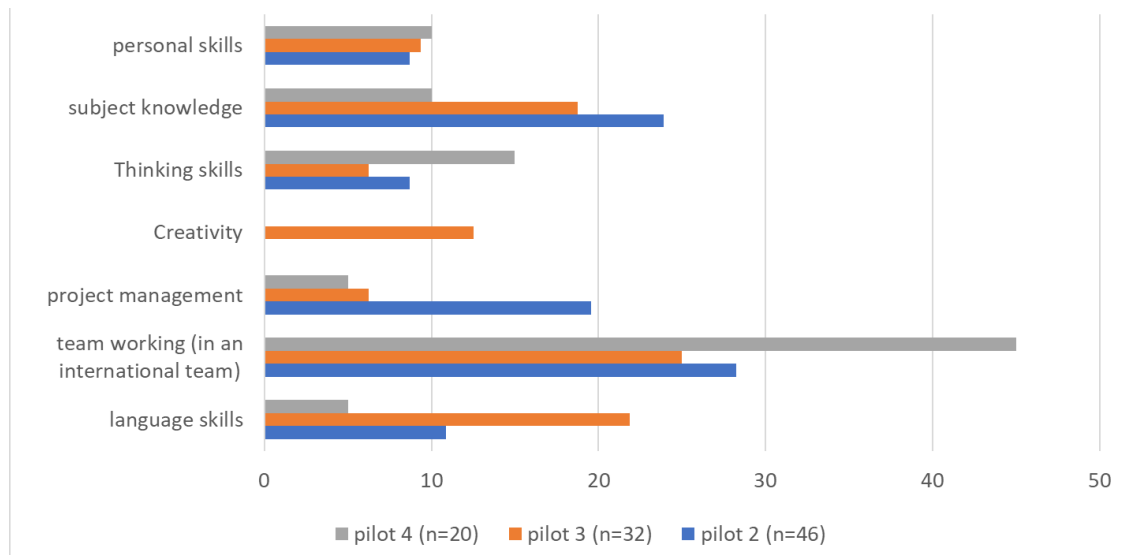
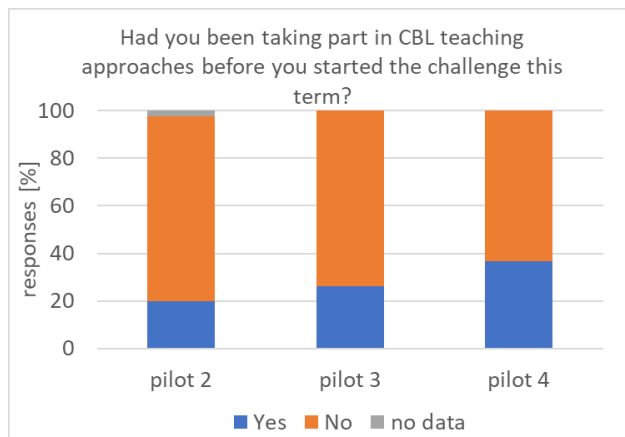**Figure 5: Personal most important Learning Goals mentioned by students**

Notice: "n" indicates each mention of a target. Some have mentioned more than one goal, which is why "n" exceeds the number of students who participated in the survey.

Next to this, students mentioned subject knowledge, e.g. gain more and or deeper knowledge in the field of their studies, most in challenge round 2 only. In challenge round 3 and 4 the most mentioned goal was to learn how to work in international teams. And language skills, e.g. learn to communicate in English, improve communication skills, was most important in challenge round 3 only. The importance of subject knowledge and project management skills as most important learning goal decrease from challenge round 2 to challenge round 4 while team working increases from challenge round 2 to challenge round 4.

Some of the interviewed students explain that even though the challenge did not (completely) match their initial motivation and expectation to gain content-related knowledge on the subject, they did learn a lot. The interviewee said: "For me, it was not like the content of the challenge, as we more or less did what I am doing in my degree. More important for me is how to be part of a group and how to figure out to organize the group itself. This means I learned how to approach different cultures. […] When I communicate to someone, I am aware that different cultures mean also different ways of communicating. I knew it before but now I really experienced it. And I think this is something really important because I was to use those in my work or the university project and so on." (P4_Int2_S1).

Students feel to have significantly improved their personal study abilities as well as social skills and new contacts. But as indicated by the survey results displayed in figure 5 in challenge round 4 they especially appreciate the "opportunity to work in a multicultural environment. And because it's very interesting […] there are people from Europe, like, let's say Spain or Germany or France, or we see, like, let's say differences in the way that we formulate or we think about problems or we formulate solution or […] the process of thinking about something or the creative thinking. So like, it's also like you learn a lot also from these team works" (P4_Int2_S2). Importantly, amongst the self-reported factors that made it rewarding for the interviewed students, 'social' aspects like making friends from different countries or being able to visit different countries, and having fun, also play an important role.

By interpreting the results, it has to be kept in mind that the expectations and experiences of the students might have changed from pilot 2 to pilot 4 because some took part several times as indicated in

Had you been taking part in CBL teaching approaches before you started the challenge this term?

Figure 6: Responses of students in [%] to "Had you been taking part in CBL teaching approaches before you started the challenge this term?"

To me personally it has been worthwhile or rewarding to engage with CBL [mean %]
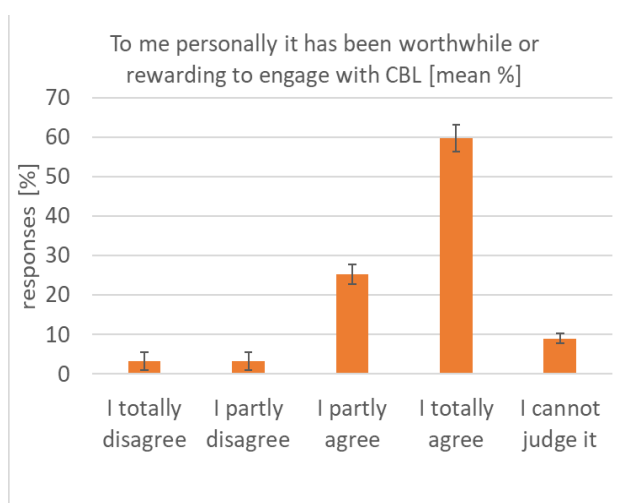
Figure 7: Students responses to the statement "To me personally it has been worthwhile or rewarding to engage with CBL.

figure 6. The number of students that stated that the have been taking part in CBL teaching approaches before were constantly increasing from challenge round 2 with 20 % to 37 % in challenge round 4.

In summary, over all three investigated challenge rounds 60 % (+/- 3,4) of students totally agreed and 25 % (+/- 2,5) partly agreed with the statement "To me personally it has been worthwhile or rewarding to engage with CBL" as summarized in figure 7.

Taking into account that interviewed students explain that sometimes the challenge did not (completely) match their initial motivation and expectation this shows that a) initial motivations and expectations may differ from the actual gains acquired in the process and that b) given the novelty of Challenge-Based Education and students' lack of experience with it, it is not always easy for them to predict in advance what may turn out to be the (most striking) personal benefit of it.

3.2 Affecting factors

The following chapter provides an overview of factors and dynamics that hinder or support the implementation of CBL for tea(m)chers and students. Based on the qualitative and quantitative data from the four research periods, we are now able to not only identify key aspects that affect the implementation (including academic cultures, institutional regulations and structures, teaching and learning conditions, external stakeholders, colleagues/support, tea(m)chers' attitudes and competencies, students' attitudes and competencies) but also to recognize and explain specific interrelations between some of these factors.

3.2.1 Teaching and system level perspective

According to the interviewees, one bundle of factors likely to either hinder or support the successful implementation of CBL stems from the **structures and attitudes** tea(m)chers encounter within their institutions. This includes the prevailing **culture** at the respective universities, the **institutional regulations and structures** tea(m)chers face, and the **teaching/learning conditions** they have to work with.

As mentioned above (Tab. 1) the participation rate in the teamcher survey was very low after the third challenge round. Therefore, the summary relies on interview data mainly and displays survey results over all three investigated rounds to indicate most persistent factors. In summary, teamchers seem to get a bit more relaxed, especially in regard to the challenge provider (P3_Int2_T1 and P3_Int3_T1). They seem to feel better informed about expectations and their own role (P3_Int3_T2). This might come along with a better understanding of CBL as a pedagogically practice. All this seems rational since a great proportion of teamchers offered a challenge for a second or third time and number of beginners in CBL within the teachers were lower in round 3 and 4 in comparison to the first and second challenge rounds as summarized in the deliverable report about teamcher training (Ellinger, 2022 Table 2).
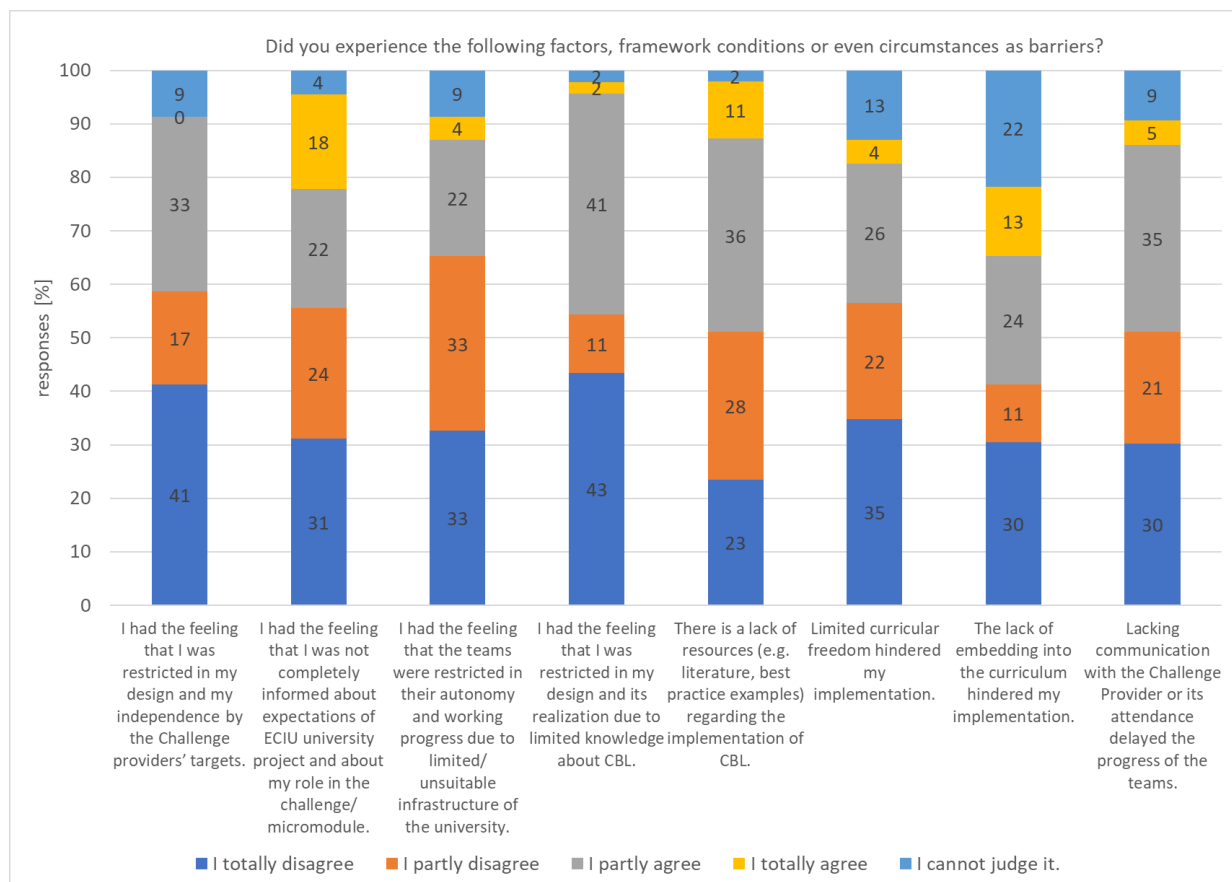
Figure 8: Responses [%] to the question: Did you experienced the following factors, framework conditions or even circumstances as barriers? Summarized from three survey rounds with n=50.

Nonetheless, in the summarized survey data (displayed in figure 8) the only statement that is still significantly different from all other asking for factors, framework conditions or even circumstances as barriers is "The lack of embedding into the curriculum hinders my implementation". This lack results in problems to find timeslots for CBL courses as one teamcher reported: "So, I taught on Wednesdays afternoon because I knew that that was the day where they have mostly a free, or they will have less classes, otherwise it would collapse with other classes."(P3_Int5_T1) Or CBL course does not fit with grading regulations, sometime even lack on Credits or other forms of formal acknowledgment (P3_Int3_T1+2).

The ECIU University

Institutional regulations and structures as well as the complicated application process and enrolment of international ECIU students as summarized in figure 9 are still an issue. Nonetheless, a multi-measure strategy was implemented in response to this in the work packages and task of the second federal phase.
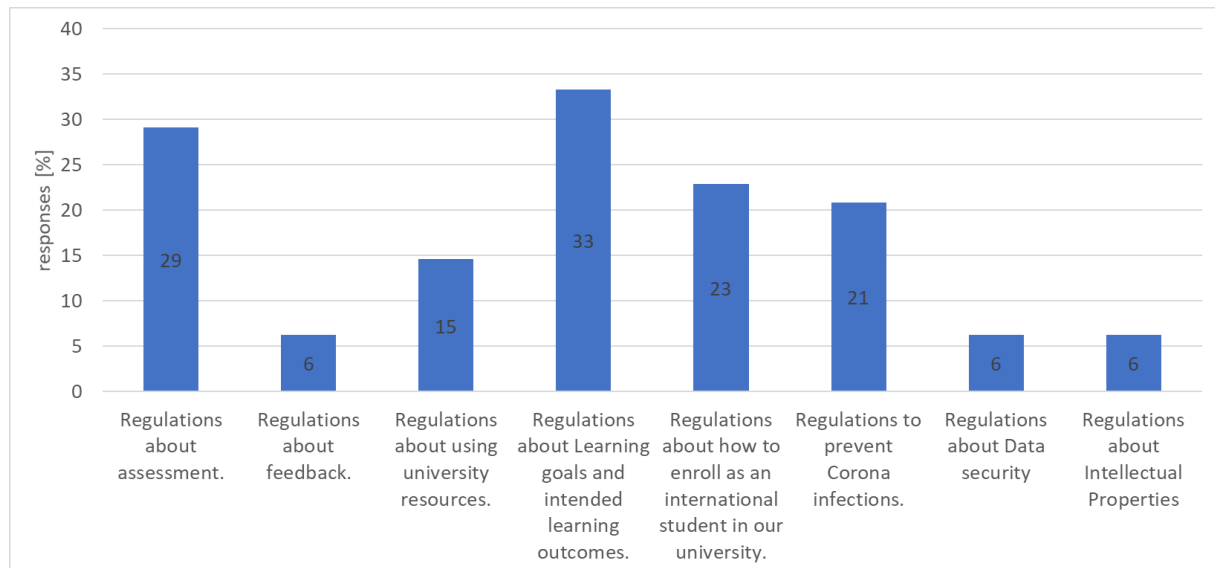
Figure 9: Subjects of regulation that limited teamcher in implementing CBL in their teaching

The research we did points out that challenges to implement Challenge-Based Learning were also linked to challenges to **system-level rules** and regulations and more connected with the ECIU management perspective. Within the last twelve months DAAD (German Exchange Academy) as well as European University Association (EUA) analysed and evaluated current challenges for the European Universities Initiative and system level reforms. Conclusion from EUA were drawn on evidence provided by national rectors' conferences, collected through a survey in April 2022 and interviews conducted in the framework of the forthcoming update of EUA's Autonomy Scorecard. From those challenges linked to system-level rules and regulations (Claeys-Kulik et al., 2022 Tab 2) the following were mentioned in regard to ECIU and Challenge-Based Education, too, although not all of them were included in surveys and interviews systematically:

- Differences in the implementation of the European approach to quality assurance of joint programmes and the number of European Credit Transfer and Accumulation System (ECTS) credits needed for a degree;
- Differences in academic calendars and grading;
- Differences in higher education access requirements (at ECIU especially for continuous learner).

Although those three might be not necessarily specific to the alliances in the European Universities Initiative they seem to be somehow connected with the Bologna Process. They might amplify in the context of multilateral alliances involving many institutions from different higher education, as stated by Claeys-Kulik et al., 2022 p4. Within the challenges that are more specific to the European Universities Initiative the following one were recognized at ECIU and Challenge-Based Education, too:

- The multiplicity of goals, motivations and expectations which may include covering diverse institutional profiles and regions, developing Community of Practices with a diverse student community (e.g. traditional students and continuous learners), offering student-centred and

> challenge-based learning in interdisciplinary teams fostering synergies between education, utilising research and innovation, to create societal impact and increasing mobility

- discrepancies in national support and co-funding
- The integration of alliances in long-term institutional strategies, consolidated buy-in from the wider university community and the upscaling of activities from pilots to integration into the normal activity flow
- Establishing a governance framework for the alliance that is compatible with and takes account of the institutional level governance setup and decision-making processes at the member universities.

The German Academic Exchange Service together with the vice-presidents of the German higher education institutions represented in the European Higher Education Networks, developed factsheets in various working discussions and exchange rounds in 2022 that describe key regulatory hurdles to European higher education cooperation at the national level, too. As EUA they identified as challenges:

- accreditation of joint programmes,
- legal entities in regard to funding, interinstitutional teaching and interinstitutional staff employment,
- lack of structural encouragement for mobility of teachers for the purpose of teaching and research

and mentioned in addition of those from EUA the following challenges that were also met by ECIU University:

- Shared learning offerings require a common understanding of the teaching and learning formats offered as shared teaching and learning technologies that can be used by all students and teachers.
- Lack of flexible solutions for the responsibility for all social, health and cultural concerns of students and the different perceptions that this is also the responsibility of a university for its students.
- Lack of flexible solutions to avoid disadvantages and protection against discrimination, as well as the different views that this is also the responsibility of a university for its students.

Although in figure 9 "Regulations to prevent Corona infections" is within the first three most mentioned regulations that limited teamcher in implementing CBL in their teaching, in summarized data from all three rounds it was not mentioned at all in teacher`s interviews after challenge round 3 in comparison to round 1 and 2. With start of winter term 21/22 all ECIU partner went back to teaching and learning on campus for their learners. ECUI learnings started to be in blended and hybrid mode. We can just speculate that based on experiences of last year with full online teaching and learning combining online with on campus activities was not experienced as a challenge.

As the survey and interview findings suggest, whether certain regulations are experienced as hindering or not will at least in part depend on the general institutional climate they are embedded in as well as on the person that faces them.

A decidedly facilitating factor to CBL and its implementation conditions is a **supportive relation with colleagues at the home university or within ECIU**. Even more than reported for challenge round one and two, tea(m)chers who co- or team-teach find it very disburdening, as it allows them to support

each other methodically (P3_Int5_T1 and P3_Int2_T1+2). The outstandingly supportive function especially of those colleagues who are also involved in the ECIU project is documented in the survey, too (Fig. 10, question 3+4). And more obvious, between month 24 and 36, we observed that teamchers conducted trainings on CBL themselves, accompanied teamchers in their first challenge as experienced experts in team-teaching or shared their findings in handouts, conference participation and publications (see Deliverable Report 3.3O6 scientific publications). The following list of shared trainings and activities might be incomplete:

- Alessandra Scroccaro CBL expert and teamchers from UNIT act as trainers on an UIS workshop in March 10th 2022 and teamchers from UiS visited the final event from UNIT in May 2022. Teamchers of UiS und UNIT support each other in a Classroom Action Research Project.
- On June 29th in a workshop called "CBL learning experience" conducted by UT 3 teamchers from DCU and one from UiS participated
- On May 24th 2022 Frank van den Berg, a CBL expert and teamcher from UT, acted as day chair and CBL instructor in a hackathon conducted by DCU. Additionally, he gave a 2-hour workshop for approx. 12 DCU teachers on assessment in CBL courses the next day.
- UT and UAB developed handouts suitable as training materials for future teamchers.
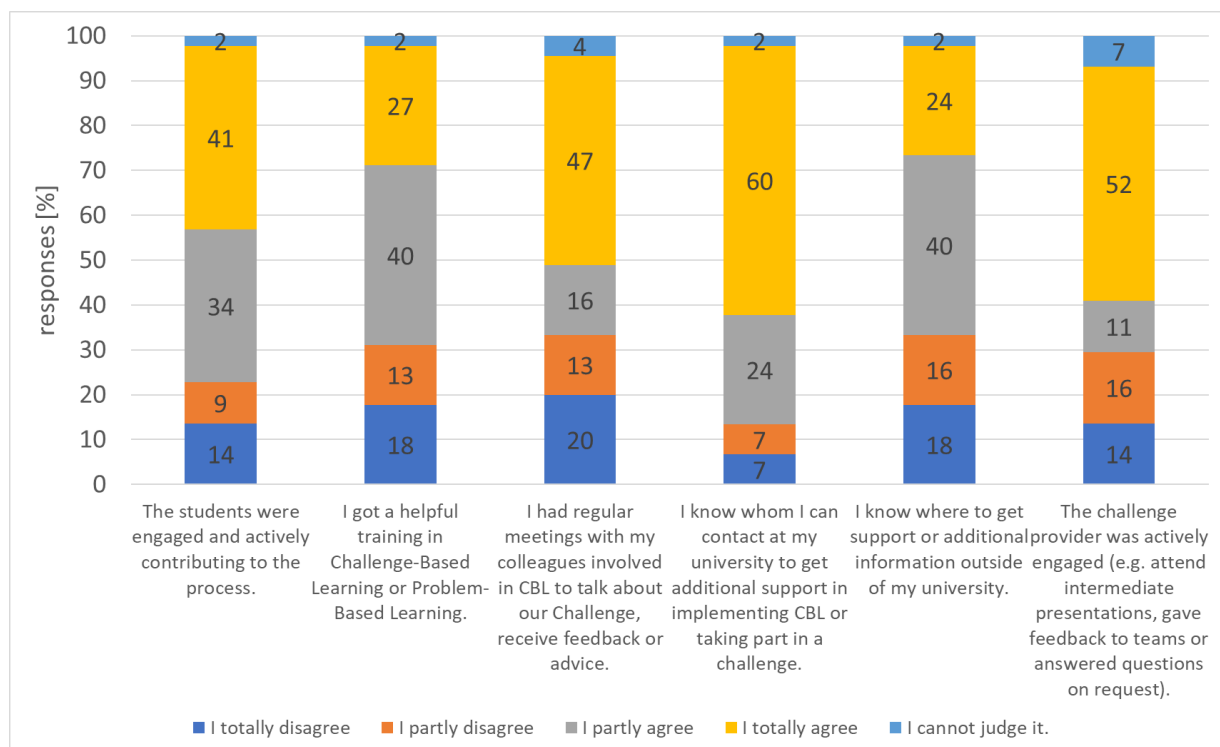
Figure 10: Factors, framework conditions or circumstances supporting teamcher in the implementation of CBL. Responses in [%] and mean of all three investigated challenge rounds.

Based on these examples, the authors recommend to strengthen the community of practice of the experienced teamchers. This could be done by incentives (e.g. funding of mobility) for team teaching, peer visits or Scholarship of Teaching projects of teamchers from two or more ECIU partner. A publication project, as a Handbook of CBL@ECIU, a jointly organized conference or participation on high level events of EU commission as speakers could keep the motion and motivation of experienced teamchers high. A figure summarizing already existing incentives offered by the ECIU partners or ECIU by

itself is missing in this report since nearly nobody in the survey answered both questions about it and they were not mentioned in the interviews.

In addition to being in contact with people within one's home institution, communicative exchange on occasions like the Round Table meetings or CBL workshops with other members of ECIU university" (P3_Int 5_T1, P3_Int1_T1, P3_Int3_T1+2) is depicted as helpful when it comes to developing one's understanding and implementation of the CBL concept.

Another set of factors important to CBL is the **personal attitude and competencies of the tea(m)chers themselves as well as of the students** they work with as stated in chapter 3.1.1. in more detail. However, despite their high level of intrinsic motivation and personal engagement, tea(m)chers differ in the way they rate their own skills in teaching and facilitating CBL. While some can build on precious experience with CBL (or similar formats like PBL) or find it easy to improvise, others report some insecurity about their roles, tasks and potential as a teacher and/or teamcher. As a consequence, tea(m)chers suggest that it is necessary to (self-)prepare for one's CBL course very well. One reported: "…so we got lots of meetings together as teamchers to discuss the process, to discuss what we will be doing. I think it was like kind of almost every week, every other week, that we see where we are and how to move forward, especially when pretty much all of us were kind of new to the process, although of course, being teachers is one experience, but going through that process was different." (P3_Int3_T1+2)

In addition, teamchers who were interviewed twice report that the university's as well as their own growing experiences with CBL have facilitated a better **cooperation with the challenge provider**. For instance, in comparison to previous rounds, potential challenge providers are now introduced to the concept of Challenge-Based Learning, its goals and their expected roles therein in advance. This helps avoiding the occurrence of role- and goal-conflicts throughout the process (P3_Int4_T1).

3.2.2 Learning perspective

The learning experiences for the learner starts with getting to know ECIU University and its learning offerings. In mean over all three investigated challenge rounds 75 % students felt that the information provided about the challenges was sufficient to them. Most interestingly students used mainly websites and newsletters of their own university to find out about the ECIU University challenges as displayed in figure 11 and not ECIU informational resources which would have provided a more detailed information. Whether it is an issue of how many clicks you need, accessibility, language issues or whether own university resources are more trustworthy for the students, is not known but would be interesting for the upcoming second funding phase.
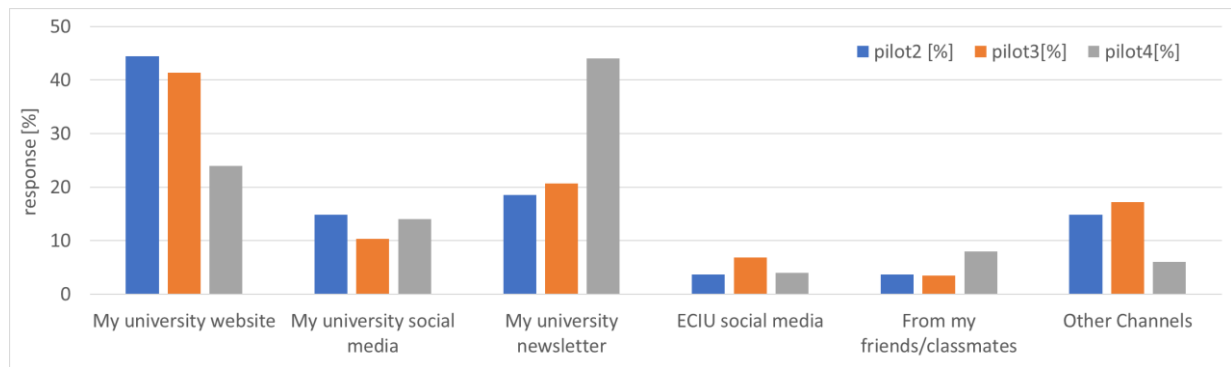
Figure 11: Selected answers from students to the question "Where did you find out about the ECIU University challenges?" in [%]. Students could select multiple options. Number of participants in each pilot/challenge round can be found in table 1.

The students who talked to us after being part in a challenge team differ in the way they experienced institutional **cultures**, **regulations and structures** and **learning conditions** as well as their **own roles** and those of their **tea(m)chers**. Although the majority of learner stated that CBL experience was worthwhile (figure 7) one student who took part in several challenges summarized as a personal statement: "It's definitely not something everyone wants to do and it's definitely not for every teacher. And not for every subject." (P4_Int1_S1).

By the last report, it was reported the interviewed students that the main issue in regard to the learning condition was of not being able to see each other in person. Especially with regard to team building and bonding, instead of only meeting online on the screen, they would have preferred to meet physically. With start of challenge round 3 in autumn/winter term 2021 most university had teaching and learning on campus again and there were no restrictions for mobility in Europe anymore. Students found it rewarding to meet physically, "when we got to meet in person in (the city where the challenge was hosted) and see how it all came together and see the campus and have a whole day of activities of meeting other students, learning about their experiences with CBL, and making the videos was really, really fun. And I think this was a big attraction to us, because we had worked for so long all online. At a zoom meeting with coordinating things was a long process." (P4_Int1_S2). Nonetheless, mobility also comes along with some organizational hurdles, it takes students more time and they miss courses in their home university (P4_Int2_S1). If the organisational difficulties could be minimised, the positive aspects for teamwork would outweigh the negative ones. One student justified meeting physically by: "We could discuss further about the different aspects, what our expectations are, we became a team, so we felt the responsibility towards each other, we could speak more openly then just when we are online." (P4_Int1_S2).

In sum, students` satisfaction with team building and bonding increased when lock downs were over and three typical characteristics of functional team dynamics were present: (1) defined roles with agreed responsibilities, (2) ability to change role with challenge progress and (3) regular feedback were present. All three characteristics were rated positive by about two-third (and often more) from the students (figure 12, questions 3-6).
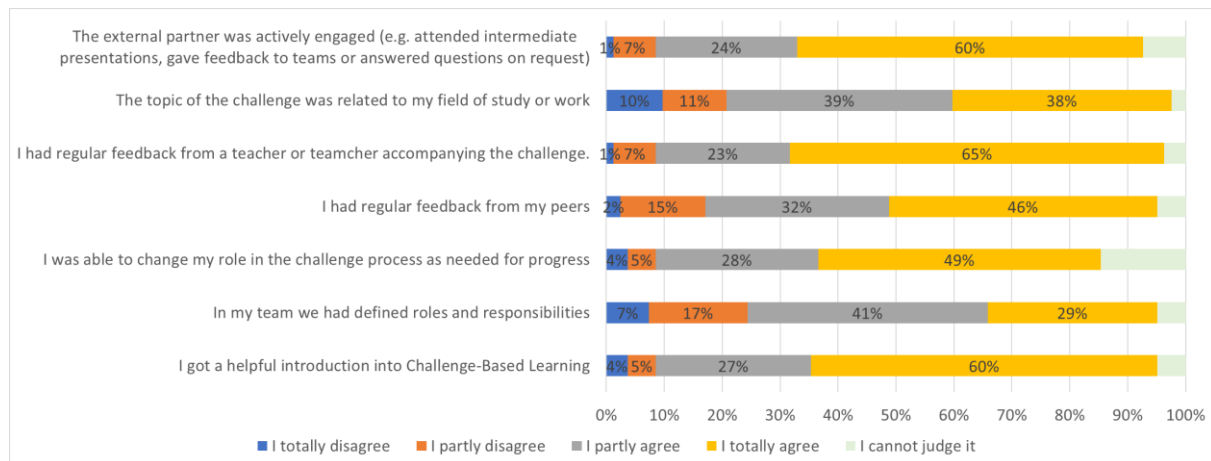
Figure 12: Factors, framework, conditions or even circumstances that were experienced as supportive by learner in a challenge team. Responses in [%] and as sum over all three investigated challenges rounds.

However, according to the interview data, it is not only the sheer amount or availability of feedback that is crucial to the students, but also its quality. This points to the necessity to properly explain the concept of CBL in order to help students in finding a good balance between acting autonomously and accepting or asking for advice. In the survey, 87 % respondents agreed that they "got a helpful introduction into Challenge-Based Learning" (Fig. 12, question 7). With regard to the process of understanding how CBL is supposed to work and their roles and agency therein, it was helpful that by challenge round 4 the number of students taking part for a second or more time increased from challenge round 2 with 20 % to 37 % in challenge round 4 (figure 6).

Amongst the factors or actors that influence the motivation, engagement and perceived self-efficacy of students, a particularly prominent role is played by challenge providers exterior to the university or, more broadly, external stakeholders (Ellinger/Mayer 2021; Mayer et al. 2022). The involvement of external partners has the potential to make students – as well as tea(m)chers – feel that they are doing something that has a potential for real-world impact as well as for their careers. Additionally, if their efforts and solutions are being acknowledged and approved by external stakeholders, especially by the challenge provider, this is likely to increase students' satisfaction and self-esteem. The downside of this affective attachment, fuelled by the pressure and competition to deliver an excellent product, may result in disappointment, emotional stress and/or overworking. Given the importance that students tend to ascribe to the challenge providers' targets, an apparently disinterested or poorly communicating stakeholder may violate students' motivation and perceived self-efficacy. From one challenge in round 4 a student reported from a feedback round with the challenge provider: "We asked also specific questions, but they could not answer in that specific way. Because they are worried or they declared they cannot, are not allowed to. […] So, a lot of projects due to the lack of data to lack of information could not reach the real goal." (P4_Int2_S1). The latter might happen as well if permanent interventions (as an exaggeration of engagement and comments) make the students feel they are being pushed towards a prescribed path instead of pursuing their own ideas. According to the survey, about two-third of students assess the challenge provider as actively engaged (fig. 12, question 1), while about 20 % (18 % in round 2, 21 in round 3 and 31 % in round 4) totally or partly agree that lack of communication with the provider or its attendance delayed their progress (fig. 13, question 1).
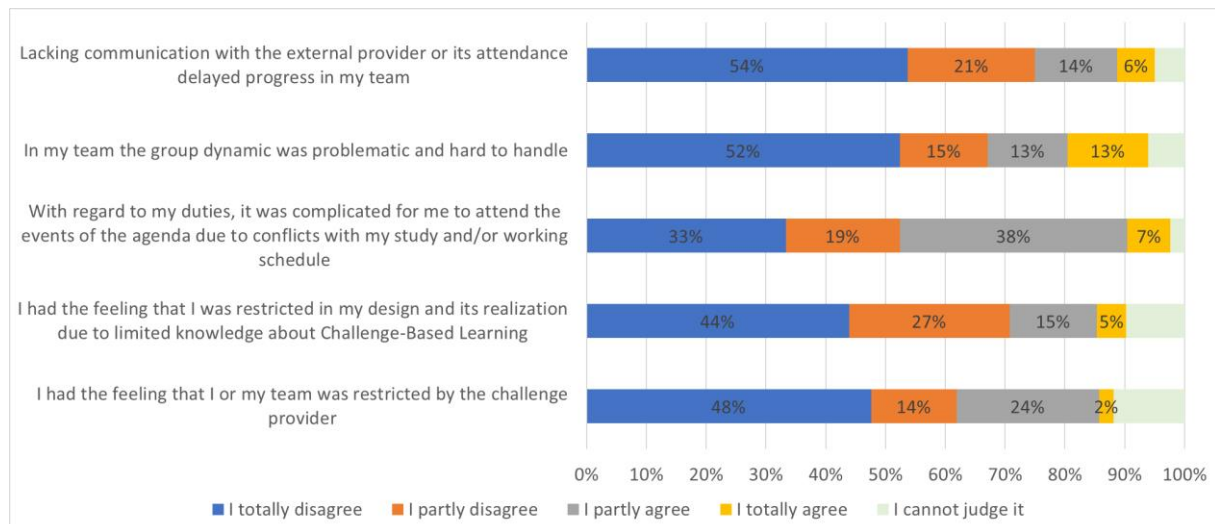
Figure 13: Factors, framework, conditions or even circumstances that were experienced as barriers by learner in a challenge team. Responses in [%] and as sum over all three investigated challenges rounds.

Main issue for students, as indicated in figure 13 as well as in the interview are connected with time. This might be an imbalance of invested workload in a (extracurricular) challenge in relation to other (curricular) duties, the challenge to handle teamwork with participants from different time zones or the given timeframe. In regard to the latter one student reported that: "challenge in exactly the middle of a term is not the best thing that a person can have. If I could, I would like to change the timing of the challenge and try to find a way to have those experiences either at the end of the winter term, after the exams or immediately at the beginning of the term. To be ready also to travel without being afraid missing important lectures or missing too much time in this." (P4_Int3_S1).

All interviews, whether with teachers or students, concluded with the question of wishes and recommendations for the further development of ECIU University. And this quote - which we would also like to understand as an outlook on the second funding phase - summarises what many interviews also pointed out:

> "So, giving it a clear stable place would make it more interesting for students. Either giving the ECs that they could get into the curriculum, that would be a great idea, so students can build up their academic curriculum based on the extra credits or giving some other form of reward to the students. Maybe in cooperation with some summer school classes or something for their master thesis or bachelor thesis, so that they could actually use this information for their own career instead of looking only for the few weird students that want to do extra things. (P4_Int1_S1)

4   Summary and Discussion

In the chapters above, we identified motivations, goals and acquired competencies as well as supporting and hindering factors with regard to implementing CBL. These include academic cultures, institutional regulations and structures, teaching and learning conditions, external stakeholders, colleagues/support, tea(m)chers' attitudes and competencies, students' attitudes and competencies. Based on our interview and survey data, we have now been able to deepen our insights and to enrich

(or sometimes contrast) the tea(m)chers' perspective with the experiences of the students. Moreover, we have started to identify interrelations and dynamics between some of the aspects that support and/or hinder the implementation. For instance, we saw that even though implementing CBL still heavily relies on the tea(m)cher's individual intrinsic motivation and their personal time and energy investment, an unfavourable institutional/academic culture may lead to a decline of the tea(m)cher's enthusiasm, whereas working with colleagues from ECIU is depicted as clearly supportive. Another example for interconnected factors would be the impact of external partner involvement on students' attitude, engagement and perceived self-efficacy.

Furthermore, the interview data collected in Pilot 3 and 4 point to certain needs with regard to future implementations and support. Very briefly, they can be summarized as follows:

Tea(m)chers:

- **Didactic support**: More and earlier advice by experts in CBL and its didactics in order to better/sooner understand concept, process, roles.
- Build a **network of colleagues** to support each other in getting familiar with CBL, develop and provide good practice examples and evaluation criteria.
- Earlier **consultations with stakeholders at/within the university** (e.g. from different faculties, administration, presidium...) to clarify and negotiate expectations, roles and duties.
- **Institutional acknowledgement** and support (immaterial and material).
- Clearer communication and more **binding agreements with challenge providers** regarding the topic of the challenge, roles and aims.
- Opening up – extend possibilities and attractiveness for students and staff from **ECIU partner universities to cooperate**. Create links and synergies between different challenges.
- **On-/offline teaching:** analyse problems and benefits of remote teaching/learning/conferencing, build and enhance opportunities to (occasionally) meet face-to-face even if located in different countries. This applies to student team meetings, teacher and/or teamcher student meetings and staff/colleague meetings.
- **Information on CBL and challenges**: set up a data-base for literature and previous projects, improve the platform, so that students and tea(m)chers get a better overview on running challenges and CBL process.

Of these concerns, some seem more personal (e.g. finding colleagues to talk to about CBL) and some are more of an appeal to improvements that could be made on an institutional level. However, the personal and structural level must be seen as interrelated, as – to stay with the example – being able to consult a colleague (or network of colleagues) is likely to be a matter of institutionally allocated time and resources, too.

Students:

- More **practicable explanation** of the CBL concept, steps and process.
- **Examples**, a data-base of projects to get an impression of the approach and the possibilities.
- More frequent and substantial **communication with challenge providers.**
- More substantial **feedback and support by tea(m)chers** (instead of just blank encouragement).
- More **meetings** (preferably offline) and more extensive discussions in course/plenary (not just group/teamwork).

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6   List of Appendices

1 Guideline for tea(m)cher interviews

2 Guideline for student interviews

3 Student survey

Acknowledgements