A3.3, O5: A Review of Challenge-Based Learning in Pilot 2

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Beneficiaries

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- 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 second deliverable report out of output 5 of activity 3.3. Its objective is to review Challenge-Based Learning (CBL) in the spring/summer term 2021 (Pilot 2), to connect our recent findings with our previous ones from the fall/winter term 2020/21 (Pilot 1) (Ellinger/Mayer 2021) and to draw conclusions with regards to upcoming challenges. 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.

[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 and to create a European educational network for all stakeholders involved.

One focus of Activity 3.3 is to set up and implement training and support for teachers and teamchers who are or will be occupied with the implementation of CBL (as documented in Ellinger 2021).

A second focus 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 the present report).

The third focus in activity 3.3 is to analyse the pedagogy and to come up with an Innovation of Education Roadmap, which will be a Deliverable Report on its own with due date at the end of the funding period and will be not addressed here.

Based on qualitative and quantitative research data, this report reviews CBL in the spring/summer term 2021 (Pilot 2) 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 fall/winter term 2020/21 (Pilot 1) as documented in Ellinger/Mayer (2021).

The report is structured as follows: Section 2 two summarizes the objectives of this deliverable. Section 3 introduces research methods and approach and then proceeds with presenting results on motivational factors, goals and competencies (see section 3.1). The subsequent section discusses factors and actors that may support or be a barrier to the implementation of CBL and shows interrelations between these factors (section 3.2). The concluding section points out recommendations and ideas towards removing existing hurdles in the implementation of CBL (section 4). The report closes with a brief outlook on planned CBL evaluation and support activities in Pilot 3 (section 5).

2 Objectives

This is the second deliverable report out of output 5 of activity 3.3. Objective of this report is to document our empirically grounded evaluation activities and findings in Pilot 2 and to connect them with the insights obtained from Pilot 1 (Ellinger/Mayer 2021).

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

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

The findings reported and conclusions drawn here will be further utilized for the development of even more targeted teacher and teamcher training and support offerings. Also, they have been taken up in the preparation and design of the third round of data collection which aims at examining and evaluating Pilot 3 in the fall/winter 2021/22.

3 Challenge-Based Learning in Pilot 2

Drawing from our explorative qualitative findings and our tea(m)cher survey from Pilot 1, we conducted six additional semi-structured expert interviews (group, pair and single) with a total of six tea(m)chers

and six students, all of them being involved in either a Mini or Standard challenge in Pilot 2. The interviews were conducted in May and June of 2021. Our interview partners' affiliations are TUHH, UNITN, UT and KTU. Main aim was 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, two extensive ECIU-wide online surveys were launched; one addressing tea(m)chers (21 participants from INSA, KTU, UA, UAB, UiS, UNITN and UT) and the second one addressing students (40 participants from DCU, KTU, TUHH, UA, UAB, UiS, UNITN and UT). The sample of n=40 responding students equals about one fifth of the total number (N=206) of students who participated in an ECIU challenge in Pilot 2. The setup and dissemination of the student survey was 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 structures are attached to this report (Appendices 3 and 4). The results were processed with Excel.

The CBL review presented here also benefits from collaborations of Activity 3.2 and 3.3: Findings from Pilot 1 were presented and discussed at the Review and Assessment Workshop on May 20th 2021 (Simon et al. 2021), helping us to identify crucial aspects to be addressed in the following interviews and data analysis. The follow-up Review and Assessment Workshop on October 26th (Simon 2021, forthcoming) was partly dedicated to introducing, collaboratively interpreting and further elaborating the findings from Pilot 2. This has also contributed to identifying the most crucial topics to be addressed in the next steps of research and tea(m)cher support.

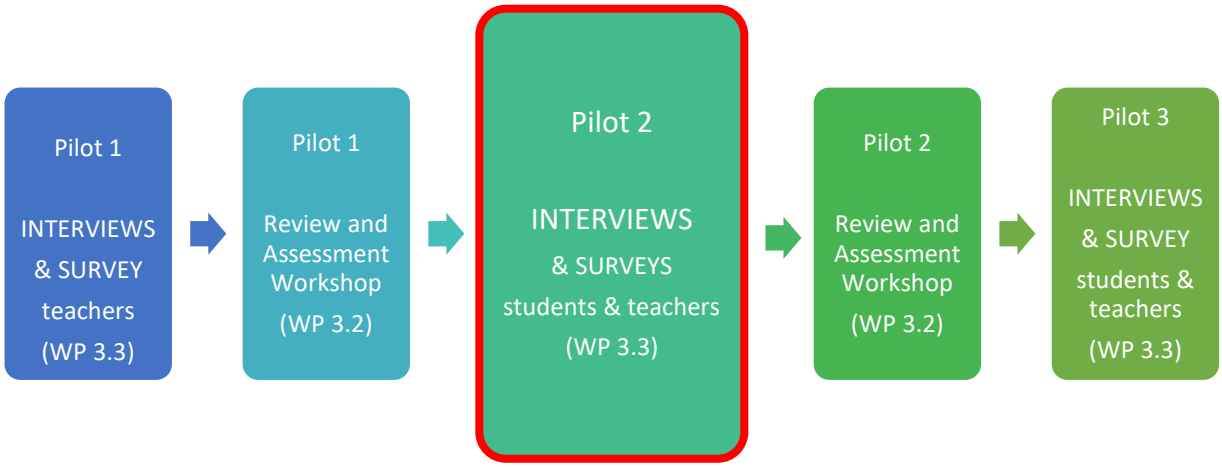

Figure 1: Design and process to review CBL (red square indicates main focus of this report).

3.1 Motivation, goals and competencies

This section investigates motivational factors when it comes to teaching or taking part in a challenge, as well as goals and key competencies that (should) have been acquired through CBL.

3.1.1 Tea(m)chers

As indicated in our Review on CBL in Pilot 1 (Ellinger/Mayer 2021), the tea(m)chers' generally positive attitude towards the concept of Challenge-Based Education and 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 seen as a major driving force to volunteer as a CBL teacher and/or teamcher. This is mirrored in the recent survey: Besides from being "curious about the topic" (71% of total agreement), the vast majority (81% fully and 14% partly) agrees to the statement "I was interested in new pedagogical practices" (Fig. 9, questions 2, 4).The reported openness towards new and 'fresh' didactics, pedagogies and teaching/learning methods is particularly relevant as doing CBL is still widely conceived of "as a huge experiment" (P2, Int 1, T1)[2], thus calling for the willingness to engage in an exciting yet unpredictable process and to become a learner, too. In turn, most tea(m)chers who say that CBL has proven worthwhile to them give the reason that CBL has enabled and challenged them to further develop their own teaching competencies and the way they work together with their students. A second aspect related to learning is that by working with external partners, e.g. businesses or municipalities, tea(m)chers get in touch with the world beyond academia. This gives them the valued opportunity to widen their horizon, that is, to gain insights into different problems, approaches and work-flows one would usually not encounter as a university tea(m)cher (P2, Int 2, T2).

Despite the undoubtedly high importance of intrinsic motivation, it is mentioned in the interviews that in addition, motivational incentives provided by the university (or the lack thereof) should not be underes-timated. Most prominently, interviewees call for an academic culture that actively encourages tea(m)chers to try out CBL, provides collegial support/training and acknowledges their engagement in terms of time and financial resources (see also section 3.2). However, as the tea(m)cher survey shows, only a minority has actually received those kinds of incentives. This, again, points to the fact that at the moment, the implementation of CBL still heavily depends on the individual motivation, engagement and resources of the tea(m)cher.

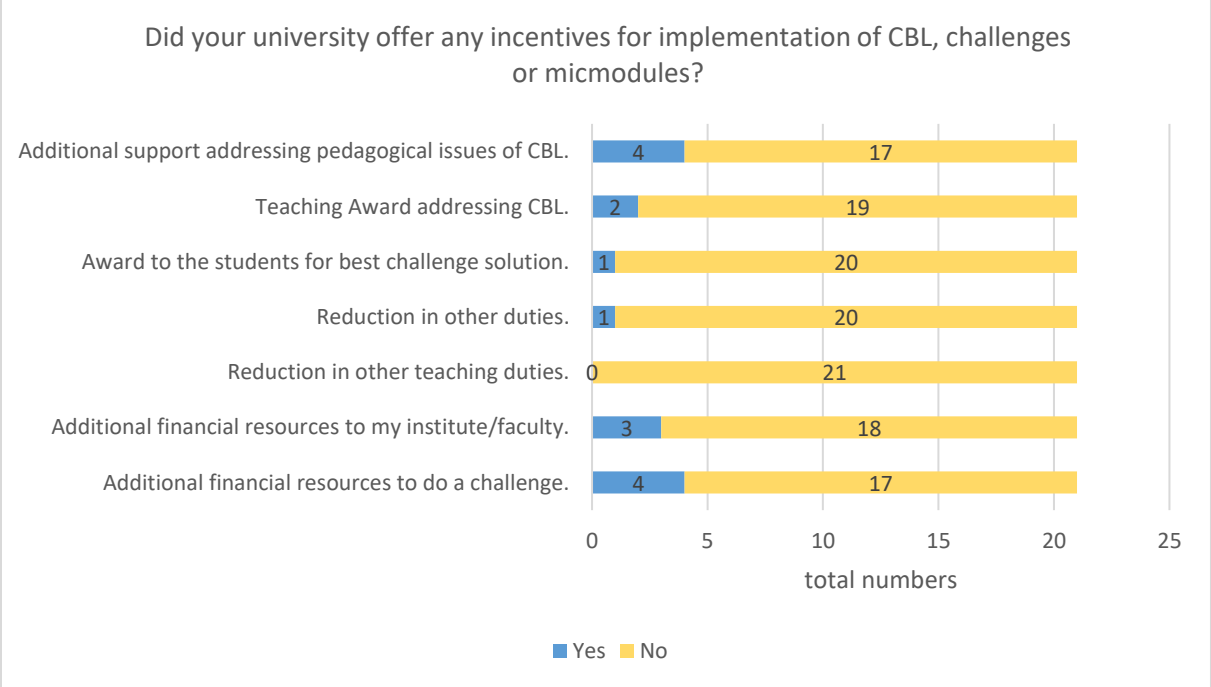

Figure 2: Incentives offered by the university to tea(m)chers

3.1.2 Students

The interviewed students, too, show a high level of intrinsic motivation. This applies to those whose CBL course was embedded in their curricula and rewarded with credit points but, of course, even more to

[2] Interview quotes/references: P2 = Interview from pilot 2. Int 1 = interview number (interview #1 out of six in pilot 2). T1 = teacher 1. A second interview partner in that same interview = T2.
S = student.

those who voluntarily chose to work on extra-curricular challenge and who received a participation certificate only. Only one student reports to have had an idea about the specific methodology of CBL before: "Last year, the university developed quite challenging series of innovative training sessions for pedagogical innovation. And it was in one of those sessions that I go to know the CBL methodology and I was really interested." (P2, Int 6, S1) Amongst the given reasons to apply for a challenge, the most frequent one is to gain knowledge on the specific topic, especially from a multi-disciplinary perspective and in a 'real-life' and labor market-related setting (see section 3.2.2). 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. The relatively high number of 28 (out of 40) persons totally agree to the statement that they were "curious about the topic of the challenge" (Fig. 12, question 3). Additionally, students were asked to share their motivations to apply for a challenge (open answer), their most important personal learning goal (open answer) and whether they think they have achieved this goal – which is fully the case for 15 and partly for 17 out of 40 participants (see Fig. 3).

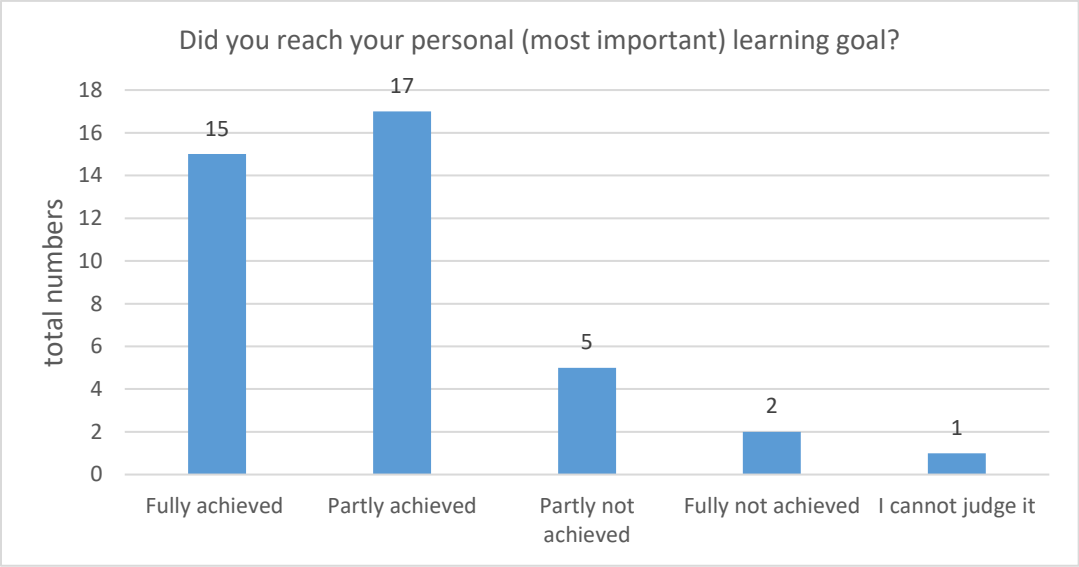

Figure 3: Students' achievement of learning goals

In addition to the open question and literature-based reviews (Membrillo-Hernandez 2019; Juárez 2020), we identified three key learning goals that can be considered as particularly linked to CBL.

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).

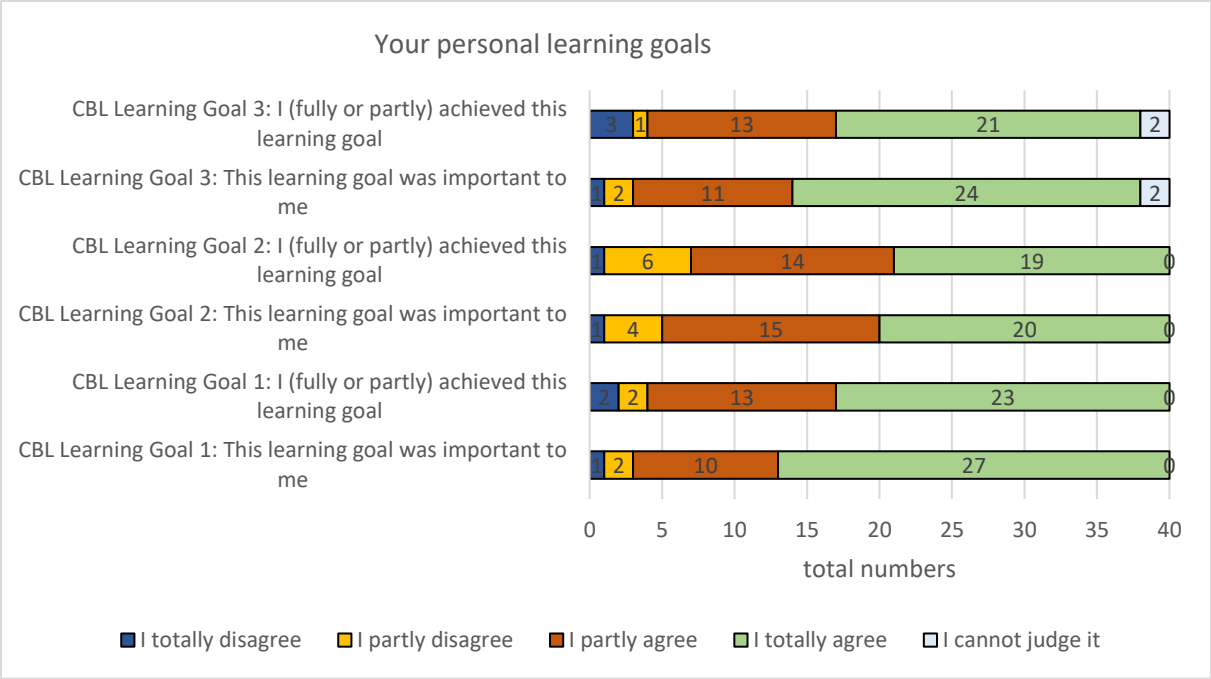

Figure 4: Students' self-perceived importance of CBL goals and success in reaching them

When being asked about learning opportunities, output and skill development in terms of language skills and key competencies, more than half of the participating students (22 out of 40) strongly agree or agree that they have increased their language skills, whereas 80% (strongly) believe to have extended their key competencies (see Fig. 5).

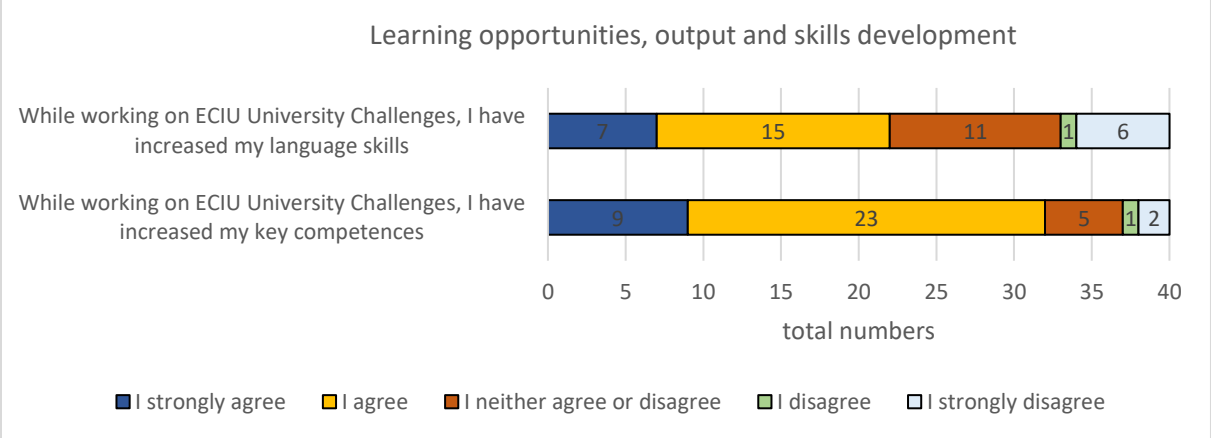

Figure 5: Students' gained language skills and key competencies

In the survey, 22 students totally and 11 partly agree that all "in all, to me personally, it has been worthwhile or rewarding to engage in CBL" (Fig. 6, question 5). Notably, some of the interviewed students explain that they may have not reached their initial learning goal and the challenge did not (completely) match their initial motivation to gain content-related knowledge on the subject. Instead, they did learn "more about organizing and working in an intercultural team with so many different backgrounds" (P2, Int 4, S1), whereby they feel to have significantly improved their personal study abilities as well as social skills and contacts. 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.

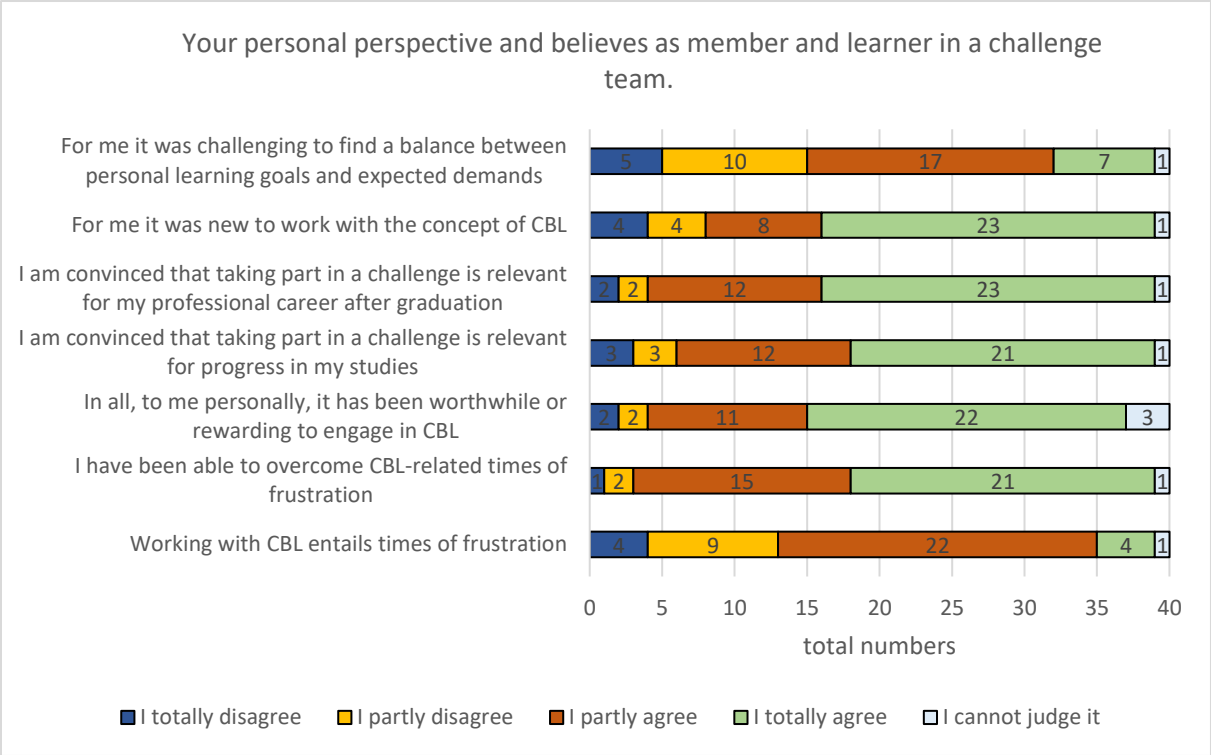

Figure 6: Students' personal perspective on CBL

3.2 Affecting factors

The following section 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 two 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 Tea(m)chers' 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. On the part of their university, tea(m)chers sometimes miss a clear(er) understanding of and commitment to CBL, which may result in poor preliminary talks, insufficient preparation and little resource offers: "I think one mistake what was done by the university itself was a lack of clear communication. About the value of CBL and this additional model in general." (P2, Int 1, T1; see section 3.1.1). Additional problems may arise from a "too complicated communication structure" (P2, Int 1, T1) between the different stakeholders within and outside the university (see below) but also amongst teachers and teamchers, for instance if one teamcher is elected as a central contact person to whom all other teamchers will have to turn instead of communicating directly amongst each other or with the challenge provider. Also, some tea(m)chers (P2, Int 1) say that the institutional allocation of the roles of teacher and teamcher (combined in one person who situationally has to act as a teacher but in another context is supposed to be a teamcher) has raised serious role-related insecurities for themselves as well as in the interactions with their students. According to the survey, about half of the respondents did not feel well informed about their role and duties in the implementation (Fig. 10, question 11).

Another issue related to institutional regulations and structures is the still complicated application process and enrolment of international ECIU students (P2, Int 3, T2) or uncertainties about status and use of the certificates some challenges grant instead of ECTS (P2, Int 2, T1). According to the recent survey and in accordance with the previous one, half of the respondents feel (partly or totally) restricted by regulations, with the most common limitations referring to learning goals and outcomes as well as to assessment (Fig. 7).

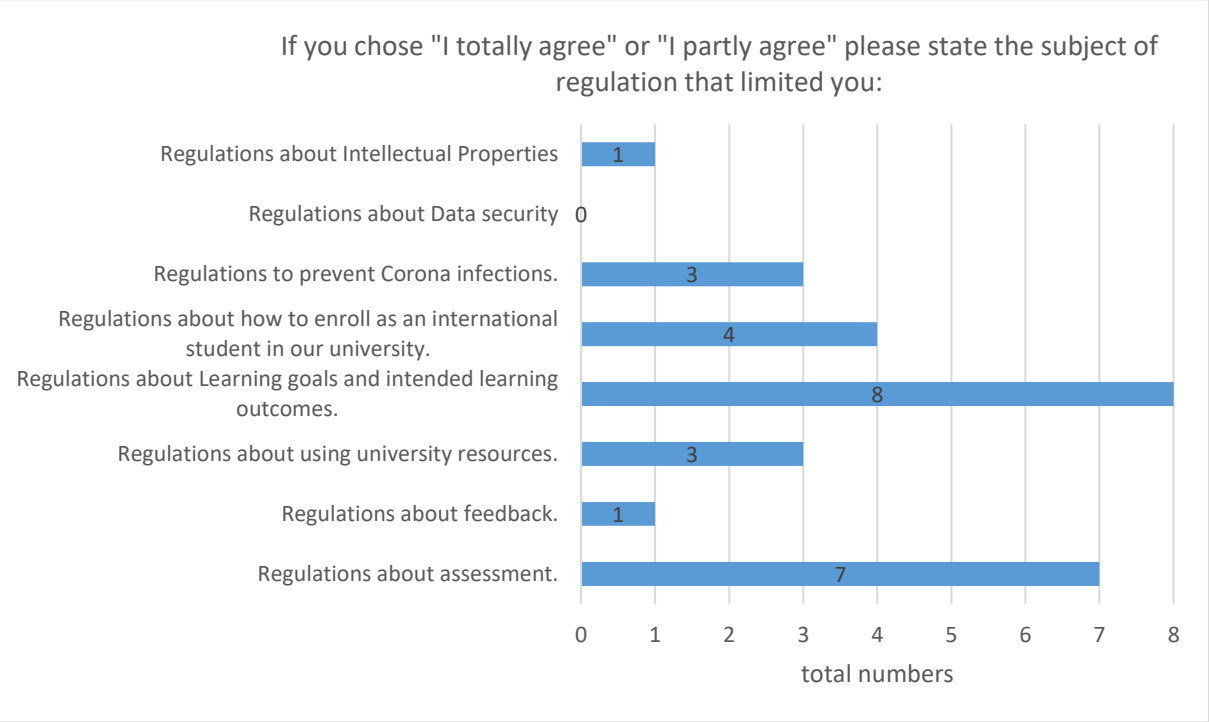

Figure 7: Limiting regulations as experienced by tea(m)chers

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. For instance, some tea(m)chers – especially those who are new to CBL – want their institutions and administrations to come up with clear definitions, stringent requirements, organizational frames, etc. in order to structure and facilitate the implementation (P2, Int 2, T1). On the other hand, at a university with a longer tradition of working with CBL or related formats (and where the general culture seems to embrace the CBL approach), tea(m)chers positively highlight their freedom – in the sense of not being limited by institutional barriers – regarding their CBL implementations: "The strong thing in (our university) is that we are free in the sense that T2 and I, we hadn't problems with the administrative regulations or curricular structures or regulations made by professors and so on. We were relatively free to structure, to propose the challenge, to manage with the time, with the students. We were autonomy[ous] in our actions." (P2, Int 3, T1)

With regards to teaching/learning conditions, the issue most frequently addressed in the interviews are concerns about meeting exclusively online. The requirement to work in an all-digital setting is due to the current pandemic but, as the ECIU aims at gathering students located in different countries, the need to deal with not being able to teach and learn face-to-face (at least not on a regular basis) will remain relevant after the pandemic. As already pointed out in our previous report, some teachers deploy uncertainties about the attendance (due to black screens), learning activities and commitment of their online-only students (P2, Int 1, T2, 3). Contrarily, "meeting in presence […] establishes another kind of relation with the students. You can catch them. To me as a guiding person, this feels much more reliable." (P2, Int 2, T1)

A decidedly facilitating factor to CBL and its implementation conditions is a supportive relation with colleagues at the home university or within ECIU. Like in Pilot 1, tea(m)chers who co- or team-teach find this very disburdening, as it allows them to support each other methodically but also to complement each other thanks to "different past experiences, […] attitudes and backgrounds. We could really mix our backgrounds. I think, it was really enriching for students." (P2, Int 3, T1) The outstandingly supportive function especially of those colleagues who are also involved in the ECIU project is documented in the survey, too (Fig. 8, question 2). In addition to being in contact with people within one's home institution, communicative exchange on occasions like "the Round Table discussion with other members of ECIU university" (P2, Int 1, T1) is depicted as helpful when it comes to developing one's understanding and implementation of the CBL concept.

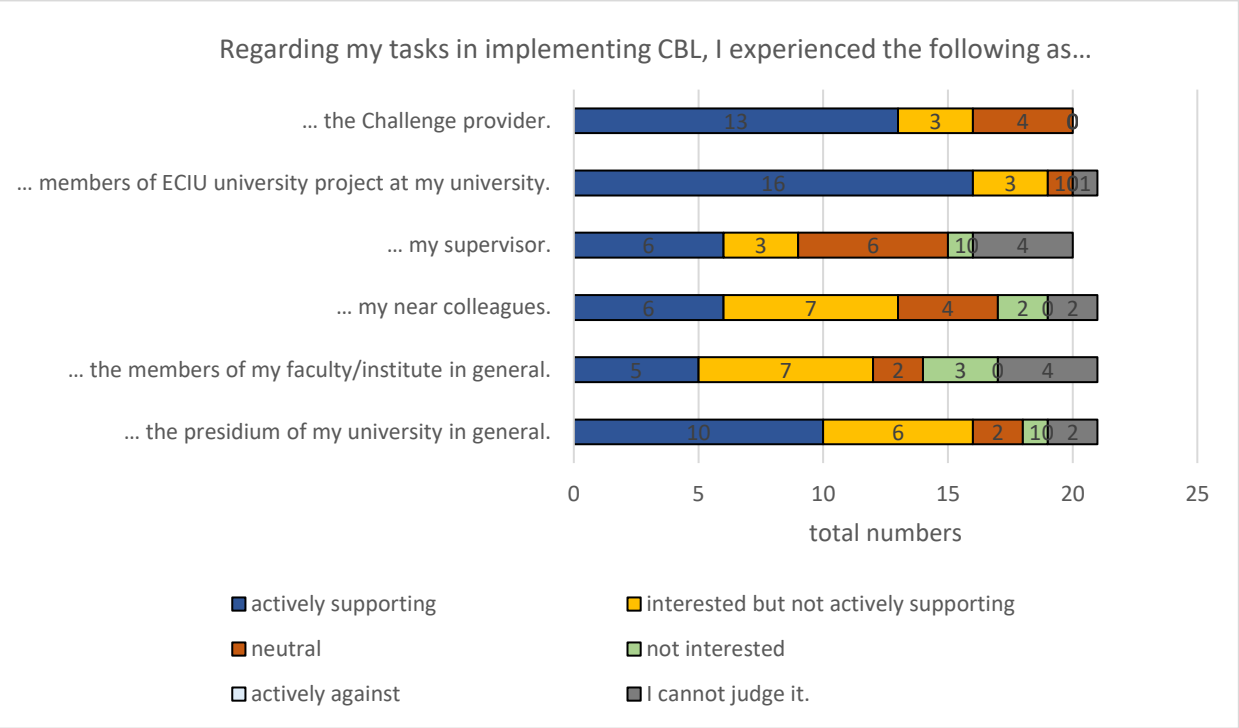

Figure 8: Levels of support from different actors received by tea(m)chers

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. The interviewed tea(m)chers present themselves as "really passionate about CBL" and as "really enthusiastic about these challenges and this way, this teaching methodology, these interactions" (P2, Int 3, T2) with students and other stakeholders. However, despite their high level of intrinsic motivation (see section 3.1.1) 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. In the survey, six participants totally and nine partly agree that they "got a helpful training in CBL or PBL" (Fig. 9, question 8), while twelve partly or totally agree that during their implementation, some of the occurring team-dynamics were hard to handle (Fig. 10, question 2). As a consequence, tea(m)chers suggest that it is necessary to (self-)prepare for one's CBL course very well. That is, "to be aware of the CBL guide, yes, to know the steps, and then really to have the scheduled course" (P2, Int 1, T2), for "challenges can fail if they are not organized well. So, you need really to make a lot of thoughts about what can happen in terms of scenarios and try to solve small issues ahead" (P2, Int 3, T2). Given the lack of (extra) resources provided by the university, extended preparation, again, requires a lot of personal time and energy investment from the tea(m)cher. At the same time, CBL urges them to "forget traditional roles in teaching" (P2, Int 3, T1). Thus, tea(m)chers are challenged to constantly and carefully balance between planning

and improvisation, structure and freedom, which partly makes for the experimental feeling the interviewees univocally report.

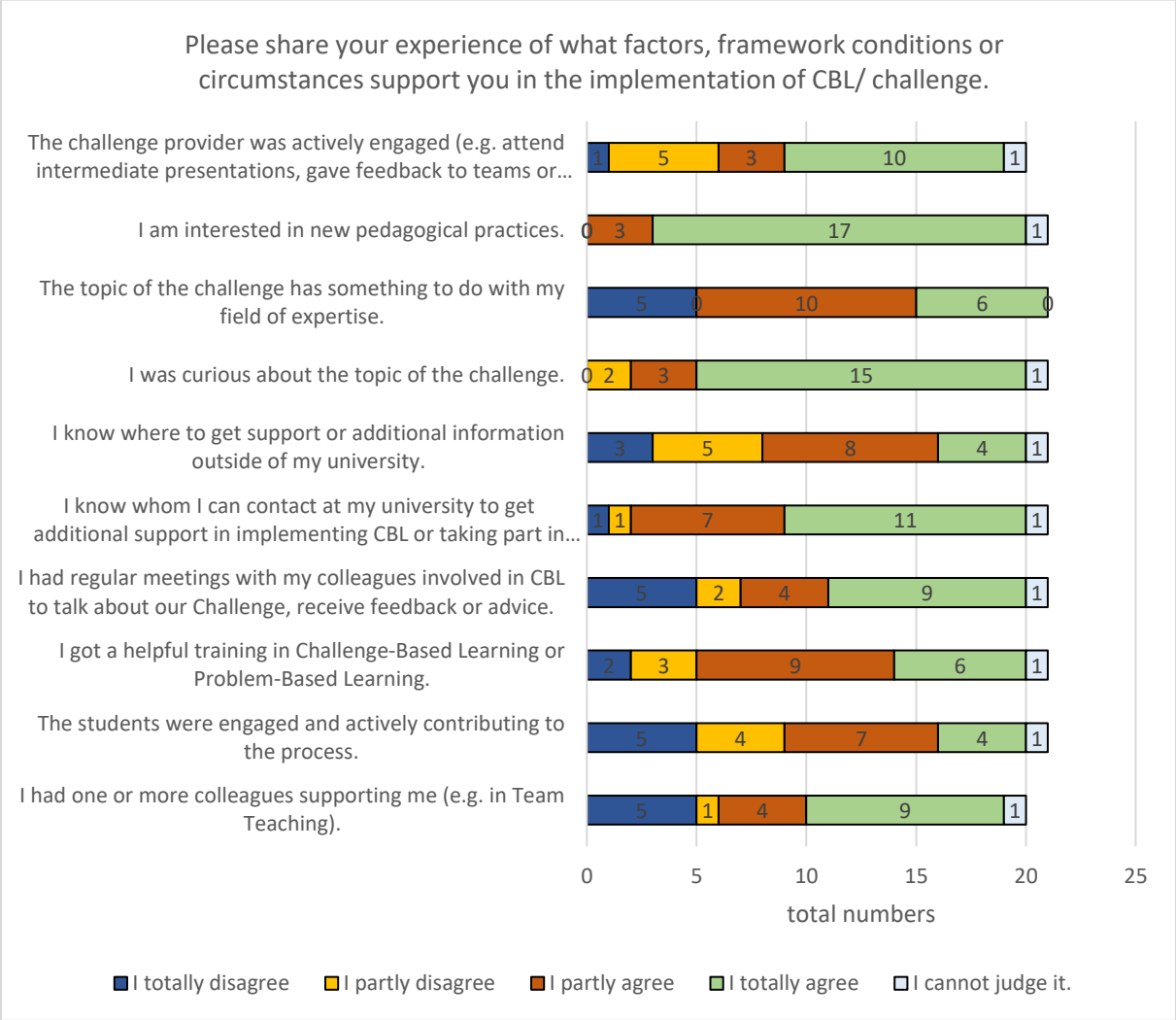

Figure 9: Supporting factors to CBL as experienced by tea(m)chers

As for their students, the interviewed tea(m)chers paint a very heterogenous picture. While some are thrilled by the high level of intrinsic motivation, engagement and joy their students show, others are troubled by a considerable number of drop-outs (P2, Int 3, T2), apparently unmotivated students or the observation that throughout their course, "the activeness, the participation level is decreasing" (P2, Int 1, T1). In the survey, only a relatively small number of four respondents totally agrees that "students were engaged and actively contributing to the process", while five persons totally disagree to this (Fig. 9, question 9). Of course, statements about the motivation and activity level of students must be seen in the context that in relation to traditional teaching/learning formats, CBL generally poses rather high demands on students' engagement (which sometimes may exceed their resources). In the survey, more than half of the tea(m)chers indicate that "the time level invested by the students was too much in relation to ECTS" (Fig. 10, question 3). Given the fact that in CBL, students need to be able to self-organize and take over responsibility for their learning processes, tea(m)chers prefer to work with master students who tend to be more "mature" (P2, Int 2, T1) in comparison with younger ones.

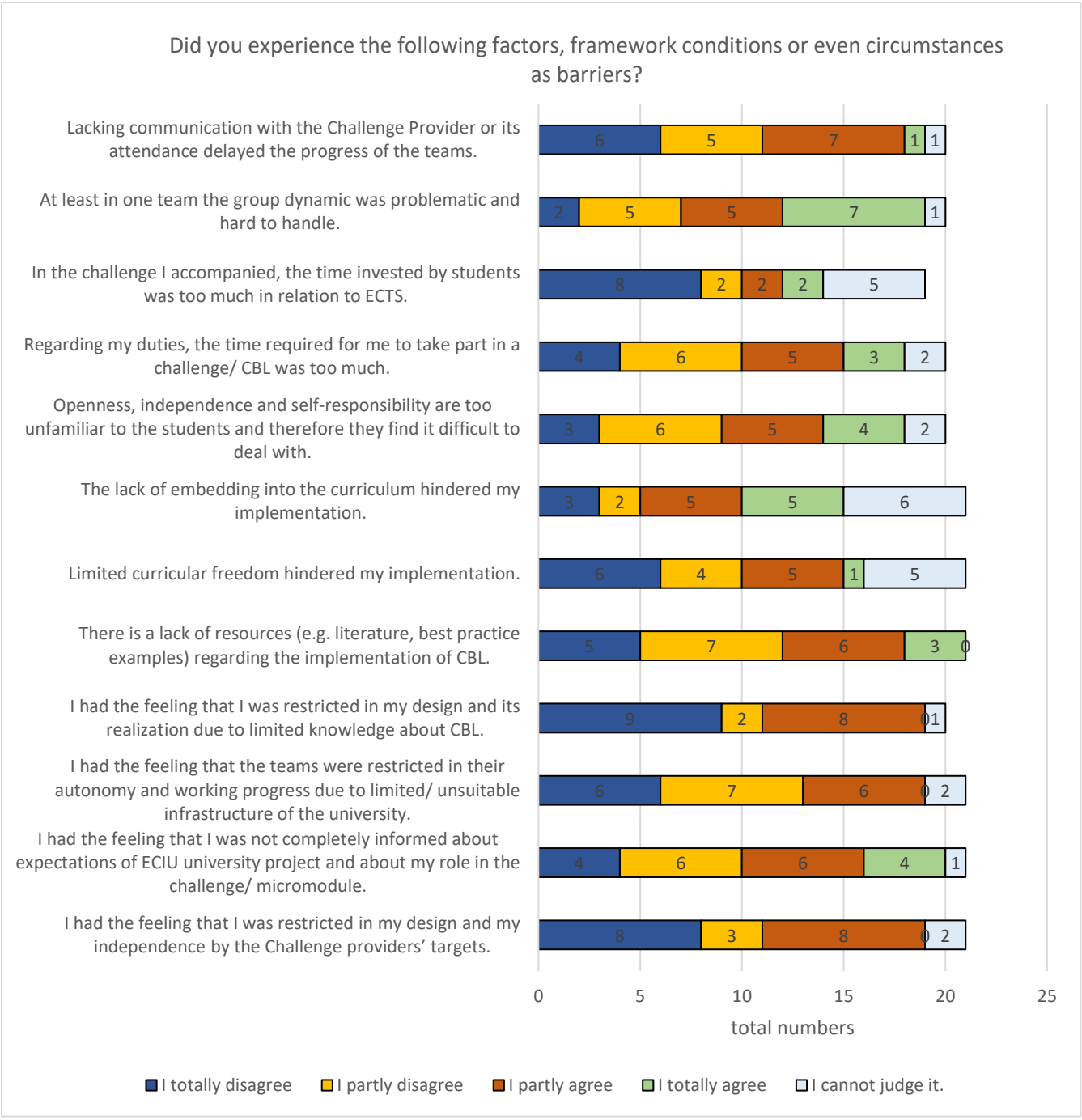

Figure 10: Barriers to CBL as experienced by tea(m)chers

Another crucial factor that may support or hinder the implementation are the relations with **external stakeholders**. On the one hand, tea(m)chers – as well as students (see section 3.2.2) – acknowledge the additional knowledge, networking recourses, stimulating real-world atmosphere and "real job experiences" (P2, Int 3, T1) that experts from the field and especially external challenge providers may bring in. On the other hand, involving external partners increases the complexity level even more and forces tea(m)chers to negotiate and handle the (potentially differing) understandings, expectations, objectives, roles and needs of the involved parties (Ellinger/Mayer 2021; Mayer et al. 2022 forthcoming). According to the survey, more than half (11 out of 20) of the respondents feel that "Lacking communication with the challenge provider or its attendance delayed the progress of the teams" (Fig. 10, question 1). Nonetheless, 13 out of 20 experienced the challenge provider as being "actively supporting" the implementation (Fig. 8, question 1).

3.2.2 Students' perspective

The students who talked to us 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**. One student (P2, Int 6, S1) particularly praises the motivational and administrative efforts that her*his university and faculty make to foster Challenge-Based Education. In contrast, others state that the way their elective CBL course was integrated into their study program was rather confusing and could have been coordinated/communicated better (P2, Int 5, S1+2) or that the timeframe of the challenge was (too) tight.

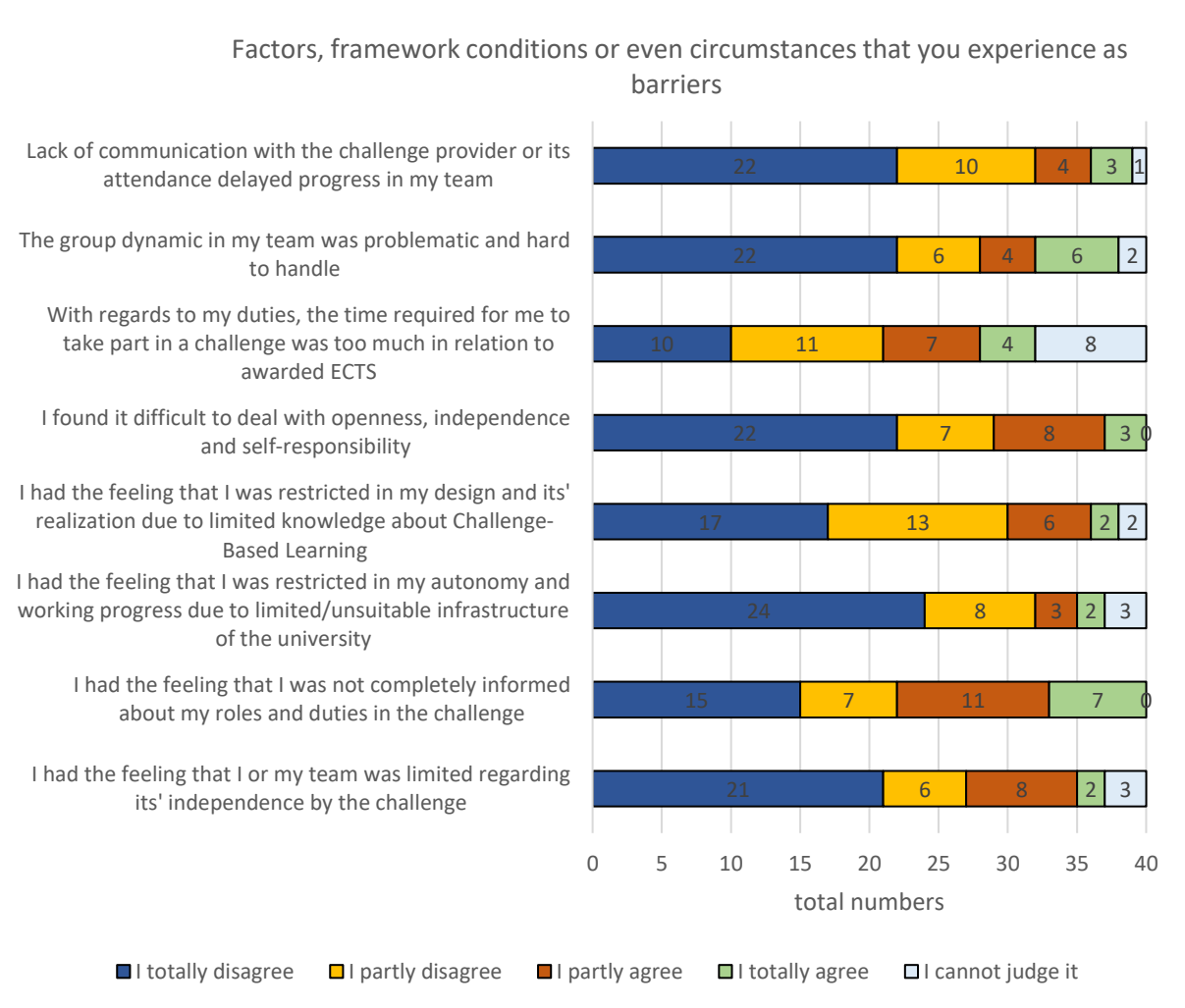

Figure 11: Barriers to CBL as experienced by students

In terms of learning conditions, the interviewed students, too, bring up the issue of not being able to see each other in person. Especially with regards to team building and bonding, instead of only meeting "online on the screen", they would have preferred to "meet physically" (P2, Int 4, S2). At the same time, at least one interviewee spots considerable advantages in a digital setting: "On the part of the teacher and organization and everything, it was easier online. For example, the challenge providers could stay at their office and still be, instead of saying 'Oh, I can't come because it is two hours away from my office'. […] That was helpful. Also, the fact that we were just on Moodle. And that we could just go and click and check what we have to do, etc., instead of sending an e-mail, what we would have done if it were in presence." (P2, Int 4, S2)

In view of judging the invested study time in relation to other duties, the survey draws a pretty mixed picture and shows a relatively large proportion of undecidedness (Fig. 11, question 3). In the interviews, however, five out of six students expressed their discontent with the given timeframe. More precisely,

they feel that they were not able to use the given time efficiently and to undergo the engage, investigate and act phase in due time:

> "For me in the retro perspective, it feels like that this challenge or the task of the challenge was a bit too much for the four weeks working period. […] We had such a broad task, we could have literally done everything and usually you need this time to gain ideas and evaluate them. That's what we actually did all the time, like every meeting in subgroups or the whole team, it was like finding a new idea, new solution, withdraw what we had before. Which is totally fine as like what S2 said, gave us opportunities. But like we needed that time really to figure out what to do. It was a bit sad after that then we had a vision what to do, because then we ran out of time." (P2, Int 4, S1)

Another interviewee describes how he*she and their team struggled to shift perspectives and actions from PBL to CBL: "For me, it was quite difficult, at the beginning I had a lot of problems. The problem was not to find a solution at some point of Challenge-Based Learning, it was to find a challenge. And my team-mates […] didn't know how to do that, they didn't understand how it was working. And so, they were looking for the problems and the solutions." (P2, Int 5, S2)

As these students' quotes suggest, it took them considerable time and energy to finally understand and to adjust to the formerly unfamiliar concept and process of CBL. Hence, they would like to have gotten an introduction to CBL which provided them with a more vivid and practical impression of the phases and principles:

> "An explanation, how Challenge-Based Learning works. How do you find a challenge? How do you implementing it and finding solutions – that's something most people know how to. But how to find a challenge, how to build a challenge from nothing. How to find the problems instead of solving them. Something that would explain it and explain it in a way that would be very pedagogical. That explains it well and simply. Maybe an example, a video example, where you could see a team that is doing it. You just see the steps and you see what they are doing each step. You see the project and the steps. They do this and this and this and this. That would help, I think." (P2, Int 5, S2)

In the survey, 22 out of 40 respondents fully agree that they "got a helpful introduction into Challenge-Based Learning", while five partly or totally disagree to this (Fig. 12, question 9). About one third felt "completely informed about my roles and duties in a challenge" (Fig. 11, question 7). With regards to the process of understanding how CBL is supposed to work and their roles and agency therein, several interviewees missed not only clearer examples and explanations, but also more guidance and a more instructive feedback from their tea(m)chers: "We needed help with how was this working, because it is a process. And this process, we didn't know it was working. We would like to be guided through the process. Have people who are like 'Oh, what you are doing is […] good. Or […] 'you should be doing like this.' Instead of just saying 'Well, do it.'" (P2, Int 5, S2). In the survey (Fig. 12, question 4), 25 out of 40 students state that they "had regular feedback from a teacher or teamcher accompanying the challenge". 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. To the interviewees it is not sufficient when they are just being assured that whatever they do is fine: "[The teachers] say 'Yes, it's good, it's good.' But when you are completely lost, it is nice to say 'This is the good way'. But we don't know where the good way is." (P2, Int 5, S2) Yet, these same students admit that even though they were offered several consultation meetings with a teamcher (in addition to talking to their teacher), they did not take these opportunities because they did not see the sense in it. This, again, 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.

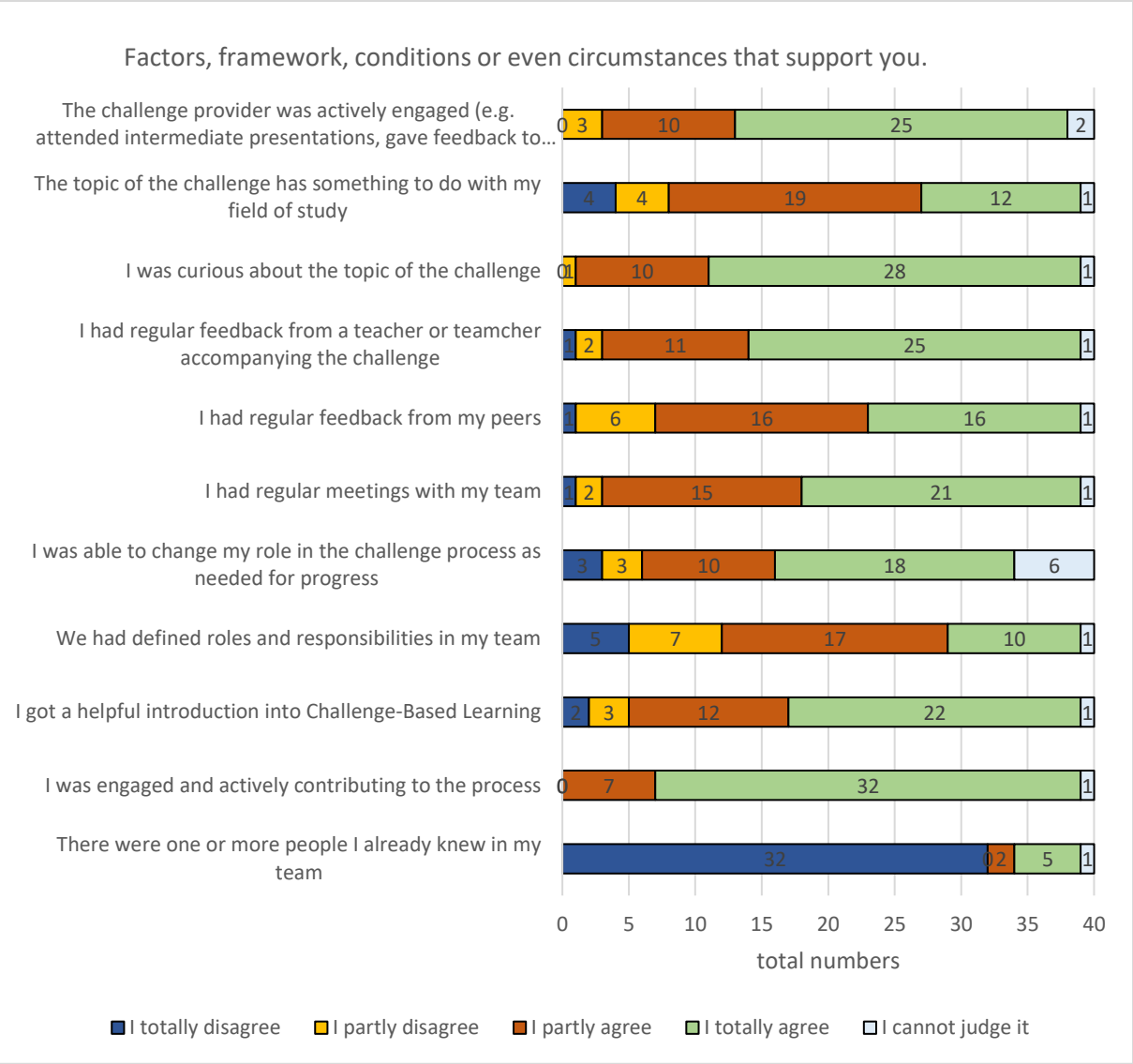

Figure 12: Supporting factors as experienced by students

Notably, the supporting factors item with the highest score of total agreement (80%) and not a single disagreement reads "I was engaged and actively contributing to the process" (Fig. 12, question 9). Also, at least in retrospective more than half (22 out of 40) believe that for them, it was *not* "difficult to deal with openness, independence and self-responsibility" (Fig. 11, question 4). This suggests that in the end, students are quite confident about their personal contribution, agency and self-efficacy in implementing a challenge and making it a success – despite intermediate periods of insecurity or frustration and even if their self-perception may at times diverge from their tea(m)cher's judgement.

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 forthcoming). 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 potential for real-world impact as well as for their careers. Thus, engaging with externals is a privileged source for an eagerness "to do it good, we need to do it better. We need to address the people. We can't deliver something boring." (P2, Int 4, S1) 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 dis-appointment, emotional stress and/or overworking (P2, Int 4). 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. 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 own pursuing their own ideas. According to the survey, 25 out of 40 students assess the challenge provider as actively engaged (Fig. 11, question 1), while seven totally or partly agree that lack of communication with the provider or its attendance delayed their progress (Fig. 11, question 1). Still, about 50% of the students agree that for them, "it was challenging to find a balance between personal learning goals and expected demands of other stakeholders" (Fig. 6, question 1). This, again, stresses the challenging task and responsibility of the tea(m)cher (or challenge coordinator) to constantly manage complex role-expectations of the various parties involved as well as to carefully balance pedagogical and external concerns.

4 Summary and Discussion

In the sections above, we identified motivations, goals and acquired competencies as well as supporting and hindering factors with regards 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 from Pilot 2, we have now been able to deepen our insights derived from Pilot 1 and to enrich (or sometimes contrast) the tea(m)chers' perspective this 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 1 and 2 points to certain needs with regards to future implementations and support. In very brief, they can be summarized as follows:

<u>Tea(m)chers:</u>

- **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 provider** 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 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 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 provider.**
- 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).

Besides from these needs, the interviewed tea(m)chers and students have formulated a number of inspiring ideas for further developing CBL, for including of life-long learners and/or towards establishing multinational, multidisciplinary challenges. Even if these visions cannot be elaborated here and will have to be presented elsewhere, the following quote from a student may give a little taste:

"Students from all over Europe working together to solve Europe's problems. I think it would be something very interesting." (P2, Int 4, S2)

5 Outlook

As mentioned above, a Review and Assessment Workshop on 26th October gave us the opportunity to present and discuss our findings from Pilot 2 with experts and practitioners of the ECIU partner universities. At the moment, the results from the plenary discussions and working groups are being systemized and processed for future use.

In parallel, we are revising our interview guidelines and survey structure to make them fit to recent research gaps and interests (e.g. integrate the perspective of life-long learners; learn more about the students' self-perceived learning outcomes). Like the previous one, the upcoming student survey will be a joint activity of WP3, WP4, WP7 and WP9. We are looking forward to starting our investigations of Pilot 3 in the fall/winter term 2021/22.

A detailed documentation of activities that have been recently undertaken and that are planned to support the Innovation of Education Labs is provided in Ellinger 2021.

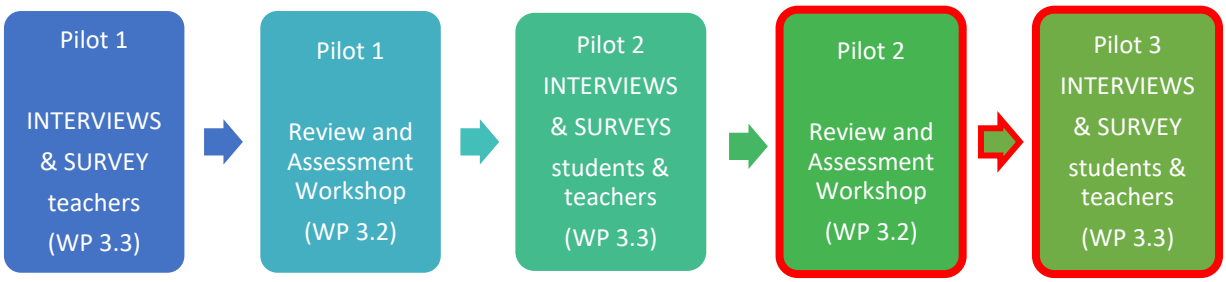

Figure 13: Timeline and review design towards Pilot 3 (red squares indicate recent steps)

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7 List of Appendices

1 Guideline for tea(m)cher interviews

2 Guideline for student interviews

3 Tea(m)cher survey

4 Student survey

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