

## CBL Assessment @ UT – recommendations and examples for teachers

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### Introduction

The UT has embraced Challenge Based Learning (CBL) as a promising educational framework to equip students with the knowledge, skills and competences needed to tackle current and future societal problems ([UT vision on Learning and Teaching](#)).

The last decade has seen an increasing attention in the literature for CBL, including literature reviews (Gallagher & Savage, 2020; Leijon et al, 2021). However, only few authors have given attention to how to assess in CBL courses (Nicols et al, 2016; Membrillo-Hernández & García-García, 2020; Valencia et al, 2020).

In discussions with UT-teachers that use CBL in their courses, we often notice that they too struggle with assessment in their CBL-course: what should they assess, how should they assess and how to come to a final assessment and grade. Based on interviews with 17 teachers about how they assess in their CBL-course and comparing this with the literature, we come to the recommendations below for how to assess in a CBL course.

In the appendix you can find more detailed information on eight investigated aspects of assessment in CBL including examples of how these aspects are executed in different courses, a list of references and an overview of the courses included in the research.

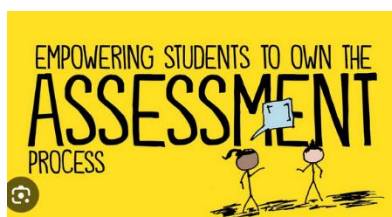
#### CBL and assessment

According to Gallagher & Savage, formative and summative assessment is included in CBL courses, different formats of assessments can be applied, individual and team effort is taken into account and often assessment rubrics designed by the teachers are used (Gallagher & Savage, 2020). Nicols et al indicate that the content understanding, real world skills and the process of CBL should be included in the assessment (Nicols et al, 2016). Membrillo and Garcia-Garcia (2020) found that checklists and evaluation rubrics are 'most objective and clear, according to teachers and students'.

### Recommendations

*\* give students a greater role in their assessment.*

In CBL, the students can (at least partly) decide for themselves what they want to learn and how to do that. Continuous reflection on their own progress and development is also part of CBL. As students are evaluating themselves during their learning, it makes sense to also give



Source: Spencer, 2020

them a formal role in the assessment of their learning. A nice way of doing this is asking students at the beginning to write a Personal Development Plan in which they indicate what they want to learn, how they are going to do this and why this is important to them. In addition, students could define the criteria for how to measure success and for achieving these personal objectives, and let them repeatedly reflect on their progress towards their goals (with peers, a tutor or the

teacher). In the end the student should discuss their learning with the teacher to come to a joined assessment.

Asking for the why of their learning is important, as it makes the students think about the relevance of the new material for themselves which increases their motivation for studying. Asking the student to indicate the success criteria lets the student think already at the beginning what quality criteria are relevant, thus directing their study and efforts. Repeated reflection on their progress and learning is also important, as it helps the students monitor during their learning process whether they still are on the right track, and if not, take action to improve.

\* *assess with the focus on learning instead of on a grade*  
CBL is all about learning. Assessment therefore should also stimulate the learning of the students. As grades are known to lead to less and more shallow learning (Ryan & Deci, 2000; Knesek, 2022; Kohn, 1999), it would be good when the assessment in CBL does not include a grade and rather continue to stimulate the learning of the student. Using a single point rubric has this potential (Fluckiger, 2010). The single point rubric describes per criterium what is the expected level and has two additional columns, one for tops (what did the student do well) and tips (what needs improvement). This combination of what is good and what can be improved will stimulate further learning. An additional advantage of the single point rubric is that it can also be used during the learning process and can be used by the student themselves for (continuous) self-assessment.

According to the Self Determination Theory, autonomy, competence and relatedness are key ingredients to determine intrinsic motivation (Deci & Ryan, 1985). Deci and Ryan also found that extrinsic stimuli (like grades) have a negative effect on the intrinsic motivation (Ryan & Deci, 2000). This is corroborated by other research that shows that giving grades leads to less and more shallow learning (Knesek, 2022; Kohn, 1999).

\* *include more (peer) feedback on more moments*

Feedback is a strong stimulus of learning. The same goes for peer feedback, where particularly the *giving of peer feedback* has the most effect on learning (Chanski & Ellis, 2017). In CBL, students should continuously document, share and reflect. This gives many opportunities for (peer) feedback. Teachers could include this continuous sharing and giving

Feedback is known to have a positive impact on the learning of students (Hattie, 2009; Hattie & Timperley, 2007). When peer feedback is used, the giving of peer feedback has the most learning effect (Chanski & Ellis, 2017).

(peer) feedback much more in their CBL-course, not only after every phase (Engage, Investigate, Act) but even within every phase. When students are asked to use distinct formats for how to share their findings on different moments, this would also stimulate multiple communication skills as well. It is important to ask the students to share not only their (content) results, but also their (reflection on their) work processes, team work and their learning from working on the challenge so far. It

also helps when the students include a tip for and question to their fellow students in every sharing moment. Before giving peer feedback, it would be good to let the students together define the quality criteria for every deliverable in the course, as this (co)defining of criteria makes students feel more connected to these criteria and as a result use the criteria more.

\* *include more reflection throughout the course*

Reflection is included in many CBL-courses, but in most courses only at the end. Continuous documentation, sharing and reflection is central to CBL. To enhance the learning in a CBL-course, more moments for explicit reflection should be included. This reflection can have different formats like written statements, reports, oral reflection, short videos etc. The reflection can also be linked to the sharing that students do in different phases and steps as indicated above.



Phases in CBL, including continuous documenting, reflecting and sharing.  
Source: [challengebasedlearning.org](http://challengebasedlearning.org)

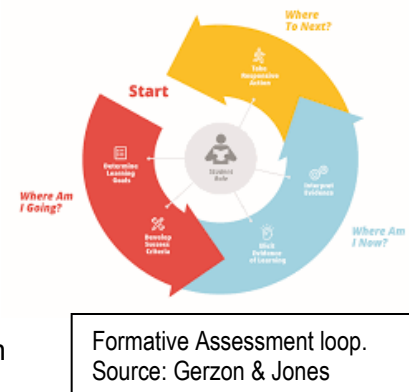
\* *assess different skills too*

CBL offers the possibility to acquire different skills, like cooperation, leading a team, critical analysis, finding relevant sources etc. Currently assessing skills is often limited to only writing and presenting skills. Assessment of other skills can be included as well, as long as these are included in the learning objectives of the

course. As CBL is all about the learning of each individual student, each individual student could define what skills they want to develop and how they will show they have mastered this skill. As described above, a Personal Development Plan can be used for this. For the assessment of different skills peer feedback can be used. In CBL students work in teams, so students will be able to give feedback to their peers on e.g. cooperation, leading teams, contribution to the work etc. Using a single point rubric or an EMRN-rubric (a rubric that distinguishes 4 levels of the criterium: Excellent, Meets the criterium, Revision needed, Not assessable; see Mazur, in Boor et al, 2021; Talbert, 2016) could be useful for feedback on and assessment of skills.

*\* use feedback and reflection as indication of progress, decrease/delete assessment at end*

Continuous documentation, sharing and reflection is central to CBL. This sharing and reflection provides relevant information on the progress of students, at every moment in the course. The teacher could use this information to evaluate whether students are on track at these moments, and give relevant feedback to stimulate further learning. These moments of evaluation can be regarded as a kind of assessment, without being a summative assessment. All moments together give sufficient information to the teacher to assess whether each student has achieved the (personal) learning objectives, especially when this information is combined with information from the self-assessment by the student. As a result, it might be possible to reduce or maybe even delete the summative assessment at the end of the course entirely.



## Appendix: Background

For this investigation we interviewed 17 UT-teachers that currently use CBL in their course. We used semi-structured interviews with nine questions with pre-coded answers and 10 open questions. Additional information was collected from the Canvas pages of each course.

The results were analysed across courses and within courses, and evaluated on eight aspects.

Below you can find a brief discussion of each aspect, including examples of how this part of assessment was executed in one or more courses. These examples are included for inspiration. If you have questions on these examples, please contact the respective teacher for more details.

### 1. What is assessed: content, skills, competences? What is the outcome?

In all but one course the content is assessed. In approx. 60 % of the courses skills are assessed, but in practice this often means only presentation and writing skills. In 15 courses a grade is the final outcome, only two courses have a pass/fail.

As CBL is all about learning and stimulating further development and grades are known to lead to less and shallow learning (Knesek, 2022; Kohn, 1999), it is remarkable that so many teachers still choose to complete their CBL-course with a grade.

#### *Example of assessment of skills assessment*

\* Minor Course Enterprise Software for the Integration of Administrative Processes: uses a detailed assessment form for the challenge. Students write a challenge report and include a team reflection in every step of CBL, where they reflect not only on the content but also on the process of working, the cooperation and the use of feedback received from the teacher.

#### *Example of assessment with pass/fail*

\* Master course Civil Engineering Challenges: uses 4 separate single point rubrics for the four different parts, with a description of the expected level of each criterium, and room for tips, tops and evidence. The student and teacher together discuss and decide on the results in the rubric.

### 2. Format for assessment

Many different formats for assessment are used in the courses. All but one course use a rubric, a single point rubric or a list of criteria for the assessment.

#### *Examples formats for assessment:*

\* Minor course Climate Change with Spatial Engineering: explaining the challenge via a story map on a special website, individual substantiation in oral interview, Personal Development Plan, poster.

\* Master course Clinical Biotechnology: paper, presentation, individual interview where student proposes topic and grade

\* Master course Weather Impact Analysis: formative assignments: designing a trigger model, challenge proposal, attribution assignment on climate change and disaster, reflection report. Summative assignments: individual pitch via a short video, written magazine article.

### 3. Assessment in group, individual or a combination

In 12 of the courses, the assessment is done on both the group level as well as on the individual level. Four courses only have individual assessment, one course only group assessment.

#### *Examples of group and individual assessment*

\* Master course Civil Engineering Challenges – group assessment: presentation on deliverable and impact study; individual assessment: Personal Development Plan, reflection and oral exam

\* Master course Subsurface Structure Engineering – group assessment: peer review of the challenge definition, observation of the group process; a video as presentation of the end product; individual assessment: individual interview

#### *Example of individual assessment*

\* Bachelor course Climate Change with Spatial Engineering – explaining the challenge via a story map on a special website, individual substantiation in oral interview, Personal Development Plan, poster.

#### *Example of group assessment*

\* Minor Course Enterprise Software for the Integration of Administrative Processes: the group works on a challenge and has to hand in several deliverables (pass/fail). The final assessment is on the group report and a group presentation. For the assessment of the report, an elaborate assessment form is used.

### 4. Reflection part of the assessment

In 12 courses reflection is part of the assessment. In nine courses the individual reflection is evaluated, in one course it is a compulsory individual hand-in but not evaluated. In two courses reflection is only one of many criteria for the group report.

Constant reflection is one of the central ideas of CBL. As such, one would expect that reflection would be included in all courses and on more moments than only at the end as one of the deliverables. We did not see examples of courses where students were asked to reflect multiple times.

#### *Example - reflection without assessment*

\* Master course Weather Impact Analysis – students have to hand in a 2 page reflection report with leading questions like ‘what task/day did you like most and why? What key fact/result intrigued/surprised you the most? What was your biggest ‘hurray’ moment so far? What was the most valuable realization for you? Handing in this report is compulsory but is not assessed, students can make an appointment with the teacher to discuss the reflection.

#### *Example – reflection with assessment*

\* Master course Civil Engineering Challenges – students have to write a Personal Development Plan at the beginning of the course. In this PDP they write down what they want to learn, how they are going to do that and what evidence they will supply. This PDP is assessed with pass/fail in week 4. At the end, they have to write a reflection report on their personal development, as indicated in their PDP. The student evaluates their self-reflection with a single point rubric supplied by the teacher. In the oral exam at the end of the course, the student and teacher together decide on how the student scored on the rubric.

## 5. Formative assessment / feedback included

In the majority of the courses feedback was included. In eight courses both the teacher and the peers give feedback to the students on multiple occasions, in two courses only the teacher would give feedback multiple times, and in one course only the students would give feedback to their peers.

Constant sharing is part of the CBL-philosophy. Every moment of sharing could also be a moment for feedback, both by the teacher as well as by the students. As such, one would expect that all courses would have multiple moments for teacher and peer feedback.

### *Examples of peer feedback at multiple moments*

\* Master course HRM and Innovation – students hand in two assignments (without their names on it), and receive feedback from a peer based on a list of criteria.

\* Minor course From Idea to Prototype – students use the programme Buddy Check to give feedback multiple times to the peers in their team, based on several pre-defined criteria on cooperation and team work.

## 6. Student roles in assessment

In eight courses the students can define own personal learning objectives. In only half of the courses the students have a role in the assessment, either by co-defining assessment criteria, co-assess or both co-define assessment criteria and co-assess.

In CBL students have a large role in their own learning, including defining their own personal learning objectives and success criteria. One would therefore expect that students would have a role in their assessment.

### *Example co-define assessment criteria:*

\* Bachelor course Semester 2 project in ATLAS – students define their own individual learning goals for the project and the relevant quality criteria for these goals.

### *Example students co-assess:*

\* Master course Clinical Biotechnology – the student starts the oral assessment interview with a brief presentation and their proposal for the final grade, then discusses the content, their approach and their self-evaluation with the teacher and together decide on the final grade.

### *Examples students co-define criteria and co-assess:*

\* Master course HRM and Innovation: students create together with the teacher the criteria for the assessment of the challenge. The criteria are used by the students when giving peer feedback, and by the teacher when assessing the students.

\* Master course Civil Engineering Challenges: for the four deliverables of this course, the students co-create the assessment criteria with the teacher; these are translated into a single point rubric. For the Personal Development Plan, the student also has to self-assess and discuss the outcome with the teacher. The teacher and student together decide on the final assessment.

## 7. Role of stakeholders in assessment

In five courses the stakeholders give feedback to the students, in three courses the stakeholders give advice to the teacher on the assessment, in only one course the stakeholder co-assesses. What was remarkable was that 5 courses indicated that they have no stakeholder involvement at all.

In CBL, the students should involve the stakeholders in all phases of the CBL process: to learn about the stakeholders' perception of the challenge, to learn from the stakeholders to understand the problems, to hear about the impact the solution has on the stakeholders. Ideally, the stakeholders will learn as well during the CBL process, because of this active involvement. As a consequence it is strange that some courses indicate they do not have stakeholders. And because of this involvement of stakeholders, one would expect they would be asked for feedback in every course, and maybe also give input for the assessment.

#### *Examples of stakeholder feedback*

\* Master course Introduction to Humanitarian Engineering – students have to make a poster about their challenge solution, and present this. Stakeholders are invited and discuss the poster with the students and give feedback. Stakeholders are also invited to vote for the best poster award.

### **8. Assessment with large groups (150 students)**

More than two-thirds of the teachers indicated they would use the same format of assessment, but would need some additional teacher capacity when 150 students would participate in their course.

#### *Example of assessments for large groups*

\* Minor course From Idea to Prototype – summative assessment is done via a group report, an individual reflection and a presentation; the latter is assessed by both peers as well as by experts.

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## **References**

- Biggs, J. and Tang, C. *Teaching for Quality Learning at University, what the student does*. 4<sup>th</sup> edition, 2011. Open University Press
- Chanski, S, and Ellis, L. (2017). 'Which Helps Writers More, Receiving Peer Feedback or Giving It?' *English Journal*, 106 (6), 54-60.
- Deci, E.L.; Ryan, R.M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum. doi:10.1007/978-1-4899-2271-7. ISBN 978-0-306-42022-1.
- Fluckiger, J. (2010), *Single Point Rubric: A Tool for Responsible Student Self-Assessment*. Teacher Education Faculty Publications. <https://digitalcommons.unomaha.edu/tedfacpub/5>
- Gallagher, S. E., & Savage, T. (2020). *Challenge-based learning in higher education: an exploratory literature review*. *Teaching in Higher Education*, 28(6), 1135–1157. <https://doi.org/10.1080/13562517.2020.1863354>
- Gerzon, N. & Jones, B. *The Student Role in Advanced Formative Assessment Practice: Self-Assessment, Peer Feedback, and Discourse*. Formative Insights – Assessment for learning . An Initiative of WestEd. <https://csaa.wested.org/wp->



[content/uploads/2020/10/The-Student-Role-in-Advanced-Formative-Assessment-Practice.pdf](#)

Hattie, J. (2009) *Visible Learning – a synthesis of over 800 meta-analyses relating to achievement*. Routledge, London

Hattie, J, and Timperley, H, (2007), *The Power of Feedback*. Review of Educational Research, March 2007, Vol. 77, No. 1, pp. 81-112. <https://doi.org/10.3102/003465430298487>

Knesek, G.E. (2022) *Why Focusing on Grades Is a Barrier to Learning. Instead, Lean into Experimentation, Discovery, and Students' Innate Desire to Learn*. Harvard Business Publishing Education, <https://hbsp.harvard.edu/inspiring-minds/why-focusing-on-grades-is-a-barrier-to-learning>

Kohn, A. (1999) *From degrading to de-grading*. High School Magazine, March 1999  
Downloaded from: <https://www.mayfieldschools.org/Downloads/fromdegradingtode-gradingkohn.pdf>

Kohn Rådberg, K., Lundqvist, U., Malmqvist, J., & Hagvall Svensson, O. (2018). *From CDIO to challenge-based learning experiences – expanding student learning as well as societal impact?* European Journal of Engineering Education, 45(1), 22–37.  
<https://doi.org/10.1080/03043797.2018.1441265>

Leijon, M., Gudmundsson, P., Staaf, P., & Christersson, C. (2021). *Challenge based learning in higher education– A systematic literature review*. Innovations in Education and Teaching International, 59(5), 609–618. <https://doi.org/10.1080/14703297.2021.1892503>

Mazur, E., *Making failure a learning tool for collaboration skills* in Boor, I., Gerritsen, D., Greef, L. de, Rodermans, J., (2021) *Meaningful assessment in interdisciplinary education – a practical handbook for university teachers*. Amsterdam University Press

Membrillo-Hernández, J. and García-García, R. M. (2020). *Challenge-Based Learning (CBL) in Engineering: which evaluation instruments are best suited to evaluate CBL experiences?* 2020 IEEE Global Engineering Education Conference (EDUCON), 885-893.

Nichols, M., Cator, K., and Torres, M. (2016), *Assessment*, in Challenge Based Learning Guide, Digital Promise and The Challenge Institute, pp. 24–26.

Rådberg, K.K., Lundqvist, U., Malmqvist, J., & Hagvall Svensson, O. (2018). *From CDIO to challenge-based learning experiences – expanding student learning as well as societal impact?* European Journal of Engineering Education, 45(1), 22–37.  
<https://doi.org/10.1080/03043797.2018.1441265>

Ryan, R. M.; Deci, E. L. (2000). *Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being*. American Psychologist. 55 (1): 68–78.  
<https://doi.org/10.1037/0003-066X.55.1.68>

Spencer, J. (2020) *Empowering Students to Own the Assessment Process*.  
[https://www.youtube.com/watch?v=8WxvVgXC\\_NY](https://www.youtube.com/watch?v=8WxvVgXC_NY)



Talbert, R. (2016) *Specifications grading with the EMRF rubric*  
<https://rtalbert.org/specs-grading-emrf/>

Valencia, A., Bruns, M., Reymen, I. M. M. J., & Pepin, B. E. U. (2020). *Issues Influencing Assessment Practices of Inter-Program Challenge-Based Learning (CBL) in Engineering Education: The Case of ISBEP At TU/e innovation Space*. In Veen, J. van der, , Hattum-Janssen, N. van, Järvinen, H.M., Laet, T. de, & Dam, I. ten (Eds.), SEFI 48th Annual Conference Engaging Engineering Education, Proceedings: Proceedings (pp. 522-532). Twente University. <https://www.sefi.be/wp-content/uploads/2020/11/Proceedings-DEF-nov-2020-kleiner.pdf>

#### Websites:

UT-website on CBL: <https://ut.onl/0lyrxag>

UT vision on Learning and Teaching, <https://ut.onl/eq1z2e7>  
[www.challengebasedlearning.org](http://www.challengebasedlearning.org)

#### Overview of courses included in the research

Course name	Bachelor/Master	Elective/compulsory
Weather Impact Analysis	Master	Elective
Software Evolutie	Master	Elective
Semester 2 project in ATLAS – sustainable transportation	Bachelor	Compulsory
Clinical Biotechnology	Master	Elective
Minor From Idea to Prototype	Bachelor	Elective
HRM and Innovation	Master	Elective
Minor Adapting to Climate Change with Spatial Engineering	Bachelor	Elective
Introduction to Humanitarian Engineering	Master	Elective
Minor New Technology & Business Development	Bachelor	Elective
CBL in Master Robotics	Master	Compulsory
B2B marketing	Master	Elective
Minor Enterprise Software for the Integration of Administrative Processes	Bachelor	Elective
Climate Transition the IJsseldelta	Master	Compulsory
NanoTechnology Design Project	Master	Compulsory
Subsurface Infrastructure Engineering	Master	Elective
Minor Regional Sustainable Development	Bachelor	Elective
Civil Engineering Challenges	Master	Elective