THEME 1. HIGHER EDUCATION FOR SOCIETAL ISSUES

In an effort to contribute to solutions for complex societal issues, institutions of higher education organize new collaborations between disciplines both within and outside of the institution. What are the tasks of higher education in the process of tackling societal issues? And what implications does this have on the direction and execution of both research and curricula? This theme focuses on the role of higher education in working on societal issues.

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ESSAY

Introduction

Grand societal challenges such as the transition to cleaner energy production or the provision of good and affordable healthcare cannot be understood or tackled by a single academic discipline or a group of professionals with the same background. To address these complex problems and reach sustainable development goals (SDGs), a transdisciplinary effort of scientists, engineers, governments, companies and citizens is required (Tejedor et al, 2017; Khoo et al, 2019). Through joint efforts they can shape the knowledge, technologies, behavior and societal structures that are needed to resolve or mitigate these challenges. However, fruitful collaboration among these groups is challenging. Differences in disciplinary background, interests and values may lead to conflicting perspectives on how societal challenges should be defined, approached, and tackled (Fischer et al, 2011).

In practice, transdisciplinary competences are still weakly developed. Typically, people adopt narrow, disciplinary perspectives on design or problem-solving processes, resulting in the development of partial rather than systemic solutions, e.g., a new artefact without taking into account the consequences for behavior and skills of users, or wider societal consequences. Academically and professionally schooled problem-solvers are often guided by their disciplinary concepts and methods while losing touch with the events and perspectives of people their solutions target (Montuori, 2013). They tend to solve problems for society, not with society. They take views of users, citizens, and other stakeholders into account, but do so from their own disciplinary and professional framing and fail to really include these stakeholders and their perspectives into the design process (Buchmüller et al, 2021).

Higher education can play a key role in the development of the transdisciplinary competences needed for tackling societal challenges. They prepare students for future jobs and can equip them with the necessary skills to work in a volatile, uncertain, complex, and ambiguous world. They can also motivate them to cross disciplinary and societal boundaries and take responsibility for transforming society and reaching SDGs. Formats like project-based or challenge-based learning are suitable for that. Actual challenges provide an authentic and engaging learning context within which students of different backgrounds can jointly apply and advance their knowledge, develop transversal skills, collaborate with stakeholders, and directly contribute to societal transformation in a local situation (Kohn Radberg et al, 2018).

Challenges of Transdisciplinary Education

Research universities and universities of applied sciences increasingly integrate projects and challenges into their curricula, in which students analyze and solve problems of external stakeholders. However,

these projects often remain monodisciplinary or multidisciplinary (Gallagher & Savage, 2020). This may be related to a tendency to pre-structure projects to make sure that students can reach disciplinary learning outcomes, or uneasiness of teachers with guiding and assessing learning outside their expertise (Visscher-Voerman et al, 2019). Transdisciplinary education, to its full extent, finds its way into curricula only with difficulty.

Transdisciplinary education moves beyond multidisciplinary and interdisciplinarity education (De Greef et al. 2017). "A transdisciplinary view, informed by systems and complex thought, addresses the larger whole, the context, the relationships and interactions, and the many dimensions or system levels that emerge in the process" (Montuori, 2013, p.48). It takes into account all relevant disciplinary and societal perspectives of a challenge, which may be different each time. This requires an integral approach, in which all components of the educational configuration are aligned in a coherent manner (cf. Van den Akker, 2003, in order to provide an optimal context for student learning (see figure 1). At the same time, the configuration should be open for contestation and conflicting perspectives. Resolving these is part of the transdisciplinary learning process.
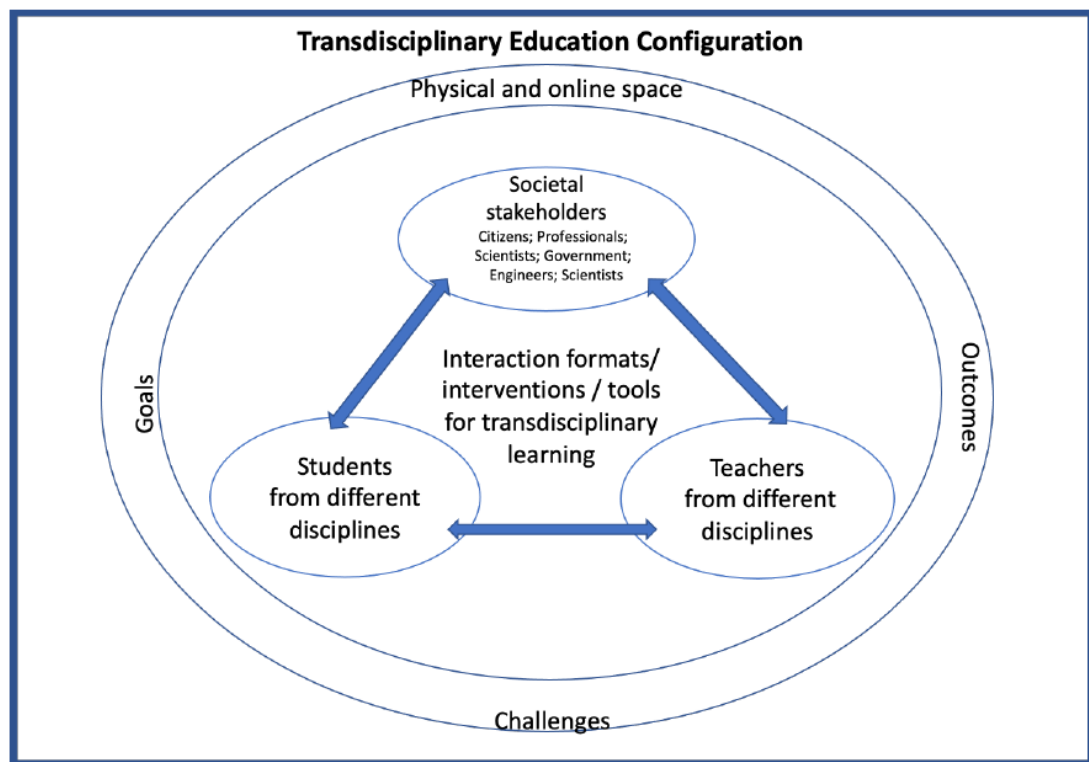

Figure 1: Transdisciplinary educational configuration

In realizing the transformative potential of transdisciplinary education, there are three major challenges, related to scaffolding transdisciplinary learning, to involving perspectives of different types of stakeholders, and to integration at the curriculum level.

Scaffolding transdisciplinary learning
Transdisciplinary learning is complex, dynamic, and impact-focused (Gibbs, 2015). It integrates knowledge and perspectives of academics, professionals and non-academics, with different epistemic bases (Polk, 2015). Moreover, the integrated knowledge highly depends on the specific challenge and stakeholder context, requiring on-the-spot tinkering and bricolage (Visscher et al, 2018) with disciplinary and transdisciplinary frames. Without good scaffolding, the learning is likely to be limited and superficial, with limited impact on student development or society (Hmelo-Silver et al, 2007; Barrett et al, 2019).

Scaffolding transdisciplinary learning is therefore essential, but available educational tools are scarce. Besides, many teachers find it difficult to support students in their transdisciplinary learning process rather than focus on sharing their knowledge or directing the process (Visscher-Voerman et al, 2019).

Involving multiple stakeholders
Transdisciplinary education requires the active involvement of multiple stakeholders in an inclusive learning community. This stimulates students and other learners to weave a variety of contrasting interests, values and perspectives into their analyses and designs, and facilitate co-learning of stakeholders who would normally remain at the sidelines of a project. This kind of education goes beyond the regular 'challenge-owner' model, in which students solve a problem for an external stakeholder and remain within the vested interests and framing of this stakeholder (Magnell & Högfeldt, 2015). To contribute to societal transformation, transdisciplinary learning should include a reflection on dominant frames and an exploration of alternatives, potentially brought in by less salient stakeholders, like small non-governmental organizations, citizens and users (Montuori, 2013). Realizing such an inclusive learning community is challenging.

Incorporating in curricula
Due to its open-ended, holistic and complex nature, transdisciplinary education is difficult to integrate in regular programmes at research universities and universities of applied sciences. Transdisciplinary initiatives often remain extra-curricular, limiting their impact on student learning and societal change. To integrate transdisciplinary learning into curricula, whole educational configurations may need reconsideration and transformation, including the programme's intended learning outcomes, teacher and stakeholder roles, educational formats, and learning spaces (cf Bouw et al, 2019).

Research questions
Transdisciplinary education has a great potential for societal transformation, but at the same time, there are great challenges related to effective scaffolding of transdisciplinary learning, building inclusive learning communities, and integrating transdisciplinary education in curricula. Redesign of educational configurations is needed to develop effective forms of transdisciplinary education, but there is a lack of knowledge on how to do this. Therefore, we propose educational design research (McKenney & Reeves, 2018), in which design principles (Van den Akker, 1999) are being developed, implemented, evaluated, and integrated in a comprehensive framework. Design principles comprise conditions and heuristics for effectively enabling transdisciplinary learning. This set-up is open to researchers, teachers and stakeholders of various backgrounds. By carrying out this research in practice and with practice, we will not only develop an evidence-base for transdisciplinary design principles, but at the same time impact society and contribute to a transformation of educational practice.

Central research question: *What are effective design principles for shaping inclusive and impactful transdisciplinary education at research universities and universities of applied sciences?*

To answer this question, a configurational approach will be adopted, which will be specified with the research consortium. Consider the following sub-questions as indicative:
- What are effective interaction formats for scaffolding transdisciplinary learning?
- Which competences do teachers need to support transdisciplinary learning and how can these be developed?
- How can stakeholder perspectives be aligned with students' disciplinary perspectives?
- In which way can the impact of transdisciplinary projects on stakeholder practices be increased?

Research approach
This educational design research project breaks down into the following steps:

Developing a tentative framework: Carrying out a review study on transdisciplinary education as well as making an inventory and analysis of experiences with transdisciplinary education initiatives in the

Netherlands and abroad. On the basis of this a tentative framework will be developed with design principles for transdisciplinary learning, targeting different elements of the educational configuration.

Experimentation and evaluation: Existing transdisciplinary educational configurations will be adapted and new configurations will be created on the basis of the design principles. Multiple cases will be carried out in parallel. In principle, these can range from targeted interventions in existing workshops to a new learning line of transdisciplinary skills. Implementation and experimentation will be a co-creative effort of innovative teachers and educational researchers, both included in the consortium, together with societal stakeholders. Qualitative and quantitative instruments will be developed for evaluating effectiveness of the interventions.

Adaptation and consolidation framework: Results of the experimentation and evaluation will be used to adapt and extend design principles and increase the robustness of the framework for transdisciplinary education. Ideally, two or more cycles of design, implementation and evaluation will be carried out in each case. In joint reflection and articulation sessions with the consortium and its partners, the framework will be further consolidated.

Expertise and roles consortium partners
In order to study and bring forward transdisciplinary education, the consortium should be transdisciplinary itself. This means that multiple disciplines will be involved, researchers as well as teachers, and that the consortium will closely collaborate with societal stakeholders. The consortium will contain the following kinds of members and partners:

- Researchers from Educational Science and from Science & Technology Studies with expertise in transdisciplinary education and research. They will provide expertise for shaping the overall framework with design principles and will form the 'glue' to fit different disciplinary and societal perspectives in the consortium together.
- Disciplinary researchers, e.g., from pedagogy, cognitive psychology, learning space design, with an interest in transdisciplinary education. They will contribute to design principles on specific aspects of the transdisciplinary learning configuration.
- Methodological experts. They will develop instruments for evaluating transdisciplinary learning in the cases and for articulating and adapting design principles.
- Teachers and educational innovators with an interest in shaping transdisciplinary education and with experience with evidence-informed educational innovation. They cocreate design principles and are in the lead for creating and adapting transdisciplinary educational configurations. Three to six teachers from different research universities and the same amount from universities of applied sciences will be involved as members of the consortium. Through them, other teachers and students will be involved as well.
- Stakeholders from the so-called quadruple helix of science, industry, government and civil society (Carayannis and Campbell, 2009) will be involved as partners in the consortium. They have important roles in the cases, the shaping of inclusive learning communities, and the consolidation of the framework with design principles.

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