A8.1, O5: Report on challenge-based education practices

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Beneficiaries

- Aalborg University, Denmark (AAU)
- Dublin City University, Ireland (DCU)
- Hamburg University of Technology, Germany (TUHH)
- Institut National des Sciences Appliquées de Toulouse, France (INSA Group)
- Kaunas University of Technology, Lithuania (KTU)
- Linköping University, Sweden (LiU)
- Tampere University, Finland (TAU)
- Universidade de Aveiro, Portugal (UA)
- Universita degli Studi di Trento, Italy (UniTrento)
- Universitat Autonoma de Barcelona, Spain (UAB)
- University of Stavanger, Norway (UiS)
- University of Twente, The Netherlands (UT)

Abstract

Challenge-based learning (CBL) is a pedagogical approach defined as “a learning experience where the learning takes places through the identification, analysis and design of a solution to a sociotechnical problem". It is described as typically multidisciplinary, to take place in an international context and to aim to find an environmentally, socially and economically sustainable solution. (Malmqvist et al. 2015)

Within ECIU University, CBL is one of the focus areas to enhance the co-operation between ECIU partner universities and to promote students’ generic skills in various ways. To find out the experiences of the first CBL pilots within ECIU University, a group of interviews, a survey and an analysis of the best practice presentations have been conducted during Winter 2021. This report summarizes and discusses the findings of these reports.

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1 Background

Integrating challenge-based learning (CBL) into higher education is one of the central objectives of ECIU University. In CBL driven courses students learn not only the substance skills stated in the course's learning objectives but also valuable generic skills, such as project management skills, teamwork skills, presentation skills and experience from working within international settings.

To identify factors that affect – either support or hinder – the implementation of CBL in universities, this report summarizes together three analyses conducted by ECIU University WP3:

- 5 explorative expert group interviews with a total of 11 participants from four ECIU Universities: Universidade de Aveiro (UA), Linköping University (LiU), Tampere University (TAU) and Hamburg University of Technology (TUHH)
- An analysis of the best practice presentation (Kaunas University of Tehcnology (KTU), Tampere University (TAU), University of Twente (UT), Aalborg University (UA) and University of Stavanger (US) from workshop Basic Principles in January 27, 2021
- A survey to gather both quantitative data as well as more detailed information, (altogether 25 respondents – 3 tutors, 12 teachers, 2 CBL experts, 2 Challenge Coordinator and 6 who did not state their role – from 7 partners of the alliance).

These interviews and surveys were organized by TUHH (Gesa Mayer, Siska Simon and Dorothea Ellinger, and summarized as reports by Gesa Mayer and Dorothea Ellinger).

In the following chapters, the findings of these three analyses are summarized. It should be noted that the deliverable contains results from altogether 7 ECIU member universities. Originally, according to the project plan, the scope of the deliverable was 11 member universities. Due to some timing constraints, the number on participating universities was reduced. Most importantly, however, the current report provides a comprehensive overview of the current ECIU University developments on CBL practices.

2 Attitudes and personal perspectives

According to both the interviews and to the survey, the respondents reported a **high level of initial intrinsic motivation** that led them to start working with CBL. The informants felt that CBL could introduce them to a different, up-to-date, and improved way of teaching. In the survey 16 out of 20 totally agreed and 3 partly agreed to the statement "I am interested in new pedagogical practices" (Figure 6, page 10). Also 16 out of 20 totally agreed and 3 partly agreed to the statement "I was curious about the topic of the challenge" (Figure 6). Only a minority stated that there has been any kind of incentive to motivated them. Mostly additional support addressing pedagogical issues of CBL (7times) or an award to the students for best challenge solution (6times) were mentioned.

CBL was depicted in the interviews as being a sophisticated constructivist approach, emphasizing characteristics such as student-centeredness, multi- or cross-disciplinarily, and real-life relevance. Results of survey showed very similar results about it. Figure 1 summarizes statements in which respondents switched into student's perspective support this view.

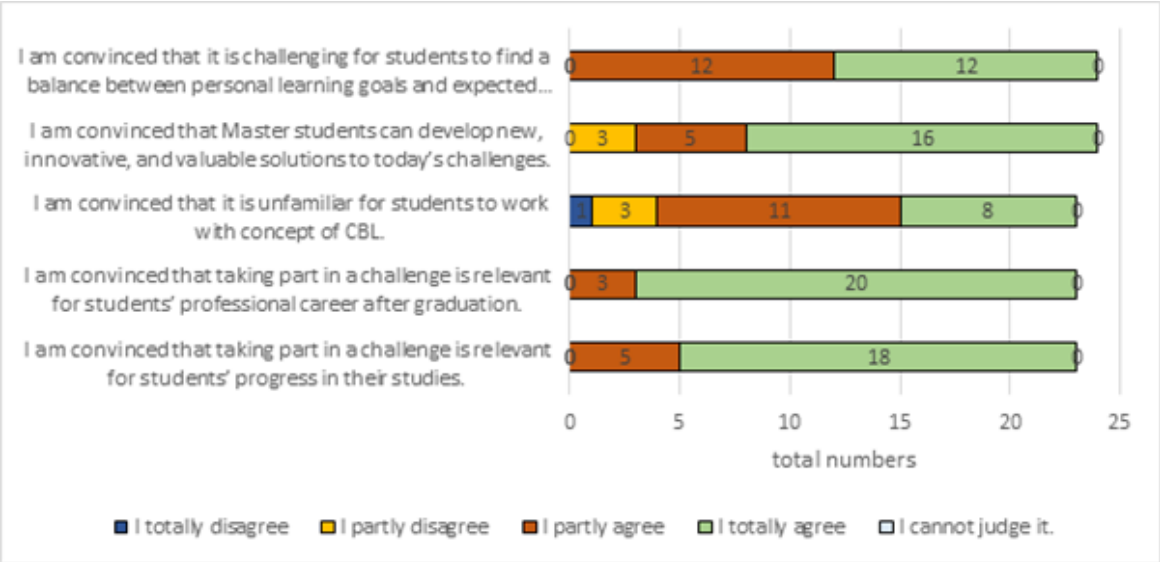

Figure 1: Perspectives on Students in CBL

With regards to their implementation practices and their roles therein, respondents of the interviews described designing and doing CBL as an exciting "experiment" not only for the participating students but also for the teachers themselves, inevitably turning them into learners too. Despite the fact that the complexity of the concept and its implementation pose high demands on students as well as on the staff (in terms of personal engagement and time investment, acquisition of new and unfamiliar knowledges and skills, negotiation of tasks, duties, and expectations as displayed in Figure 2), respondents stated that all in all, **engaging in CBL has been a decidedly rewarding experience for them**. This impression was highly supported be 22 out of 23 persons that attended to the survey and agreed that "it has been worthwhile or rewarding to engage within CBL"

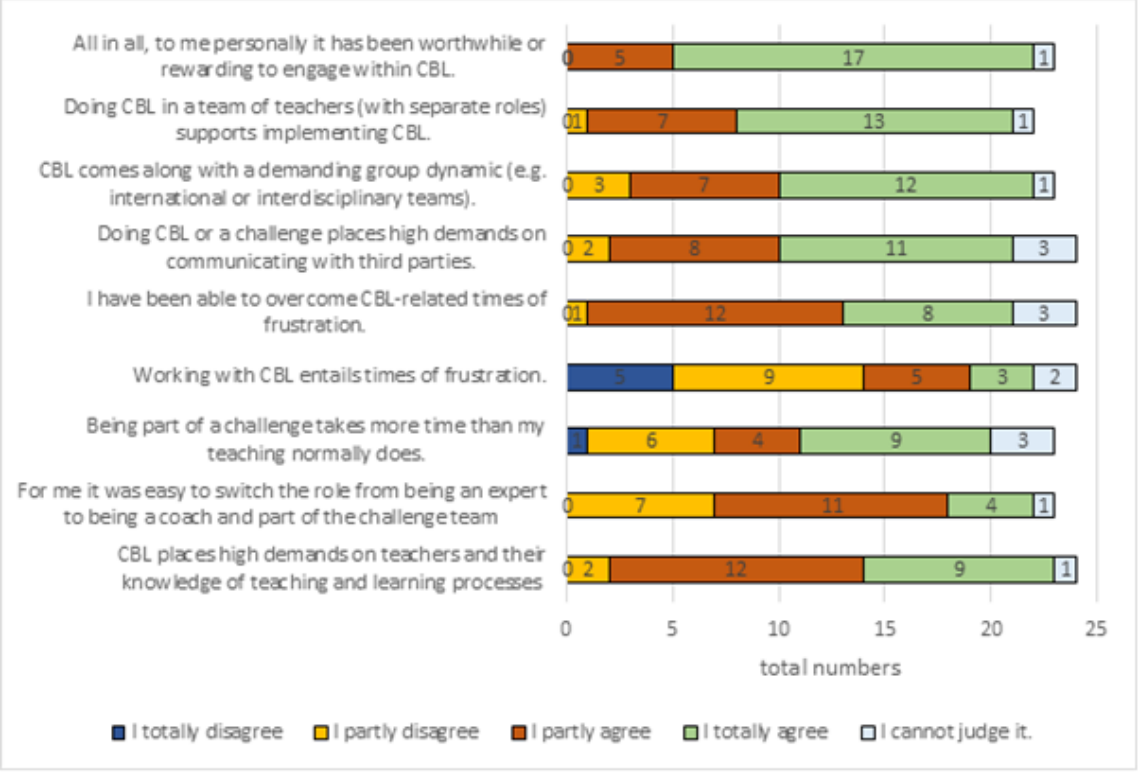

Figure 2: Personal perspective as member of the challenge team

Even though the experiences from the respondents were very positive, it is important to remember that the respondents most likely consisted of persons who are eager to test and adapt new pedagogical methods and were thus positively oriented towards the pilot. If the ECIU University plans to enlarge the use of CBL pedagogy more widely, it is necessary to present the advantages of the use of CBL pedagogy to teachers as well as to give teachers enough time to adapt the ideology of CBL in their own courses.

3 Affecting factors

In the interviews and the survey, the following factors that can either support or hamper the implementation of CBL were analyzed:

- culture (points of view and policies of the involved parties)
- rules and structure
- personal resources and attitude
- working conditions
- academic staff/colleagues, and
- student attitudes and competences.

The implementation may be affected in positive or negative ways by the **cultures and agendas of different actors** from within or outside of the university. In the survey report, one interviewee compared the relationship between the "university people" and the project team to "a divorced couple", with the university side strictly insisting on "university goals and the course plans, […] the assignments, all the boring things" (Interview 1, B1), while the project part had no sense for those restricting regulations. Similarly, another interview partner suggested that the notion of what counts as knowledge and the overall teaching/learning culture prevailing at universities of technology put certain hurdles to the implementation of CBL. Another major issue concerning university culture and regulations is the desired inclusion of students and teachers from ECIU partner universities into joint CBL-projects. Here, some informants report that key administrative prerequisites regarding, for instance, the enrolment and participation of exterior and international students have not been established yet.

In the survey, roughly half of the teachers (including tutor teachers) agreed (totally or partly) that "Regulations limited the implementation of CBL in my teaching". Regulations addressing teaching quality management as regulations about learning goals and intended learning outcomes as well regulations about assessment were among three most often mentioned regulations as displayed in Figure 3. As expected, based on the regulations about how to enroll as an international student in own university as those to prevent COVID-19 were often experienced to limit CBL implementation.

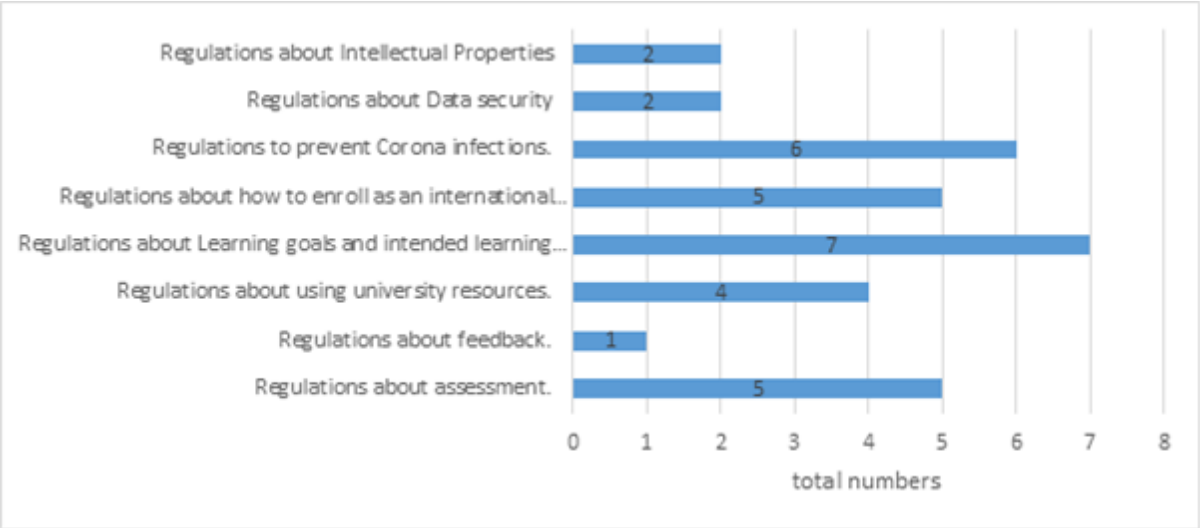

Figure 3: If you chose "I totally agree" or "I partly agree" please state the subject of regulation that limited you. Multiple choice possible

The surveys also recognized the crucial role of the **external stakeholders**. Those respondents, who worked with external partners, did not only report the difficulty to negotiate one's own and the students' ideas and expectations with those of the external stakeholders, but the lack of presence and engagement of the **Challenge Provider,** may disrupt the process too. Thus, the authors of the survey report recommend that when discussing the implementation of CBL, the relationship with the Challenge Provider should be considered as critical.

Additionally, more detailed information about what kind of experience the respondents have of different stakeholders was asked in the survey. Results indicated a positive atmosphere. Figure 4 shows that stakeholders directly involved in ECIU University project were experienced as actively supporting, and near colleagues or other members of the institute, as well as presidiums, were experienced as either supporting or at least interested in the majority of the answers.

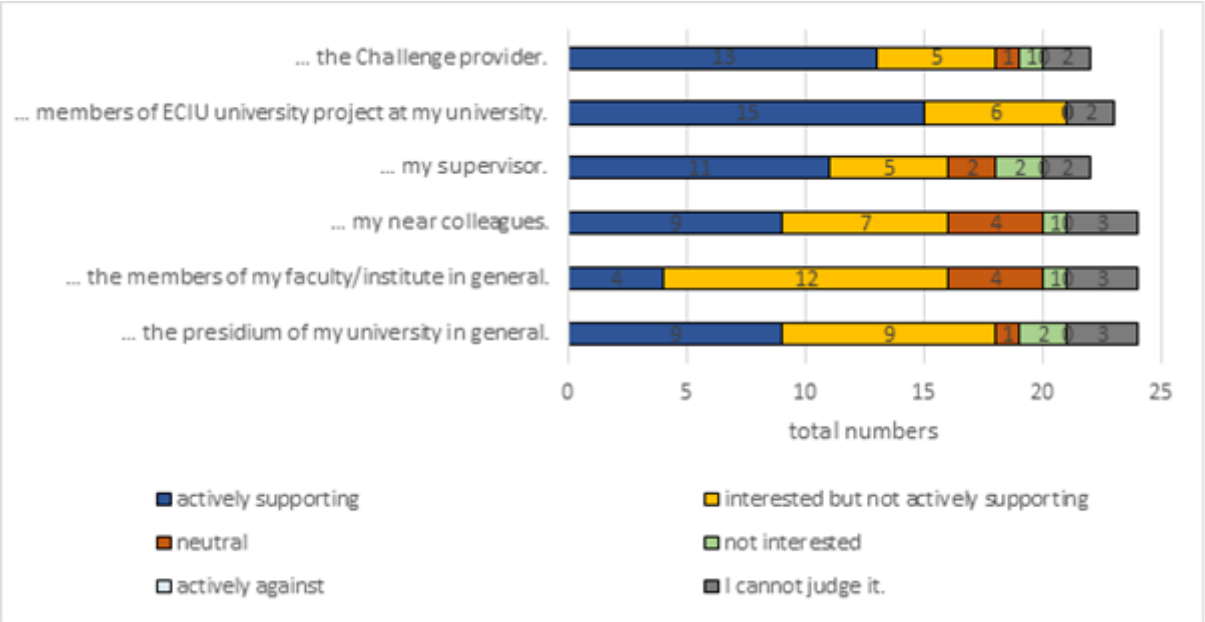

Figure 4: In the survey, the respondents were asked: "Regarding my tasks in implementing CBL, I experienced the following as..."

Related to culture (approaches and agendas of different actors) but also touching on questions of **didactic and personal resources**, some interviewees were reported having experiences of uncertainty with regards to implementing CBL "correctly". For instance, two interview partners went through a "phase of frustration" due to being confronted with conflicting interests and ideas of the Supervisor, the International Office and the local CBL expert. In the survey, 14 out of 22 disagreed (totally or partly) and 8 agreed (totally or partly) that "Working with CBL entails times of frustration" (see Figure 2 earlier). Especially those who had not worked with CBL or similar formats before deplore a lack of specifications as well as best practice examples that could give orientation and prepare for the new role that differs from traditional teaching.

According to the reports, respondents called for **clearer and more binding definitions and vocabulary** (i.e., an agreement on what exactly the word "challenge" refers to), supportive didactic resources like a handbook, the opportunity to formalize and transfer the knowledge they have gained throughout pilot 1 (or previous work) in order to pass it on to those who are going to do follow-ups, and a platform or database where challenges could be published. These would give both teachers as well as their students more vivid and comprehensive examples of what CBL may actually look like. In the survey overall picture had not been clear and half of the respondents had felt limited in their implementation due to missing knowledge (Figure 5).

According to the interviews and survey, implementing CBL brings along **an extra load of labor** for teachers. Especially when it contains supporting and supervising the students and negotiating with the university or the Challenge Provider. In survey 12 persons had agreed (total or partly) that "Regarding my duties, the time required for me to take part in a challenge/ CBL was too much" and 8 disagreed (total or partly) as displayed in Figure 5.

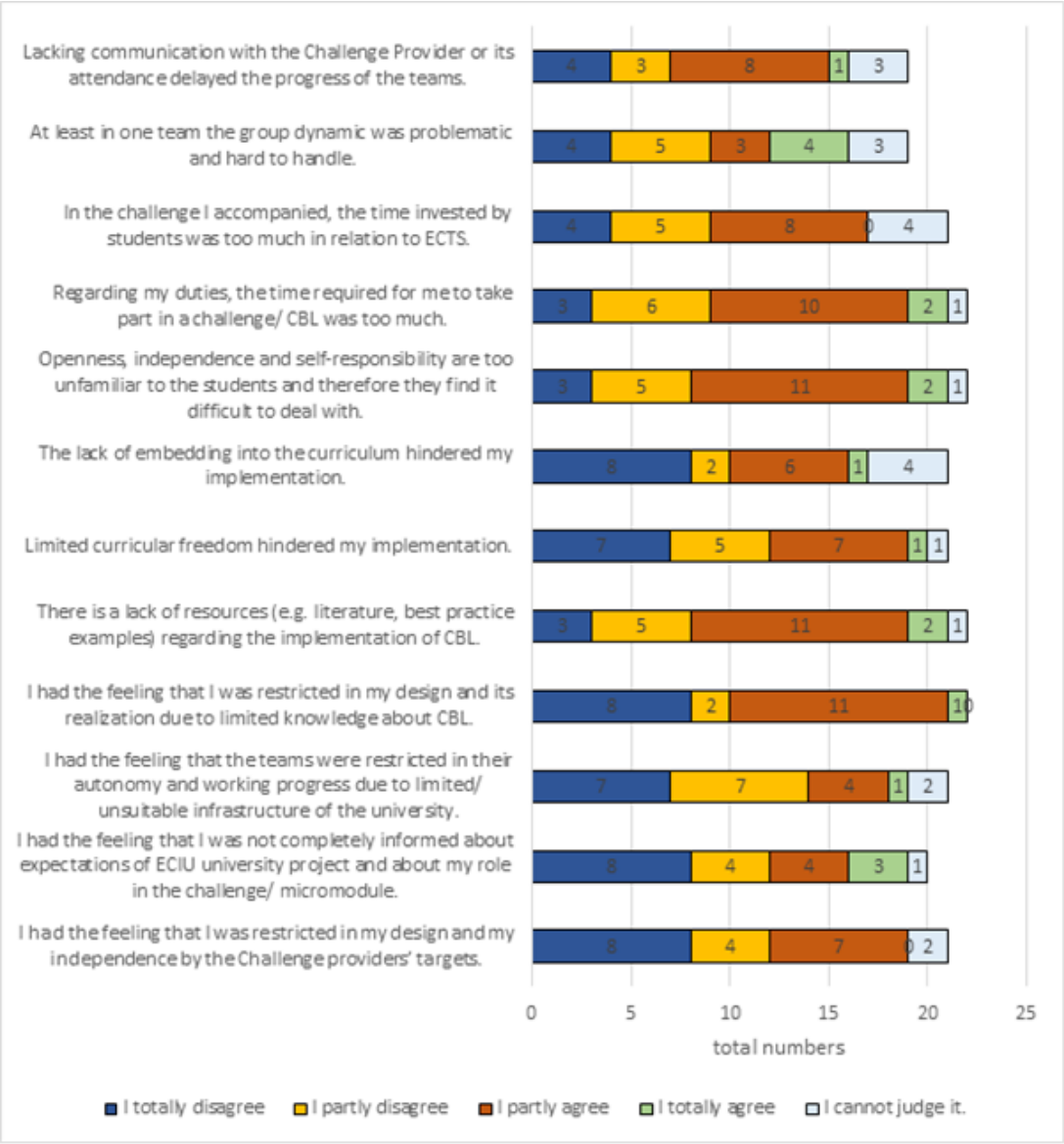

Figure 5: Did you experience the following factors, framework conditions or even circumstances as barriers?

According to the survey report, all respondent showed a great deal of enthusiasm for CBL. This **personal engagement was seen as a major driving force** in implementing it, for the respondents were willing to invest a considerable amount of their time and energy. On the other hand, CBL's complexity and costliness was recognized as a potential obstacle, for if the teachers (and the administrative staff) are not ready or able to spend that much time on it, it will hardly be implemented successfully and sustainably. In the survey all factors mentioned in the interviews to hinder implementation were mentioned but for nearly every one of those a 50:50 distribution on agreement and disagreement were stated. There was not a single factor found to be more important than other.

Another important factor highlighted in the reports was the **working conditions**. These are composed of the involved cultures (i.e., the university's and other partners' values and policies; see above), the budget allocated to the projects, available teaching/learning spaces and equipment as well as the number of courses or curricular units and students the teacher has to take care of. In addition, precarious working appointments (e.g., short-term contracts, freelance teaching) may contradict the teachers' ability to further progress into CBL. In times of the COVID-19 pandemic the issue of digitalization (available resources, IT infrastructure, personal competences) is an important factor.

Some interview partners who taught an all-online seminar did not experience the necessary physical distance as interfering with the quality of communication and teamwork. In contrast, two interviewees who held a hybrid course mentioned to find it hard to address both groups simultaneously and difficult to foster this dialogue within and between the teams due to technical barriers.

The **academic staff and colleagues** who may support the implementation process were also mentioned as another affecting aspect. All interviewed partners and three out of five best practice examples worked in teams or tandems. In the survey, two out of three respondents stated that they had a colleague supporting them in team-teaching or regular meetings (Figure 6). Team-teaching was highlighted as an important facilitator in the interviews. As indicated in the Figure 6, the participants of the survey also positive experiences of having an actively engage challenges provider and an access to additional information and support.

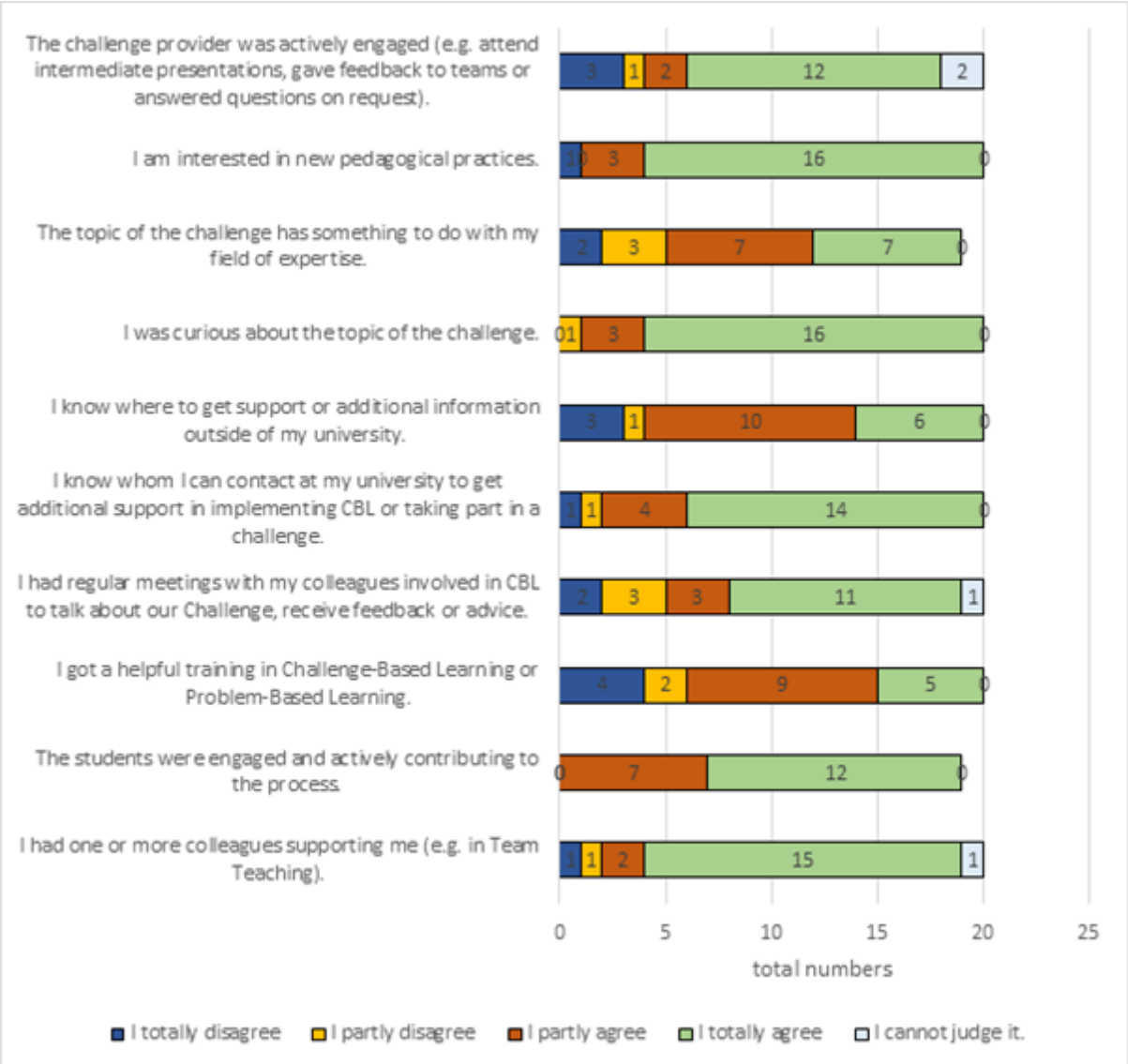

Figure 6: Please share your experience of what factors, framework conditions or circumstances support you in the implementation of CBL/ challenge.

Acknowledging that CBL seems to be quite demanding for the students in terms of workload and in terms of adjusting to an unfamiliar methodology, several interview partners were reported being delighted by their students' feedback. Same were true for the survey in that 100 % of respondents either partly or totally agreed in the statement "The students were engaged and actively contributing

to the process." Regarding **competencies that students may bring along**, respondents found it helpful for their implementation if the students have previously participated in similar learning formats (e.g., Project-Based Learning), if they already have a certain (common) pre-knowledge of the topic, and/or if they are Master's students and thus (expected to be) already trained to work and think independently.

4 Conclusions

This report was based on two reports in which participants from ECIU partner universities had been interviewed or surveyed, in addition to which, a best practice presentation from workshop Basic Principles (January 2021) had been analyzed by TUHH experts. The reports focused on the experiences of CBL from seven partners of the ECIU alliance.

The reports focused on two themes: the attitudes and personal perspectives towards using CBL as a teaching method and affecting factors to promote or hinder the use of CBL. According to the reports, the teachers who had started working with CBL have reported a high level of intrinsic motivation and their experiences in engaging in CBL have been rewarding. These results are promising and suggest that CBL as a pedagogy is worth considering to be used more widely. However, it is important to recognize that the 11 interviewed persons and the 25 survey respondents represent only a small group of personnel in the ECIU member universities and their attitudes towards testing new pedagogical ways of education have probably already been positive.

In the reports, six factors affecting the use of CBL were analyzed: culture, rules and structure, personal resources and attitude, working conditions, academic staff/colleagues, and student attitudes and competences. It was recognized that implementing CBL requires an extra load of labor both with regards to negotiating with the challenge providers and with the supporting and supervision of the students. The relationship with the challenge provider was described to be critical for the success of using CBL as well as the adequate presence and the engagement of the challenge provider.

The need for clearer definitions was also raised as an important issue in the reports. Starting from the fact that there has not been even any common agreement on what the term "challenge" refers to, there was a need for a handbook consisting of examples of what CBL may actually look like and for a platform where challenges could be published.

The support of academic staff colleagues was also an important affecting factor, especially the in the form of team-teaching. Working conditions, on the other hand, can be a hindering factor, if e.g., the workload of the teacher is already too high or if the teachers are working in short-term contracts which may contradict the teacher's ability to further progress into CBL.

In addition to the experiences of the teachers, the reports remind that CBL can be demanding also for the students in terms of workload and adjusting to an unfamiliar methodology. However, all the respondents felt that the students who had taken part in a CBL experiment, had been engaged and actively contributing to the process. Additionally, the respondents experienced f that it was helpful if the students had previously participated in similar learning formats (e.g., project-based learning) or had pre-knowledge of the topic, or were Master's students and thus already more capable of working and thinking independently.

5 References

Beyerlin S., Gotzen S., Linnartz D. (2020) *Herausforderungen für Lehrende beim Forschenden Lernen*. In: Wulf C., Haberstroh S., Petersen M. (eds) Forschendes Lernen. Springer VS, Wiesbaden. https://doi.org/10.1007/978-3-658-31489-7_12

Bulmann U., Bornhöft S., Ellinger D. (2019) *Barriers and enabling factors for engaging engineering students in research. A multi-perspective approach*. In: Proceedings of the 47th Annual SEFI Conference. Annual Conference of European Society for Engineering Education (SEFI). Budapest (Hungary), 16-19 September 2019, pp. 1458-1468.

Feixas, M., Fernández, I., Zellweger, F. (2014) *What factors affect learning transfer? Academic development in perspective*. Paper presented at the ICED Conference 2014: "Educational Development in a Changing World", Stockholm.

Malmqvist, J., Rådberg, K. & Lundqvist, U. (2015) *Comparative Analysis of Challenge-Based Learning Expriences*. In: Proceedings of the 11th International CDIO Conference, Chengdu University of Information Technology, Chengdu, Sichuan, P.R. China, June 8-11, 2015.

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