EWUU vision on CBL

Project Innovative didactic concepts
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Preface
The charge of the project team Innovative didactic concepts has been to create a didactic concept for Challenge Based Learning for the alliance. A concept starts with a vision. From this vision, we derived a proposal on how to organize challenge based learning within the alliance.

Based on this vision a "handbook" has been constructed to provide anyone interested in Challenge Based Learning in the context of the alliance with information on this concept and with ready to use tools for their own education. This handbook can be seen as an interactive and living guide for our different stakeholders.

Vision on Challenge Based Learning
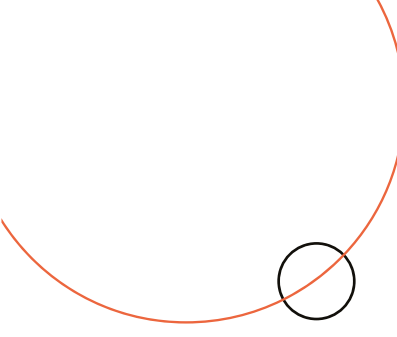
Creation of this vision
This document presents the alliance vision on Challenge Based Learning. To create this vision, we organized a series of design thinking sessions with diverse stakeholders (steering board; alliance students; alliance academics). These sessions were led by three main questions:

- Future needs and developments in education;
- The alliance as a context for educational innovation;
- Challenge Based Learning as a didactic concept

1.1   Future needs and developments in education

The suddenly forced state of relative hibernation that the world faced in 2020 and 2021 has taught us some rather significant lessons. A miniscule crown shaped virus has provided us with the ultimate empirical evidence that indeed everything is connected to everything. It turned out that a Chinese food market is connected to the global political and economic order in more ways than we ever could have imagined. It has forced us to re-evaluate the ways in which we conceptualize and organize our world (Bauman 2007). A reappreciation of things and processes that we consider essential.

The year 2020 has also provided us with many instances that made us reconsider this thing we call education. Of course, it is not new to rethink education and learning especially in instances where education was dealing with highly complex, techno-scientific problems. Education in times of the pandemic merely functioned as a catalyst for such reconsiderations and a push towards trying to do education differently. From an alliance perspective, we were already focused on blended education as the norm before the pandemic hit. During the

pandemic, we saw that much of our everyday education could also be provided in online modus. However, the imposed shift to online education also brought to the fore that there are some ingredients that had often been largely overlooked, but now proved to be essential for learning. This highlights the need for an appreciation of the role of subjectification in education (Biesta 2015) and education as open ended becoming (Pickering 2007). A characteristic of education that proved difficult (if not impossible) to organize in an online or hybrid setting. Therefore, in this vision we look forward to a post-pandemic situation, where we focus on education that requires the emancipation of learners to become the owner of their learning trajectory and on education that follows the needs of the learner.

From an educational perspective, the crown shaped virus has acted as an affirmation that education should not be conceived as the transfer of knowledge, but as a guided interaction (dance) between learner and the world this learner attempts to engage with. It is no news that many of the major challenges that the world is facing today are highly complex, wicked, global and at the same time very local. In all cases, science and technology are to be regarded as part of the wickedness, rather than the external providers of analysis and solutions. Obvious challenges, amongst others, are climate change, future energy provision, and distribution of food (see https://sdgs.un.org/goals). In these challenges, it is key to consider the techno-scientific sides and opportunities of these challenges, highlighting the need for explicit attention to responsible use of science and technology in a societal context. It is common knowledge, but this particular instance does provide us with the opportunity to rethink how education is linked to the grand challenges of our time and the position of education as an actor in the world. It raises questions like:

- How can we organize our education in such ways that the real-world challenges are put central stage and that it is oriented at making relevant contributions and adhere to problem solving? [Fluid education / nomadic education / Assessment as formative feedback loops]
- Do the traditional roles and definitions of students and teachers still hold up? In the light of notions like lifelong learning, we might need to focus less on education as a means for students to obtain diplomas, but more on enabling learners to become continuous learners. [Growth mindset / reflexivity]
- What does education look like when it is geared towards transdisciplinarity, inclusivity and the fostering of diversity?

In summary, the world is changing and facing grand challenges and this requires professionals that are able to make impactful contributions to these challenges.

The challenge for our academic institutes is to organize education so that it is fit for educating academic professionals that are able to navigate cultural and disciplinary boundaries. This requires a shift away from knowledge transfer-focused education to a focus on the education of a reflexive and engaged attitude, aligning with the related required transformational skills and competences for sustainable development (Inner Development Goals). In doing so, educating professionals need the ability to embrace the uncertainties at play and adapt to changing circumstances. And finally, academic professionals require the capacity to re-think and rebuild organizational structures and think beyond traditional roles. Such a learning organization also requires a different role for the teachers (from lecturing to guiding).

1.2 The alliance as context for innovation of education

The strategic alliance TU/e, WUR, UU and UMC Utrecht is formed around the motto: Challenging future generations. We want our students, teachers, and researchers to be ready to take on the grand challenges in the world, in our education, and in science.

The combination of institutes offers a wide variety of academic disciplines and aims to be complementary in terms of disciplinary focus, meaning that the challenges can entail a unique combination of engineering, life sciences, natural sciences, humanities and social sciences. This provides our students and scientists with new possibilities to broaden the scope by collaborating with disciplines outside their own organization and to use the specialized expertise of these disciplines. In doing so, students are able to make use of the added richness of disciplines of all institutes and beyond. When we take the definitions of Stock and Burton (2011, see box at the end of this paragraph); from multi- or interdisciplinarity (for instance between two beta-studies or within one university) to transdisciplinarity (e.g between alpha and beta-studies, across universities, an in connection with the real world). The result is not just the sum of all the complementary content, but can also focus on partly overlapping content from different perspectives. By using a transdisciplinary approach and various integration techniques we learn how to cross and make use of the different disciplines to tackle both local and global challenges.

Next to expertise, the bundling of facilities and resources provides an additional array of possibilities. The increased scale and network of the alliance partners offers new opportunities to all partners to innovate, to be visible and to create a buzz of change. By offering transdisciplinary challenges, the alliance is able to explore broadly oriented academic talents across institutes. The combined expertise and niche-knowledge on state-of-the-art education can also serve as an accelerator for educational innovation. This can be found in the shared concept of Challenge Based Learning, in exploring different aspects of this didactic concept, for example self-directed learning, assessment for learning, and future learning spaces.

All institutes in the alliance are proficient in Challenge Based Learning, but have their own experiences, capabilities, and focuses. When combined, we do not only have access to this magnitude of experience, but also have the opportunity to create a shared vision and concept, that complements the visions and concepts of the different institutes. This leads to an added value for each individual institute. Common goals working on the same area of problems provide focus and make use of the added value in research and education. The alliance themes – preventive health and circular society – are good examples of this added value of the alliance and serve as important focus-areas for the future challenges in our research and in our research-based education.

From an educational point of view, the question is how we would like to use these advanced possibilities to create added value for all our students. The combination of our institutes offers an opportunity for our students to create a learning path not limited to the individual institutes. For that purpose, students need to have access to resources of different institutes and find all resources relevant to their development. Challenge Based Learning creates a powerful learning space for our students and researchers where they can meet new interesting people and ideas, learn how to collaborate and cocreate across disciplines, connect to different resources from our partners, and innovate together with different partners and ecosystems.
More detail on how we would like to shape CBL at an alliance level will be described in the next paragraph.

> **BOX - *Modes of cross disciplinarity***
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> *There are several ways in which the interactions between members of scientific communities (Lele and Norgaard, 2005) engage with each other and with the world. In engaging with complex or wicked problems, science might need to move away from singular descriptions to discursive (Norgaard et al 2009) post-normal scientific- ones (Funtowicz and Ravetz 1993) that embrace uncertainties, rather than try to reduce these, as the 'normal' scientific response would be. The different ways in which academic tribes and territories (Becher and Trowler 2001) relate to each other and to the world are often described in different forms of cross-disciplinarity.*
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> *In their review paper, Stock and Burton (2011) distinguish between Multi-, Inter-, and Transdisciplinarity. These are defined as:*
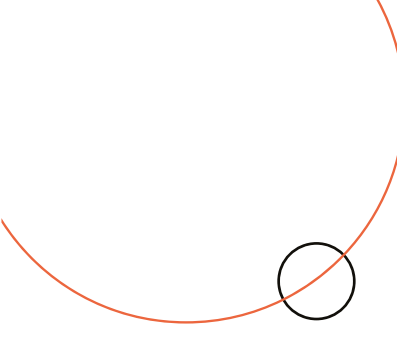>
> *"**Multidisciplinarity** is characterized within the literature as the least integrative from of integrated research—yet, equally, it is arguably the most attainable. Multidisciplinarity features several academic disciplines in a thematically based investigation with multiple goals— essentially, studies "co-exist in a context"" (pp.1095).*
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> *"**Interdisciplinarity** may be regarded as a step up from multidisciplinarity. Interdisciplinary studies focus on address ing specific 'real world' system problems and, as a result, the research process forces participants (from a variety of unrelated disciplines) to cross boundaries to create new knowledge" (pp. 1096).*
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> *"In this sense **transdisciplinarity** is the highest form of integrated project, involving not only multiple disciplines, but also multiple non-academic participants (e.g., land managers, user groups, the general public) in a manner that combines interdisciplinarity with participatory approaches" (pp.1098).*

1.3   Challenge Based Learning as didactic concept

Challenge Based Learning has been a growing approach in the educational landscape of higher education. The driving force of this model is to facilitate students in a self-directed and on-demand learning trajectory in which they perform highly authentic tasks in multidisciplinary teams in an equal partnership and mutual learning process with the academic world and practice to solve multi-complex problems. This creates an incentive mechanism for students to self-regulate their own learning process and the initiative to cross disciplinary knowledge boundaries to creatively build new knowledge, also regarded by Saywer (2004) as collaborative emergence. This emergence leads to a transdisciplinary collaboration needed to design and develop feasible and viable solutions. It motivates students to deepen and extend their knowledge and

develop disciplinary and transversal competences, needed for their future professional career and a lifelong learning mindset.

As mentioned, our society is currently facing a variety of local, national, and global highly complex and wicked problems. To prepare and guide our students to become complex problem solvers, Challenge Based Learning (CBL) offers a highly diverse and immersive cradle to discover which competencies and talents need to be (further) developed and nurtured to develop a professional identity.

The following principles form a configuration of Challenge Based Learning within the alliance TU/e, WUR, UU, UMC Utrecht with the aim to create a safe and highly motivating learning environment, which consists of immersive design characteristics to nourish personal and professional growth.

1.3.1 Principle 1 Highly complex problems

An authentic learning context is an important requirement for CBL. The first step in creating this is to present an authentic, highly complex problem. The alliance focuses on offering challenges on preventive health and circular society. A challenge agent, who is frequently also the problem owner, presents the problem to the students. The awareness that students can contribute in solving an authentic highly complex problem, that will benefit society, increases the motivation (Gaskins et al. 2015) and gives a sense of urgency and an impulse to the student's interests to engage in a collaboration to start a challenge. Another characteristic of the complexity of the problem is that different types of knowing (academic and non-academic), perceptions and experiences must be merged in order to develop a feasible and viable solution. Consequently, students become aware that they need to actively construct interdisciplinary ways of knowing and create consensus in order to merge this into an integrated and transparent view of the actual problem. This active involvement can transform into a state of flow when there is a balance between solving the problem and applying one's knowledge, skills, and attitudes (Csikszentmihalyi, 1979).

A problem is applicable for CBL if it has a certain level of openness, is ill-defined and transcends the specific disciplines in a sense that there is no one-size-fits all solution. The openness is also characterized by the fact that the challenge can lead to several solutions applicable for different stakeholders and end users. It is an incentive for students to engage in an ideation phase to develop different paths to solutions that requires testing and prototyping. In this manner' students experience that they can create impact by transferring their knowledge, skills and attitudes and apply it to solve a problem to create a better world (Newstrom, 1986) .

Dealing with uncertainty
An important side effect is that students are faced with uncertainties about how to solve the highly complex problem. They are triggered to explore the knowledge domains and expertise within the team and define the possible knowledge gaps. They investigate which other academic and non-academic disciplines are needed to fill those knowledge gaps to merge this into a SMART problem definition. They will also need to create a network of stakeholders and actively involve them in the gathering of knowledge by (empirical) research, interviews with stakeholders, and creative brainstorming sessions. This awareness creates a new incentive for students to investigate which additional competences are required to take the next steps in the challenge. During this phase they will meet with a coach to discuss their own learning needs and goals.

1.3.2   Principle 2 Community of Practice

Since students must deal with several unpredictable factors concerning the problem and the path towards a solution, a Community of Practice (CoP) offers a safe and rich learning environment. Community building is a crucial part of Challenge Based Learning and is created before students start with solving the challenge itself. Wenger, Trayner, and de Laat (2011) defined a CoP as a "learning partnership among people who find it useful to learn from and with each other about a particular domain. They use each other's experience of practice as a learning resource" (p. 9). Based on this definition it is evident that the challenge agent, the students, lecturers, coaches, (educational) management, internal and external stakeholders are part of the CoP. All members actively participate and negotiate in building a common ground based on shared values and goals such as respect for (cultural) diversity, a sense of connection and belonging between the members and the world, equality, a learning and sharing mindset and building trustworthy working relationships. In this way, students feel safe to iteratively explore and learn in trial-and-error modus.

A distinctive property of the CoP is that it facilitates the co-construction of interdisciplinary knowledge as a means of sustainable learning (Scholz & Steiner, 2015). In this process of co-construction, students are supported in their development by a rich formative and summative feedback- and assessment cycle. These cycles can be initiated on-demand by the student, a peer, a team or other members of the CoP. To nurture a mutual and equal learning community, the students will be guided in the development of feedback skills by a coach, peers and other members of the CoP. In addition to the on-demand feedback and assessment cycles, several mandatory milestones will be set to provide and share more formal feedback with the challenge owner and other stakeholders.
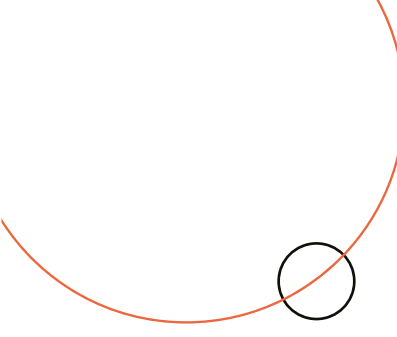
Next to giving and receiving feedback, a student has the opportunity to incrementally self-assess to receive formative and summative feedback. Assessing oneself requires time to develop certain skills and therefore a student can select this as an obligatory option. In this manner, students collaborate with a broad range of community members to identify the exact problem and subsequently, design a feasible and viable solution. This collaboration with several actors not only deepens their knowledge but also motivates and engages students to broaden their own network and get a glimpse of their future professional life (Garay-Rondero et al. 2019).

The alliance facilitates CoP's in hybrid forms, which means that students will be part of this community in an online as well as offline modus. A challenge can be offered in several different capacities (e.g., part-time/full-time, blended/offline/online) and this is leading for the configuration of the community.

1.3.3   Principle 3 Challenge agent and stakeholders

A highly complex problem has one or more problem domains and stakeholders. A CBL is initiated by a challenge agent. Usually, this is the first stakeholder that students need to pro-actively involve in the challenge. The challenge agent represents or can be the actual problem owner, can be a mediator between different stakeholders to promote solutions or has the influence to implement solutions in a viable manner. To provide students with an authentic highly complex problem, a challenge agent outside the academic world presents the problem in the form of an open assignment description. Dealing with this open-endedness and complexity requires an active approach for the students and the challenge agent to create co-ownerships and interact, negotiate and investigate to co-create solutions. Therefore, the challenge agent plays an engaging and active role in the CoP and in the development and unique scaffolding of the challenge.

The challenge agent co-creates in the CoP and is aware of their pro-active role in the learning trajectory of the student teams. With the students in the lead, the challenge agent is genuinely interested in the co-construction of knowledge, gives advice, approves, provides formative feedback, is available for interviews and connects students to experts in their network. The challenge agent is in that sense, next to being a problem owner, a facilitator that guides the students in the development of knowledge creation, skills and attitudinal conditions, and is aware that the quality of the final products can be diverse in terms of quality.

1.3.4   Principle 4 Learner agency

In the initial stage of setting up the CoP, students become aware that CBL also stands for being in control of their own learning and that they have the responsibility to take initiative, make decisions and set their own competencies. Next to defining mandatory team competencies, students have the flexibility to create their own palette of competencies on an individual-, team- and community level.

Students have the freedom to explore their talents, reflect on future careers and find windows of opportunity to experiment with new roles and tasks. To kick-start this, students are coached individually to help them reflect and overthink this set of learning needs that will create the on-demand center part for their growth. Students are also encouraged to find peers with similar and/or complementary needs and wishes so that they can actively learn and support each other. Sharing the outcomes of this learning with all the CoP members will nourish a common ground for growth.

Acknowledging and controlling your own competencies, expectations and managing the process toward these goals produces larger learning gains opposite to the more instructor-directed learning approach (Means et al., 2009). This also creates incentives to develop self-management skills and the need to develop reflective skills inducing reflection-on-action (the choices that were made) and reflection-in-action (learn how to adjust choices as they are made).

1.3.5   Principle 5 Growth, feedback and assessment

By participating in an alliance challenge, students can broaden their horizon by collaborating in cross-institutional interdisciplinary teams. Every student brings along a unique set of tacit and tangible knowledge, personality traits, motivations, talents, interests, and experiences based on their life's personal, professional and educational experiences and (cultural) background.

In coaching sessions, students explore which palette of competencies matches their learning- level and needs. There are three competency domains:

1. They can set competencies that are linked to their academic study and have a more disciplinary character. These competencies are linked to a specific bachelor and or master programme.
2. This set of competencies is related to solving highly complex problems in collaboration with the challenge agent. One can think of Analyse and understand, Critical and creative thinking, Design, Prototyping and testing, Networking and sharing.
3. They can set competencies that have a focus on career and life skills such as flexibility and adaptability, initiative and self-direction, cultural and social interaction, productivity and accountability, leadership and responsibility (Trilling & Fadel, 2009). To develop these competencies,

students need to grow into these competencies by developing them in different settings. The alliance therefore offers students challenges throughout their educational career.

The student is responsible for the development of these competencies. To faciliate students, the CoP offers several tools and learning activities. This will be initiated at the start where they will create a personal development plan. The student has several coaching meetings to create a jump-start to deliver a first version of this plan.

Collaborating and learning in cross-institutional CBL teams also creates opportunities to set competencies outside of the academic curriculum. In this manner, students can explore what it implies to become a life-long learner and discover which professional career opportunities are in line with their talents and skill set.

1.4   Conclusion and visual

In conclusion, the text above led the reader from the challenges the world is facing, through the alliance context to an educational vision for Challenge Based Learning in our alliance contact. In short, four principles and five key characteristics as designed. All is summarized in the visual below.

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