SYMPOSIUM: Interdisciplinary futureproof higher education

Abstract symposium (max. 500 characters)
In response to the workforce and to tackle complex societal challenges, interdisciplinary educational methods and curricula are needed, which are discussed in the following papers. Paper 1 introduces the transition cycle as an educational approach to work on such challenges. Papers 2 and 3 discuss two new inter/transdisciplinary curricula, teaching students competitive skills for the labor market in Regenerative Medicine and Technology and Materials Development.

PAPER 1: Students as change makers: an evaluation of the transition cycle method

Abstract (max. 500 characters)
Our world is ridden with urgent, but daunting societal transition challenges such as climate change, inequality, pandemics, or digitalization. The 'transition cycle' is an approach in which students work on a transition challenge in four separate phases; imagine, connect, act, and assess. In this paper we report on the course in which we use the transition cycle, its underlying concepts, basic components, implementation, and outcomes.

Extended summary (max. 750 words)
The modern world is faced with complex global sustainability challenges, such as climate change, inequality, migration and demand for resources. These so-called 'wicked problems' are 'multi-level phenomena involving a multiplicity of mutually interacting actors and factors and their functions cannot be localized in any specific component' (Tromp, 2018 p.14). Because of its complexity it is difficult to agree on definitions for these challenges and hard to reach consensus on the best solutions.

Current and future generations need to be able to deal with these complex challenges. Therefore, students in higher education should be educated in the skills necessary to be able to face complexity, unsustainability, and uncertainty. Accordingly, the OECD developed the learning compass 2030 in which three transformative competencies are formulated: creating new value, reconciling tensions and dilemmas, and taking responsibility (OECD, 2019). The Inner Development Goals are another example of a collection of skills which are based on the Sustainable Development Goals of the UN. The Inner Development Goals (IDG's) aim at inner development, coming from the belief that we lack the inner capacity to deal with an increasingly complex environment and challenges (Inner Development Goals, 2022). The IDG's are divided into five categories: relationship to self, cognitive skills, caring for others and the world, social skills and driving change. Although the existence of frameworks for transformative skills, university education is currently lagging in teaching these skills in curricula. Also, sparse initiatives in which transition education is implemented are not often evaluated. For example, Tamura and Uegaki (2012) stress the importance of new educational models for sustainability education and the role of informal education at universities after evaluating sustainability education at Ibaraki University. Others, like Tassone et al., (2018) state that in higher education we should foster more responsible forms of teaching and learning. According to them higher education should focus on 'being relevant' (e.g., connecting to real-world issues through inquiry processes) and responsive (e.g., keeping up with changes) and especially important to focus on being reflexive (e.g., considering and questioning the normalized assumptions and values of one's endeavors) and to foster an ethics of care (e.g., considering the perspectives and needs of others and the ethical implications of those endeavors) (Tassone et al., 2018, p.349).

At this point there is no consolidated body of knowledge and know-how about how to teach students the skills needed to be able to deal with complex transitions. We aim to contribute to this knowledge by

introducing and evaluating a newly developed educational method; the transition cycle. By doing so we will answer the question: how to teach university students basic skills and knowledge for transitions.

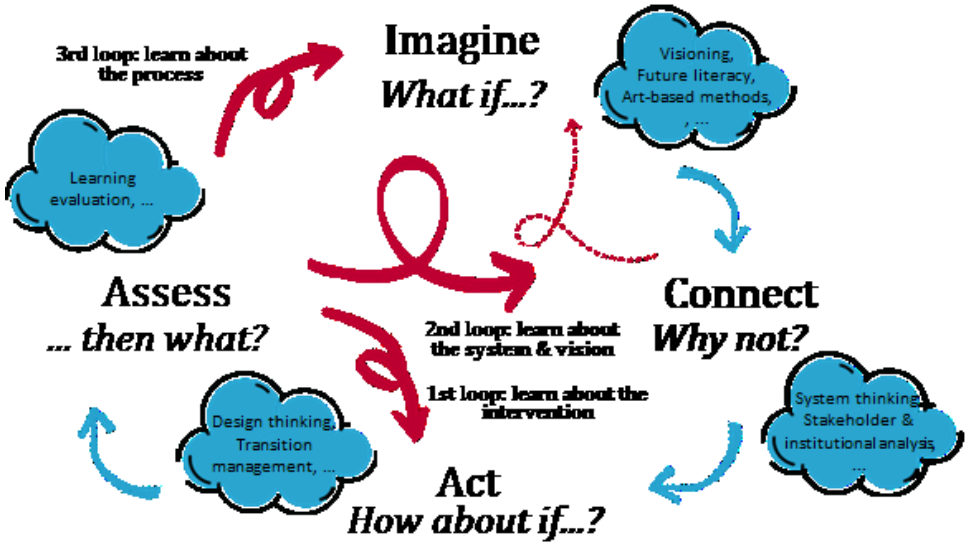

Figure 1: The transition cycle

Using the example of the honors course The Next Great/Small Transformation at the University of Amsterdam, we evaluate how the transition cycle can be implemented and how the methods contribute to learning basic skills and knowledge for dealing with transitions. Finally, the paper discusses issues and new opportunities that were identified during the implementation of this program.

Literature

Inner Development Goals (2022) https://www.innerdevelopmentgoals.org/framework

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Tassone, O'Mahony, C., McKenna, E., Eppink, H. J., & Wals, A. E. . (2018). (Re-)designing higher education curricula in times of systemic dysfunction: a responsible research and innovation perspective. Higher Education, 76(2), 337–352. https://doi.org/10.1007/s10734-017-0211-4

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PAPER 2: From a New Transdisciplinary Bachelor "Regenerative Medicine and Technology" to a more Sustainable Future

Abstract (max. 500 characters)

In response to the demands of the labor market Maastricht University has designed a new, unique and student-centered undergraduate program with the focus on Regenerative Medicine and Technology. The program aims to train students in and across multiple disciplines: Science, Engineering and Technology, Medicine, and Entrepreneurship rendering them competent to design, develop, evaluate and market new medical therapies and devices based on regeneration. These (bio)medical innovations will contribute to a more sustainable healthcare system, economy and eventually future.

Extended summary (max. 750 words)

Regenerative Medicine (RM) is a relatively new and rapidly evolving field found at the intersection of science, technology, medicine and entrepreneurship. The field attempts to replace, mimic or recreate human cells with the aim of recovering diseased or damaged cells, tissues and organs. With the input from the labor market, at the Maastricht University we have recognized the need for a new researcher profile that would receive training in and across multiple disciplines and have taken the initiative of designing an undergraduate program focusing on Regenerative Medicine and Technology. Within this innovative and first-of-its-kind program we aim to educate a new generation of researchers and engineers who will be able to adapt to any area of RM, and contribute to the design, development, evaluation and marketing of innovative medical therapies, products and devices. As such, the students are intended to develop a unique combination of skills necessary to eventually cure diseases as opposed to merely treating their symptoms. This will in turn not only improve the life of many but also contribute to a more sustainable healthcare system and a more sustainable economy.

Applying the principles of problem- and research-based learning our program intends to offer a STEM foundation which would be strongly integrated with relevant aspects of medicine and entrepreneurship. Using the principles of backward chaining and constructive alignment, the desired competencies have been defined and translated into a three-year curriculum for the envisaged program. The first year offers a strong foundation in science, engineering and regenerative medicine. The second year focuses on application of the acquired foundation in RM. An example of this is a clinic- or industry-inspired student research project. In addition, special attention is paid to the development of translational science skills necessary to bring new therapies and products onto the market and truly make a difference. The third year includes a minor and a semester-long research graduation project in RM.

The program has been accredited and will welcome its first students in September 2023. The new program intends to integrate the perspectives and input of the international higher education community and wishes to collaborate on multi- and transdisciplinary projects that will not only further improve and innovate our education but also contribute to a more sustainable future.

PAPER 3: Training students for the future workforce: the development of interdisciplinary skills in a science curriculum

Abstract (max. 500 characters)

The new Master of Materiomics focuses on interdisciplinary competences in response to the workforce and to tackle complex societal challenges. Students progressively engage with different perspectives through identification, coordination, reflection, and transformation (boundary crossing theory), and fill out a growth portfolio. This paper discusses the interdisciplinary curriculum, identifies factors impacting interdisciplinary competences, and proposes future improvements.

Extended summary (max. 750 words)

In the academic year 2022-2023, the Faculty of Sciences at Hasselt University introduced the new Master of Materiomics, aimed at students with a strong interest in the development of sustainable and innovative materials. The cultivation of interdisciplinary competences among students is imperative in response to the intricate interdisciplinary challenges that society faces today (e.g., the energy transition, evolving industrial processes, and limited resources). Additionally, it aligns with the needs of both local and global employers in this regard. Therefore, when designing our university's Master of Materiomics program in materials science, we adopted an interdisciplinary approach as the foundation for curriculum development. Students are trained to establish connections between the fields of chemistry and physics and apply experimental and computational methods.

Throughout the curriculum, students are gradually exposed to various perspectives and methodologies, by means of the four learning mechanisms derived from boundary crossing theory: identification, coordination, reflection, and transformation (Kluijtmans, 2019, based on Akkerman & Bakker, 2011). The learning process begins by encouraging students to establish connections between different perspectives. Subsequently, they synthesize these perspectives through group work and assignments. Finally, they apply their knowledge to tackle novel and intricate material-related problems through a hands-on project, internship in a company, and their master's thesis.
In order to maximize the development of interdisciplinary competences among students and to ‘connect the dots’, a learning portfolio is used, which is discussed three times a year with a mentor (professor of the master). In this learning portfolio the student reflects on their growth along the interdisciplinary learning line and is encouraged to give examples to support their reflections. By means of this mentoring program, the mentor supports the student in the development of their interdisciplinary competences and simultaneously these mentoring conversations can give the educational team insight in how the interdisciplinary learning line is implemented in practice and where adjustments might be required. For this latter, also focus groups within the educational teams were organized with a focus on interdisciplinary teaching. In addition the yearly educational day for lecturers associated with the Master of Materiomics also includes a discussion moment between the lectures on how the interdisciplinary learning line is implemented and here also good practices are shared with the goal to improve their courses with respect to interdisciplinarity. In this paper, we discuss the development of the interdisciplinary curriculum and its interdisciplinary learning line, highlight the primary fostering and impeding factors encountered by students and the educational team with regards to interdisciplinary competences, and discuss possible improvements for the future.

Literature

Akkerman, S. F., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research, 81, 132-169.*

Kluijtmans, M. (2019). Leren verbinden: het opleiden van bruggenbouwers. [Learning to connect: educating bridge builders.] Inaugural lecture ‘Education to connect science and professional practice’. Utrecht University: Faculty of Medicine.

How does your contribution on higher education generate an impact in the field? (answered for the entire symposium)' (max. 100 words)

At this very moment, society is facing complex and inherently interdisciplinary grand challenges, such as climate change, an increasing aging population, pandemics, innovative and secure communication technologies, the energy transition, changing industrial processes, and finite depleting resources. At the same time, the labor market demands a new researcher profile, trained in and across multiple disciplines, who can work in interdisciplinary teams, and is able to communicate across disciplinary boundaries. In response to this, interdisciplinary education is needed. The symposium adds to the field by describing an innovative educational method and discussing two futureproof curricula which aim to tackle these challenges.