

Piloting a Design Thinking Based Pedagogy for Teaching Innovation and Co-Creation at a Liberal Arts and Science College in Netherlands

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Abstract

This research aims to describe the Design Thinking (DT) based Global Citizenship program and the institutional context at Liberal Arts and Science (LAS) education at Leiden University College (LUC) in Netherlands, with the goal of sharing lessons learned for similar initiatives at LAS around the world. A case study approach was used to examine diverse DT activities conducted at LAS-LUC with undergraduates along with review of institutional mechanisms supporting these activities. Data were collected through literature and document reviews, observations, in-depth interviews, student focus group discussions (FGD) and faculty in-depth interviews. This case study of a DT program implemented at a major LAS college in the Netherlands, illustrates how such a program can be successfully introduced. A qualitative analysis showed a positive association between DT and students' perceptions of their creativity and personal growth in understanding sustainability practices. Students reported that the DT approach was enriching and demonstrated appreciation for multifaceted application of knowledge across disciplines. Nonetheless, results from FGD show that students encounter difficulties in abstracting ideas from real situations to tractable innovative solutions. The findings from our study can inform and support the ongoing transformation in LAS education to go beyond traditional disciplinary ways of teaching. We call for educators to engage students in the complex interactions between social, economic and environmental systems to build students' capacities to address and solve wicked problems in the real world.

Keywords: Design Thinking, Education Innovation, Active Learning, Project Based, Wicked Problem

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Introduction

Liberal Arts Education in Europe

The concept of liberal arts colleges, as they are commonly understood today, began to develop in Europe during the 19th century. At this time, a growing number of institutions were established that were dedicated to providing a comprehensive and well-rounded education in the arts and sciences, rather than focusing solely on vocational training (van der Wende, 2011).

One of the earliest examples of this type of institution was the University of London, which was established in 1826 as a non-denominational institution with a curriculum that included a wide range of subjects in the arts, sciences, and humanities. Other early liberal arts colleges in Europe included the University of Berlin, established in 1810, and the École Normale Supérieure in France, established in 1810.

These early liberal arts colleges were seen as a response to the rapidly changing social and economic conditions of the time, and were designed to provide students with a broad and flexible education that would prepare them for a variety of careers and life paths. Over time, the idea of the liberal arts college spread to other parts of Europe and beyond, and today it remains a cornerstone of higher education in many countries (van der Wende, 2011).

The liberal arts and sciences college model as we understand it today in the Netherlands started to develop in the late 20th century and early 21st century. Prior to that, the Dutch higher education system was largely focused on specialized universities and technical colleges, which offered vocational training in specific fields (Oomen, 2016a; Roberts, 2012).

The first liberal arts and sciences colleges in the Netherlands were established in the 1990s and early 2000s. One of the earliest and most prominent examples is the University College Utrecht, which was established in 1998 and is widely considered to be one of the leading liberal arts and sciences colleges in the country.

These institutions were established with the goal of providing students with a broad and interdisciplinary education that emphasized critical thinking, creativity, and communication skills. The curriculum at these colleges typically includes courses in the natural sciences, social sciences, humanities, and the arts, and students are encouraged to explore a wide range of subjects and pursue their own interests (Sklad et al., 2016; van Klink & de Vries, 2016a).

Today, liberal arts and sciences colleges in the Netherlands are highly regarded and offer a unique and valuable form of higher education for students seeking a broad and well-rounded education (Oomen, 2016b; van der Wende, 2013).

Liberal Arts Education and Design Thinking

Liberal arts and science colleges differ from traditional disciplinary colleges in their approach to education and the skills and knowledge they aim to impart to students. Some of the advantages of a liberal arts and science education include: interdisciplinary learning, critical thinking skills, communication skills, career flexibility.

In comparison, traditional disciplinary colleges often have a more narrow focus on a specific field or subject area, and may not provide the same opportunities for interdisciplinary learning or the development of critical thinking and communication skills. However, they can offer a more in-depth education in a specific field, which can be an advantage for students who have a clear idea of the career they want to pursue (van Klink & de Vries, 2016b).

A global citizenship program at a liberal arts and science college in the Netherlands is a type of educational program that aims to promote a sense of global awareness and responsibility among students. The program typically includes a range of activities and experiences designed to help students develop an understanding of the world and the issues that impact it, and to encourage them to become active and engaged global citizens (Emma Cohen de Lara & Hanke Drop, 2017).

The specific components of a global citizenship program may vary, but some common elements include: interdisciplinary coursework, study abroad opportunities, service learning, and cultural events and activities. The goal of a global citizenship program at a liberal arts and science college in the Netherlands is to equip students with the skills, knowledge, and experiences they need to become informed, engaged, and responsible global citizens who can contribute to creating a better world (Emma Cohen de Lara & Hanke Drop, 2017; van der Wende, 2019).

Design thinking is a problem-solving approach that involves empathy, experimentation, and iteration. It can be integrated into a liberal arts and science college education curriculum as a framework for developing critical thinking skills and preparing students for real-world problem-solving. The steps of a design thinking curricula framework that are applied in education are: empathize, define, ideate, prototype, test, and to refine. It's an iterative cyclic approach where students continue to iterate on their solutions, incorporating feedback and making changes as necessary (Buchanan, 1992; Gerardou et al., 2022).

By incorporating design thinking into a liberal arts and science college education, students can learn to approach complex problems with empathy and creativity, and develop the skills necessary to find innovative solutions. Additionally, the design thinking process can help students develop critical thinking and communication skills, which are essential for success in any field (Gerardou et al., 2022).

Teaching wicked problems of sustainability

Sustainability is a complex and multifaceted issue that requires interdisciplinary approaches to solve. Wicked problems of sustainability, such as climate change, deforestation, and resource depletion, are particularly challenging because they are difficult to define, have multiple causes, and can have far-reaching consequences.

Applying design thinking framework within liberal arts and science education for teaching wicked problems of sustainability could bring several strengths. It allows students to contextualize the problem. It provides students with a comprehensive overview of the problem, including its history, causes, and impacts. This will help students understand the complexity and interconnectedness of the issue. Design thinking framework encourage interdisciplinary approaches. Students are able to explore the problem from multiple perspectives, including science, economics, politics, and ethics given the strength of liberal arts and science education. Students will be challenged to question conventional wisdom and

think critically about the root causes of sustainability problems and potential solutions. Students will understand the complex systems that drive sustainability problems and how they are interrelated. Design thinking also encourages students to work in teams to develop and implement solutions to sustainability problems and encourage students to take concrete steps to address sustainability problems, such as participating in community-based initiatives, conducting research, or advocating for policy change (Buchanan, 1992; Earle & Leyva-de la Hiz, 2020; Gerardou et al., 2022).

By teaching wicked problems of sustainability in a liberal arts and science college, students can develop the skills necessary to tackle complex challenges and make a positive impact on the world. Additionally, interdisciplinary approaches can help students understand the complexity of sustainability issues and develop innovative solutions that address multiple dimensions of the problem (Taimur et al., n.d.).

This research aims to describe the Design Thinking (DT) based Global Citizenship program and the institutional context at Liberal Arts and Science (LAS) education at Leiden University College (LUC) in Netherlands, with the goal of sharing lessons learned for similar initiatives at LAS around the world. More specifically, this research aims to answer the following two questions:

- How can an inter- and multi-disciplinary approach be promoted in education at LAS when addressing wicked environmental problems?
- How can Design Thinking be applied to promote problem solving, and the ability to operate in new situations when addressing wicked problems in LAS?

Methods

Teaching wicked environmental problems - Design Thinking in curricula

Designing the Future of wicked problems (Research Clinic 2021 semester 2) was taught in hybrid due to Covid-19 with assignments and associated written instructions disseminated via Brightspace during 2020-22 (1,5 years). Total number of enrolled students were 13 students with 16 weeks of project based learning (Table 1). Students worked in three- or four-person teams to explore the intersections of social phenomena critical to wicked problems of waste and sustainability. The course was broken into five stages following the design thinking model that correspond to the course lectures and assigned readings. Each lesson in the module includes comprehension activities and concludes with an ‘investigation’, a project-based activity where students explore a wicked problem of waste issue in their schools or community. Data collection was done through case study approach including student participant observations, focus group discussion, reflection journals, in-depth interview with instructors involved.

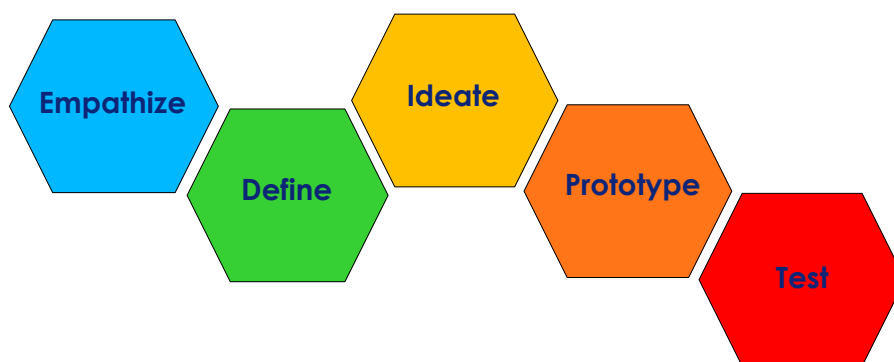


Fig 1. Design Thinking Framework

Table 1. Overview of students enrolled in Research Clinic for Design for the Future program

Research clinic name	Design for the Future: Wicked Environmental Problems in Sustainability and Health
Academic year	Feb - May 2021 (16 weeks)
Length	2 hours per week: (online) classes, lab session, office hours, walk/talk with students, pitch improvement session, fieldtrip, final pitch event.
Student Enrollment	13 Undergraduates
Format	Online / in-person hybrid (based on Covid regulations)

Table 2. Final research clinic structure

	Structure of the research clinic	
Week 1	Overview of the course - what is design thinking	Getting to know the clinic, the instructors and each other
Week 2	Understanding context - household hazardous waste global problem local action	
Week 3	Design thinking - empathy understanding the problem	Students start hands on application process of understanding the problem the community faces
Week 4	Design thinking define the problem within the context	Students start hands on application process of defining and focusing the problem the community faces
Week 5	Understanding context - expert from The Hague municipality waste management and	

	pharmacy association on household hazardous waste and medical waste	
Week 6	Design thinking - Application of knowledge - ideate	Students brainstorm for ideas based on their research/knowledge/context to find solutions for the problem the community faces on household hazardous waste challenge
Week 7	Design thinking - Application of knowledge - prototype	Students create prototype with the use of basic models or examples of the product to test to finetune their solutions on household hazardous waste challenge
Week 8	Spring break	Students keep working on prototype and do initial tests
Week 9	Design thinking - Application of knowledge - prototype	Students keep working on prototype with the use of basic models or examples of the product to test to finetune their solutions on household hazardous waste challenge
Week 10	Design thinking - Application of knowledge - testing	Students engage with the community and experts to rigorously test the prototypes. This involves active research methods including, but not limited to, online survey, qualitative research methods to gather data and finetune their solutions. Teams often use the results to redefine one or more further problems. Some students have returned to previous stages to make further iterations, alterations and refinements – to find or rule out alternative solutions.
Week 11	Fieldtrip to innovation centre of Leiden University	First official practice pitch of prototype and team bonding activities.
Week 12	Design thinking - Application of knowledge - Pressure cooker session	During the pressure cooker session, students are encouraged to revisit all design thinking steps that they have taken, within a limited amount of time. After revisiting all steps the students do a swot analysis on their prototype to find the strengths and weaknesses and to find out which next steps to take.
Week 13	Practice pitch/presentation to the community about their solutions How to communicate your idea	During the last class session, the students receive tips and tricks for their pitch and are given the opportunity to practice their pitch in front of a pitching expert.
Week 14	Final pitch/ presentation to the	Students present their ideas to their fellow-

	community about their solutions	students, instructors and an expert panel.
Week 15	Lessons learned - focus group discussion	During the focus group, students are asked to reflect on the course, steps taking and lessons learned.

Results

After interacting with the content and activities in the modules, the students devised their investigation and implemented it in their schools or communities. The students recorded their results and experiences in various forms (e.g., videos, PowerPoint presentations, art exhibitions). These artefacts were uploaded to course module web platform by the instructors for access by peers. The instructors gave feedback about the artefact through the platform and other design thinking platform applications (e.g. Mural). One group of students investigated waste discarding behavior of their peers in the dormitory setting and held an art workshop of the medical waste during Covid-19. Here they identified various types of medical waste and considered how they were discarded. From their workshop they concluded the awareness efforts in their community were effective(Fig 2).



Fig 2. Art workshop on medical waste

The students applied critical thinking competencies to knowledge gained about the state of wicked problem of hazardous waste in their specific community.

medical waste is more of a big picture problem... when I signed up for this ... thought about it more with like antibiotic resistance...coming from hazardous waste... now I'm more thinking about it with like, there's a lot of different types... like we were talking about birth control. There's a lot of different kinds of medicines, and also like substances. Yeah, I think it's a much more diverse problem than I thought it was. (Student no. 1 FGD May, 2021)

We're learning, we're engaging with wicked problems or global challenges can actually be fun, because that's what [someone] already said, like, yeah this topic is horrible but I never felt negative in my classes or during my meetings. Whereas in

other courses, when we discussed all the bad stuff, and there's so much bad stuff, but like at the end of the lecture, you're like, "Oh." (Student no. 9 FGD May, 2021)

Students also gained emotional resilience - overcoming concerns/values about wicked problems of sustainability.

I also was surprised to discover that “killing your darling” and starting over is not really as scary as it seems (if you do it with the right people maybe). I was very afraid by that at the beginning, but we reached that point in the end and it was actually a change for the better, now looking back at our entire journey. (Student no. 4 FGD May, 2021)

I am a perfectionist person as well as an indecisive person because I don't want to make the wrong choice. I think that this clinic did not help me overcome this necessarily, because it forced me to be more indecisive and more perfectionistic due to the iterative process. Therefore, a skill I could work on is being confident in my own decisions. (Student no. 11 FGD May, 2021)

Two very important skills that I got from this research clinic are adaptability and patience. Feedback-giving exercise at the end of the clinic and I think it is very useful. I am definitely going to incorporate the lessons learned in this clinic in my personal life as well, not only in my professional one. (Student no. 9 FGD May, 2021)

Students also experienced proactive engagement (e.g. creativity or innovative solutions) and learning in a time of pandemic, COVID-19.

How collaborative the classes were and the diversity in the type of material we had to prepare with from podcasts to videos. It allowed for multiple types of learners to be included in the classes and thus be able to comprehend the material beyond just reading. I also liked the activities that were encouraging our creativity and improvisation. (Student no. 6 FGD May, 2021)

While students found hybrid education challenging as well as working in teams students were seeing the benefits of team cooperation (Fig 3).



Fig 3. Students working in groups during hybrid session

I feel that there was also a lot of structure to the clinic and again, the instructors made sure to give us a solid framework within we could elaborate on our process of designing a solution for the problem of HHW. Another very pleasant surprise was to notice how, irrespective of the time point within the clinic, the team that I was part of had always been very pleasant to work with. (Student no. 11 FGD May, 2021)

Overall students expressed the strength of application of research to practice and benefit of engagement of students in wicked environmental local challenges. Students tackling wicked environmental problems demonstrated that they were able to learn and practice empathy from Design Thinking.

Conclusion

What we found from the process was that students experienced collaborative learning and learning-by-doing as effective ways of learning practical skills that are accompanied by close support. As students were applying design thinking with real-life cases about ‘wicked problems (WP)’ in sustainability it activated the students’ own thinking and problem solving. It also demonstrated impact both on the creativity of the processes and responses, as well as the emergent ideas and innovative interdisciplinary knowledge. Moreover, students were able to overcome their fear of failure working as a group to produce a collaborative creative situation. We also saw that students were able to appreciate the creative insight and different

experience of others which facilitated group cohesion as well as allowing diversity of ideas to emerge throughout the process. The students were able to work as equals in a creative process, rather than adversaries in a critical rivalry, and will therefore generate creative responses based on unusual and new combinations of thoughts and thought processes.

Applying Design Thinking into curriculum content does encourage a sense of possibility in students to overcome hopelessness in university classrooms and beyond. We recognize the academic breadth and depth can be at odds, faculty and students are already typically overextended, hence solving wicked problems in sustainability will depend on more than innovative undergraduate training programs. Nevertheless, our own efforts to achieve the vision we propose here is to underpin our optimism that innovative, interdisciplinary undergraduate training programs can be realized.

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