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## Teaching the Co-Design Canvas in Living Labs

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**Abstract:** Our society faces many challenges, necessitating collaborative efforts among multiple stakeholders. Our students learn this in living labs. This paper explores preliminary research on introducing co-design to novices. We introduce a case study exploring how design educators can support students in developing co-design competencies. Central to this study is our Co-Design Canvas, introduced as a pivotal tool for fostering open dialogue among diverse stakeholders. This stimulates collaboration through effective teamwork and empathic formation. The research questions aim to discover effective methods for introducing the Co-Design Canvas to living lab students, and to identify the necessary prior knowledge and expertise for both novices and educators to effectively engage with and teach the Co-Design Canvas. The paper advocates for a pedagogical shift to effectively engage students in multi-stakeholder challenges. Through a series of workshops, the Co-Design Canvas was introduced to novices. We found that this required a significant cognitive stretch for staff and students. The paper concludes by presenting a, for now, final workshop format consisting of assignments that supports introducing the Canvas and thereby co-design to societal impact design novices. This program better prepares students and coaches for multi-stakeholder challenges within living labs.

**Keywords:** *co-design; empathy; teaching; stakeholder; living lab*

### 1. Introduction

Our society struggles with many societal challenges. To tackle them, multiple stakeholders need to collaborate. Our students learn this in living labs. The authors share initial explorations of utilizing the Co-Design Canvas to address societal challenges in our educational lab settings. This aligns with the overall DRS theme Futures of Design Education, and more specifically, to the sub-theme Approaches, processes, methods and tools in design education.

This case study paper presents a preliminary explorative research on the iterative development of a workshop format to support coaches and students in developing co-design competencies within Living Labs. The authors argue for revising traditional instruction methods to better equip students for multi-stakeholder challenges on societal and environmental themes. Therefore, we use the Co-Design Canvas as a teaching method/tool to foster collaboration by effective teamwork and empathic formation. This explorative research aims to refine the teaching method to introduce the Canvas tool properly.



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This paper is structured in four sections: we start with the theoretical framework and research gap and methodology, then we discuss the case study, results, and the final workshop format. We conclude with research insights and limitations, suggestions for further research.

## 1.1 Theoretical framework

In the following paragraphs, the concepts of co-design, the Co-Design Canvas, and living labs are explained to provide a foundational understanding for case study presented in chapter 3.

### *Co-Design*

Design aims to transform current situations into more desirable ones (Simon, 1996). Co-design is a democratic approach that involves individuals affected by design choices in the collaborative decision-making process (Sanoff, 1990). Sanders and Stappers (2008) define co-design as a process that harnesses collective creativity throughout the entire collaborative design journey. This entails stakeholders from diverse disciplines contributing expertise and experiences to both the design process and its content (Kleinsmann & Valkenburg, 2008). Particularly in major societal challenges, roles and responsibilities are often ambiguous, and the stakeholders themselves collectively shape the design process. A co-design process starts by understanding stakeholders' individual and collective interests, values, desires, experiences, knowledge and influences (Lee et al., 2018). Moreover, impact in co-design hinges on transparency, empathy, open dialogue (e.g., Lee et al., 2018; Smeenk et al., 2021), and understanding the various stakeholders.

### *The Co-Design Canvas*

Multi-stakeholder projects struggle with whom to include and how to ensure process accessibility (Chen et al., 2016), while Lee et al. (2018) found that a shared and systematic understanding can be achieved by eight key design decisions underpinning co-creation projects.

Building on this work, Smeenk et al. (2021 & 2023a 2023b) developed the Co-Design Canvas, a proven tool for societal impact which functions as an intermediate-level knowledge tool that "plays a direct role in the creation of new designs" (Höök & Löwgren, 2012) in multi-stakeholder collaborations. Barendregt et al. (2018) define an intermediate-level knowledge tool as design knowledge, exemplified by concepts, patterns, guidelines, methods, toolboxes and scenarios. These intermediate level knowledge tools can be useful in education as teaching method for novices in new ways of working such as co-design is. The Co-Design Canvas, also termed as key enabling methodology, includes imagination, participation, experimental learning environments (labs) and impact (KEM's for Mission-driven Innovation, n.d.). Therefore, we argue that this Canvas is suitable for our educational living labs where students work on real-life societal lab assignments involving multiple stakeholders.

The Co-Design Canvas features four main categories (Why, Who, How, What) as depicted in figure 1 (a). Serving as a teaching method, it can foster multistakeholder collaboration in living labs by effective teamwork and empathic formation (e.g., Hess & Fila, 2016). Its subsequent eight co-design decision cards (context, purpose of change, focus, stakeholders, impact, results, activities, settings) are displayed in figure 1 (b). The manual provides practical guidance on how to facilitate co-design conversations and processes, as shown in figure 1 (c).

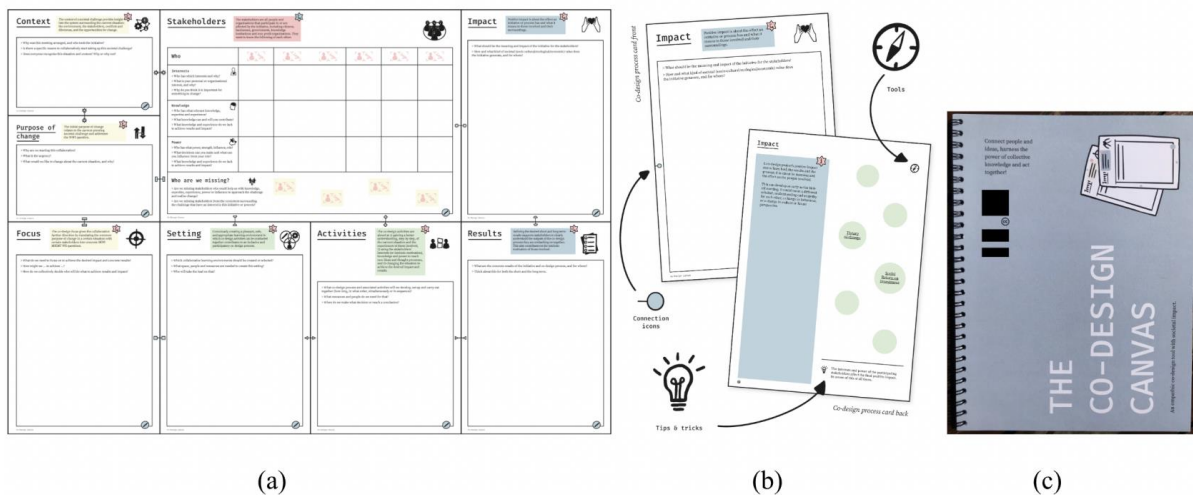


Figure 1. The Co-Design Canvas and Manual of Smeenk et al., 2021: a) canvas, b) cards, c) manual

### Living Labs

Labs are seen as appropriate educational environments to prepare students in higher education for professional roles in the work field (Den Heuvel et al., 2011; Van de Broek et al., 2020; Overdiek & Geerts, 2021). At our Dutch University of Applied Sciences, labs function as dynamic environments where researchers, coaches, students, work field professionals and other stakeholders collaboratively learn. They focus on complex societal challenges that involve a sense of urgency (Inholland, 2022), such as sustainability, climate adaptation, digitalization, and inclusivity (Inholland, 2023b).

Within our Creative Business domain, we aim to be of value to local communities and therefore base our labs in their neighbourhoods (Inholland, 2021). Here, students engage with residents, governments, and partner organisations (Inholland, 2023c). In our labs, students tackle wicked problems which are described as ill-defined social system challenges characterized by ambiguous information, multiple stakeholders with conflicting interests, and system-wide complexities (e.g., Churchman, 1967). These complex, intertwined issues are inherently difficult to grasp, and by lack of overview often prevent clear courses of action (Smeenk, 2021). The Co-Design Canvas can be helpful.

This educational approach relates to High Impact Learning principles (Dochy & Segers, 2018), encouraging deep learning through active, experiential, and participatory experiences. Students collaborate interdisciplinary in their 3rd or 4th year of bachelor, striving to establish a reciprocal connection between research and education (Inholland, 2023a). The Cone of Experience by Dale (1969) illustrates retention rates (10% to 90% after two weeks) based on the level of involvement in various teaching methods. Living labs engage students actively, enabling a 90% retention rate through Active Doing, encompassing both actions and discussions. Addressing societal issues in living labs challenges students and staff, often invoking higher order thinking skills as per the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001). These skills, combined with the activation of prior knowledge (Hailikari et al., 2008), and integration with learning goals (Hattie, 2011), enhance the didactical comprehension for Living Lab students.

## 2. Teaching the Co-Design Canvas

The step-by-step guidance of the manual (and also book by now) provides practical recommendations on how to prepare, start, analyse and conclude a co-design session with multiple stakeholders. However, the Canvas and its Manual did not yet provide guidance for the didactical application in higher education with students who are novices to co-design and tackling societal challenges.

### 2.1 Research gap

Although one would expect that the Co-Design Canvas provides students with an appropriate, feasible, and visual overview and tool to explore and align stakeholders' expectations and goals, develop a shared understanding, and new insights, the authors found that only reading the Manual provides for (cognitive) understanding but students seem in demand for more explanation and experience to conduct it in their living lab practices. Therefore, the authors organically ideated the educational program of co-design workshops the last year(s). Although, students have

experience in applying canvasses, such as the Business Model Canvas (Osterwalder & Pigneur, 2010), it is an assumption or expectation that they are eager to use other canvasses. Before joining the living lab, students mainly work on practical assignments for one external client with a specific assignment, mostly commercially oriented. Co-design is about collaboration and shared ownership. Living labs strive to create design opportunities, rather than best solutions. Thinking differently requires knowledge, and even more, mindset. Most students find the vagueness, uncertainty and complexity of lab assignments with multi-stakeholder collaborations discomforting, while some thrive on the offered freedom and ownership. Based on this explorative research, our experiences, iterations, reflections and feedback collected, the authors wrote this case study paper and disseminate our findings with our fellow (design) educators.

## 2.2 Research questions

We set up our explorative with following research questions:

1. How to introduce the Co-Design Canvas to living lab students in a way that fosters understanding and encourages its practical application in their lab challenge with other stakeholders?
2. Which prior knowledge and expertise is required to effectively introduce, understand and embrace the Co-Design Canvas to novices in co-design?
3. Which prior knowledge and expertise is necessary to effectively teach the Co-Design Canvas to students?

## 2.3 Methodology

### *Context*

From September 2022 to April 2023, the first author conducted explorative research on the development, refinement and evolution of the Co-Design Canvas workshops for students and staff in different living labs. She visited four different labs to host seven workshops aiming to improve the practical application by students in lab assignments. Five of the workshops were introductions, and two workshops were follow-ups of the introduction workshop. Each workshop was designed differently for learning and iteration, aiming to develop a program that would help students embrace the Co-Design Canvas for multistakeholder collaborations. Feedback from the internal train the trainer session and an internal preparation meeting was also incorporated. Participating students came from diverse study programs such as Communication, Business Innovation, Creative Business, Tourism Management or Facility Management (part of the Creative Business domain at Inholland), as well infrequently other domains or other educational institutions from national or international universities. The student population is characterized by a mix of genders, in their 3rd or 4th year of bachelor studies, with an age range between 19 and 25 years. Table 1 below details the case study context, including the estimation of participants and feedback providers.

### *Process*

Post-workshop, impressions from lab staff and students regarding the positive and negative aspects of their experience. Follow-up questions were added when relevant to obtain specific information or examples. Feedback was collected either written (by email) or oral (with notes transcribed afterwards), and meticulously documented, then organized into meaningful clusters by affinity mapping on recurring themes (see table 2 for a comprehensive overview) in an document and subsequently organized into meaningful clusters by affinity mapping based on recurring themes. Key variations emerged from the affinity mapping, characterized by iterations on previous versions. Affinity mapping helped systematically cluster the valuable insights, extracting meaningful patterns from the feedback. Harboe and Huang (2015) describe this as a technique for organizing and analysing data spatially based on similarity or relation. Each group of notes receives a name, and the groups are then clustered into major clusters. The iterations led to a final workshop format as presented in table 3.

### *Limitations*

The case study reflects the researcher's individual interpretation and subjective perception of feedback, which may limit its applicability to master or bachelor students from other programs with traditional teaching methodologies. The reliability and validity are low, offering a non-representative sample of living lab students. The practical nature of this exploratory research required a retrospective methodology, where analysis followed implementation. The case study, characterized by intersubjectivity and iterative feedback loops, may exhibit biases, providing merely an initial direction for future investigations.

Table 1. Summary of workshop context, participants and feedback providers in chronological order.

Date	Lab	Participants	Feedback providers
27.09.2022	ULT-Amsterdam	Ca. 25 interdisciplinary students	1 learning coach, students, 1 lab lead
11.10.2022	ULT-Amsterdam (follow-up session of 27.09.2023)	Ca. 25 interdisciplinary students	1 Learning coach
03.02.2023	ULT-Amsterdam preparation for next semester	2 lab staff	1 Learning coach, 1 lab lead
21.02.2023	Sust. Media Lab The Hague	Ca. 10 interdisciplinary students	1 Learning coach
07.03.2023	ULT-Rotterdam	Ca. 30 interdisciplinary students	3 Learning coaches
21.03.2023	Sluislab	Ca. 5 interdisciplinary students	1 Learning coach, 4 students
23.03.2023	ULT-Amsterdam	Ca. 25 interdisciplinary students	1 Learning coach
05.04.2023	ULT-Amsterdam & Rotterdam	9 lab staff	7 Learning coaches, 1 lab lead, 1 lab coordinator
06.04.2023	ULT-Amsterdam (follow-up session of 23.03.2023)	Ca. 25 interdisciplinary students	1 Learning coach

### 3. Case study: Co-Design workshop

#### 3.1 Development and iterations

The clustered feedback is summarized in table 2 and explained in chronological order below.

In the initial workshop on 27.09.2022, the first author explained co-design and the methodology to conduct a co-design process. She explained the Co-Design Canvas' elements (four categories, eight co-design decision cards) and its overall aim. Next, the first author involved a few students by playing a role game, using the university campus as the topic serving as practical and simple real-life example. The workshop goal to encourage students to apply co-Design in their lab assignment and facilitate group conversation with stakeholders using the Co-Design Canvas, was not achieved. The gap between prior knowledge and the new approach was too broad. Students struggle embracing societal assignments with multi-stakeholder collaboration. Most of them have not learned or experienced a relevant design method or approach before joining the living lab. Students were confused on how to utilize this new knowledge, and were hesitant to reach out to stakeholders. They failed to grasp the value of co-design. The main insight from this iteration was that Co-Design needs to connect with students' prior knowledge and experience. In order to support this shift from cognition (explanation) to affection (experience), the first author began to introduce Multiple Perspectives in simple terms with the aid of a practical exercise which is related to their lab assignment.

The follow-up workshop for those lab students on 11.10.2022, the first author included a mind mapping exercise to activate students' prior knowledge about co-design. They were asked about their knowledge and experience in co-design to illustrate that project collaboration is a familiar task, continuing in their lab and beyond. Three new questions were asked to introduce students to the Mixed Perspectives theory (Smeenk et al, 2016). The assumption was that this theory could aid students in increasing awareness about their own perspective/experience (with regards to the lab assignment), as well as those of others (being the target group or stakeholder as second perspective, or the public knowledge of others as third perspective). Thereafter, the Co-Design Canvas was introduced as beneficial tool for alignment and learning, emphasising the importance of utilizing questions in the stakeholder card for engaging group conversations – rather than individual interviews.

In preparation for the upcoming semester, two lab staff members and the first author collaboratively discussed the teaching approach on 03.02.2023. The integration of the co-design workshop into the semester's teaching framework, along with its interlinking with other tools, was discussed. Moreover, the interaction and communication with lab coaches before and after the workshop was improved to assure student learning is strengthened by repetition. The conversation underscored the need for an internal lab staff training, enabling lab coaches to capitalize on the knowledge transferred in the workshop. Focusing on regenerative placemaking, the lab prioritizes inclusivity and sustainability as core values, serving as connection points to the co-design decision elements as discussed in the theoretical framework in chapter 1. The lab has a strong preference for two workshops per semester to augment learning effectiveness and practical application in the lab assignment.

The next student workshop on 21.02.2023 catered to a smaller group of students, thus enabling in-depth conversations and follow-up questions to students. The feedback collected prompted a minor facilitation improvement: engaging students to cluster their input on the three collaboratively rather than individually, enabling them to build on each other's input. This collaborative exercise of creating a joint visual collage in the shape of an iceberg engages peer learning and sharing. It helps to connect perspectives to the Co-Design Canvas, serving as

practical source of relevant questions for stakeholders engagement. As showcased in figure 2 and 3, living lab students collected their own experiences and emotions as comments on pink post-its, insights from the target group and stakeholders on blue post-its, and findings by desktop research and literature review on green post-its. After the silent individual brainstorming, students collected their input on the three parts of the iceberg visual on the whiteboard, referring to three perspectives (Smeenk et al., 2016). The author introduced the three perspectives interactively, drawing an iceberg to emphasise levels of accessibility and visibility.

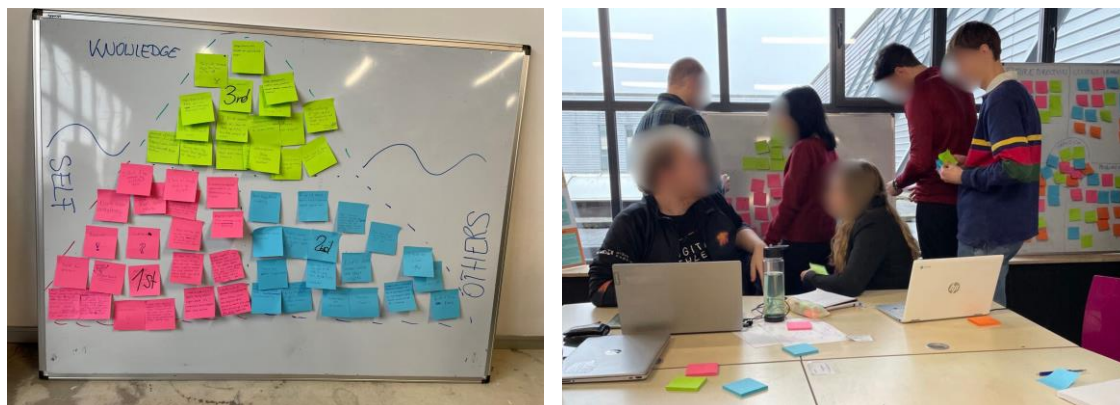


Figure 2 and 3. Living lab students of the Sustainable Media Lab The Hague (Image by authors).

The following student workshop on 07.03.2023 included a relatively large group in a spacious and flexible venue. This setup enabled students to explore the Co-Design Canvas with a sizeable six square meter plastic canvas laid on the floor. Figure 4 showcases this interactive and collaborative exercise. By throwing a ball, the first author collected prior knowledge of students regarding project collaborations, and connected their input with relevant cards on the Co-Design Canvas. The predominant feedback from lab coaches highlighted timing, seeking for more time for students to apply the content of the canvas for their lab assignment. Additionally, there was a demand to ask follow-up questions to students to foster lab assignment-related conversations. Clear explanations of each exercise were included beforehand, so students knew why they were doing it, and how it relates to their lab assignment. It helps students understand the reason behind didactical choices (Hattie, 2011).

The next student workshop on 21.03.2023 for a small-sized student group enabled ample time for personal introductions and exploring motivations behind choosing the lab for their 3rd year minor. This personal engagement led to in-depth conversations about the lab assignment and its stakeholders. The primary feedback collected underscored the impact of visualization. Students were encouraged to map their stakeholders (organizations or individuals). The first author demonstrated a simple way of stakeholder mapping by prompting students to draw three circles on paper, illustrating the relatedness and relevance concerning the lab assignment. Stakeholder mapping served as introduction to co-design, shifting focus towards the stakeholder card of the Co-Design Canvas. Hand-drawing a simple stakeholder map closed the previous knowledge gap, while creating an activating learning environment.

The next student workshop on 23.03.2023 extends the internal preparation meeting from 03.02.2023. The learning coach enriched these insights, recommending more time to be devoted to student comprehension and discussions on the application of co-design for each lab assignment student group. The stakeholder mapping unveiled overlooked stakeholders, enabling students to incorporate them in their lab assignment work. Aiming for more active involvement and physical engagement, the idea emerged to explore using clay in the upcoming follow-up workshop.

The follow-up workshop on 06.04.2023 inaugurated an activating check-in exercise, where students, standing in a circle, evaluate their prior knowledge by answering yes/no questions. The rationale was that this exercise could support students in aligning with the lab process while simultaneously providing instant feedback to the educator regarding student progress. The first author also introduced a clay modelling exercise, where students created symbolic physical figures representing each stakeholder. This imaginative task fostered conversation and team bonding. Consequently, student groups evaluated each concept using clay dots. This engaging assessment aided students in aligning with each other to which extent each of the concepts corresponds to each of the stakeholders. The voting process yielded further insights on inclusivity and relevance of concepts, prompting students to refine their concepts. Figure 5 illustrates this exercise.





Figure 4. Living lab students of the ULT-lab Rotterdam getting introduced to the Co-Design Canvas on a large six square meter PVC print. They throw a ball to brainstorm relevant collaboration aspects, which the authors connect to elements on the partly covered canvas (Image by authors).



Figure 5. Living lab students of the ULT-lab Amsterdam crafted symbolic clay figures to represent stakeholders of the assignment onto the large PVC canvas. Next, they evaluated each concept based on relevance or desirability per stakeholders. Each concept was assigned one dot colour, and each student spread 15 dots per concept across stakeholders. (Image by authors)

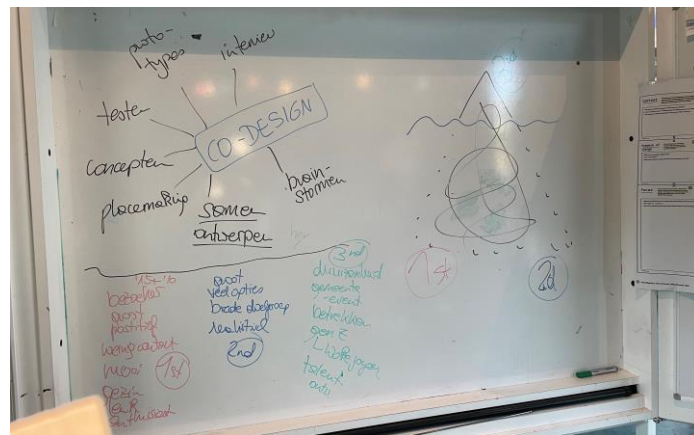


Figure 6. Living lab students of the Sluislab Amsterdam brainstormed their prior knowledge about co-design while the first author mind mapped main terms visually (left side). The concept of perspectives was explained with visual support, drawing the iceberg on the whiteboard (Image by authors).

The earlier mentioned need for a lab staff training was addressed on 05.04.2023. The train-the-trainer session aimed at fostering deeper integration into the lab's educational and didactic approach. The Co-Design Canvas was collaboratively viewed as ideal guiding method throughout the semester, providing grip for students. For the lab staff, it facilitates alignment of all teaching activities around co-design, merging seamlessly with regenerative placemaking, the lab's focus theme and approach.



Table 2. Summary of collected feedback in chronological order.

Date; lab	Feedback provider; insights by affinity mapping	Iterations and outcomes
27.09. 2022; ULT-Amsterdam	1 learning coach, students, 1 lab lead <ul style="list-style-type: none"> <li>EXPLANATION: Students were not able to host a co-design session themselves because they <i>didn't understand the value</i> of it.</li> <li>PRACTICAL: It was difficult for them to <i>schedule meetings</i> with stakeholders due to passive attitude and limited motivation. Some students did not dare to ask for support from the lab team.</li> <li>RELEVANCE: The <i>roleplay topic was not relevant</i> for all students.</li> <li>APPLICATION: Students did not understand how the Co-Design Canvas can be applied for their assignment.</li> </ul>	<ul style="list-style-type: none"> <li>NEW APPROACH: No more roleplay and classical explanation of the canvas. Instead, redesign the workshop and <i>meet the students at their current knowledge</i>:</li> <li>PRIOR KNOWLEDGE: Collecting what students know about co-design via <i>live mind mapping</i> (showing that collaborating in a team has similarities)</li> <li>ACTIVATION: questions about student experience/emotion, their field research insights, and third person work (multiple perspectives)</li> <li>RELEVANCE: Asking students which of the perspectives they know the least (mostly the second).</li> </ul>
11.10. 2022; ULT-Amsterdam (follow-up session of 27.09.2023)	1 Learning coach: <ul style="list-style-type: none"> <li>KNOWLEDGE: about stakeholders is missing.</li> <li>PASSIVE: Students mainly sitting at table.</li> </ul>	<ul style="list-style-type: none"> <li>STAKEHOLDER MAPPING: Introduce stakeholder mapping by asking students to <i>draw a simple stakeholder map</i> and fill it in. Bringing their individual maps together into one group version.</li> <li>ACTIVATION: <i>Selecting three important stakeholders they have not spoken to</i>, leading them to formulate an action: approaching them</li> <li>ACTIVE: Include standing exercises</li> </ul>
03.02. 2023 ULT-Amsterdam	1 Learning coach, 1 lab lead: <ul style="list-style-type: none"> <li>OVERVIEW: Co-Design Canvas visualises how ecosystem grows; it accompanies inclusive design.</li> <li>INTEGRATION: and follow-up by learning coaches is crucial.</li> <li>PRACTICAL: 2 workshops are ideal: one for basic knowledge and mindset, one as follow-up to deepen knowledge and practical application for assignment.</li> <li>TEACHING METHOD: 3 perspectives match the development of climbs (climb 1: mainly 1st and 3rd perspective, climb 2-3 mainly 2nd perspective, climb 4: all perspectives)</li> </ul>	<ul style="list-style-type: none"> <li>INTEGRATION: of tools/methods</li> <li>SIMPLIFICATION: focus on relevant parts of the Co-Design Canvas</li> <li>STAFF TRAINING: Train-the-trainer for lab staff to prepare and follow-up workshops.</li> </ul>
21.02. 2023; Sust. Media Lab The Hague	1 Learning coach: <ul style="list-style-type: none"> <li>INTERACTION: engage with the input collected in the 3 perspectives on the visual iceberg</li> </ul>	<ul style="list-style-type: none"> <li>ACTIVATE CLUSTERING: While putting their own input onto the iceberg, cluster them with input from other peers. 3 questions: 3 post-it colours, 2 sheets each – total 6 post-it per person) – to experience 3 perspectives</li> </ul>
07.03. 2023; ULT-Rotterdam	3 Learning coaches: <ul style="list-style-type: none"> <li>PRACTICE: The application of canvas should be longer, Shorten the intro</li> <li>IN-DEPTH: devote more time to the canvas, ensure that questions are thoroughly answered</li> <li>PLAYFUL THEORY: make interactions with the floor canvas even more engaging</li> </ul>	<ul style="list-style-type: none"> <li>GOAL: <i>Explaining</i> aim of each exercise beforehand.</li> <li>AGENDA: Introduce program visually</li> </ul>
21.03. 2023; Sluislab	1 Learning coach, 4 students: <ul style="list-style-type: none"> <li>STAKEHOLDERS: Understanding the stakeholders involved, and how to engage them</li> </ul>	<ul style="list-style-type: none"> <li>FOCUS: Let students choose relevant questions for stakeholder.</li> </ul>
23.03. 2023; ULT-Amsterdam	Learning coach: <ul style="list-style-type: none"> <li>IN-DEPTH: Allocate more time to ensure students grasp the Co-Design Canvas, as some found it challenging.</li> <li>VALUABLE: exercise helps identify missing stakeholders. Students found it interactive and educational.</li> </ul>	<ul style="list-style-type: none"> <li>PLAYFUL: Create an interactive exercise for follow-up workshop: let students express stakeholders as clay figures, rather than writing their names.</li> </ul>
05.04. 2023; ULT-Amsterdam & Rotterdam	7 Learning coaches, 1 lab lead, 1 lab coordinator: <ul style="list-style-type: none"> <li>GUIDE: use the Co-Design Canvas as the leading method during the semester to improve alignment and integration.</li> </ul>	<ul style="list-style-type: none"> <li>CENTRAL: Using co-design as the main methodology</li> </ul>
06.04. 2023; ULT-Amsterdam (follow-up session of 23.03.2023)	1 Learning coach: <ul style="list-style-type: none"> <li>CLAY BUILDING: students were asked to shape clay figures of key stakeholders.</li> <li>VOTING: It aligned teams when assessing concepts and its relevance for diverse stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>STAND-UP: Standing exercise activated prior knowledge from the first workshop. Standing in a circle includes everyone, and provides a shared experience of self-evaluation based on check-in questions by the educator</li> </ul>

### 3.2 Results and outcomes

Based on the collected and clustered feedback, the authors below share the results and outcomes by answering the research questions.

1. How to introduce the Co-Design Canvas to living lab students in a way that fosters understanding and encourages its practical application in their lab challenge with other stakeholders?

#### ***Learning by Doing***

Several times the first author observed that the initial Co-Design Canvas workshops were not as effective as expected. Students struggled to apply the Co-Design Canvas in their lab assignment due to a lack of understanding of its value. Consequently, the teaching approach was shifted from cognitive explanation to experiential learning, involving mind mapping to activate prior knowledge, and stakeholder mapping to build on previous work for the lab assignment. to craft symbolic clay figures to represent stakeholders and evaluate concepts accordingly. Only then, students are able to select relevant questions for each stakeholder, draw a simple stakeholder map, and the use of Co-Design Canvas as tool for internal and external alignment. The Co-Design Canvas can act as a supportive tool aiding student teams to align internally, and also to align externally with multiple stakeholders. It necessitates a fundamental understanding of stakeholder thinking. In order to immerse students into the meaning of co-design, it is imperative to make them aware of multiple perspectives that are integral during collaborative living lab assignments.

#### ***Encourage playfulness***

Interactive learning methods were found to be effective in engaging students. Techniques such as hand-drawing on paper, clay modelling of stakeholders (figure 5), mind mapping (figure 6), and clustering answers on post-its (figure 2 and 3) were used to immerse students into co-design and assignments. The authors believe that those activities lead to learning effectiveness by better retention rates (Dale, 1969). The role play was not as effective in helping students understand the value of co-design since they perceived it as irrelevant.

2. Which prior knowledge and expertise is required to effectively introduce, understand and embrace the Co-Design Canvas to novices in co-design?

#### ***Explain the goal***

It was suggested by lab coaches that the goal of each workshop activity should be explained to students beforehand, highlighting its practical application to their lab assignment. To help students realize the value of the Co-Design Canvas, it is crucial to explain why it is used as a tool. That means, connecting students experience in project collaborations with the decision cards of the Co-Design Canvas, as well as sharing the a short story on how the Co-Design Canvas was created in a real-life project (Smeenk et al., 2021), building on an academic research paper (Lee et al., 2018).

#### ***Canvas as means***

The first author found that students experienced the Co-Design Canvas as fill-in-the-blank exercise, rather than a tool for insight, collaboration and alignment. The authors noticed that students struggle to perceive it as a means, rather than an end. Students need to both comprehend this concept theoretically and apply it practically. This necessitates a facilitation approach that is both specific and adaptable. Depending on the context and students' prior knowledge, an experienced educator can dynamically adjust the workshop format as needed. The Co-Design Canvas application needs to be properly introduced and explained. As mentioned before, students are most often not familiar with co-design processes and therefore, not familiar with stakeholders either.

3. Which prior knowledge and expertise is necessary to effectively teach the Co-Design Canvas to students?

#### ***Building on prior knowledge***

Depending on their prior knowledge, the workshop needs to be tailored to integrate students' current level of knowledge and assignment progress. For instance, starting the workshop with a visual collection of relevant stakeholders (Stakeholder Mapping), followed by an analysis of who of these stakeholders the students have been in contact with. Relevant stakeholders who have not been contacted yet are selected. Only then, the Co-Design Canvas is being introduced by highlighting relevant questions to ask stakeholders. The Co-Design Canvas serves as rich and diverse source to find relevant questions to address to the beforementioned selected stakeholders.

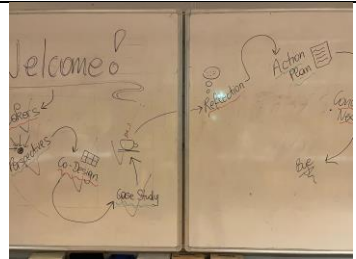
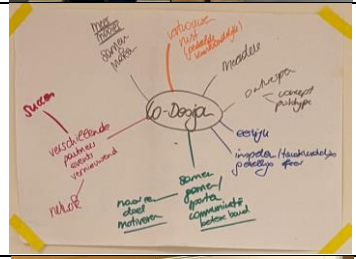


### Embed and integrate





To maximize student learning efficacy, it is beneficial to embed the Co-Design Canvas as a leading methodology throughout the semester. For instance, the ULT-lab Amsterdam, with a strong thematical focus on regenerative placemaking, expressed interest in integrating it with placemaking tools, and merging it with the existing climb structure. Two workshops (introduction and follow-up) per semester emphasize the foundational role of co-design, and enable a visual representation of the Co-Design Canvas development. In the follow-up workshop, students used the Co-Design Canvas to evaluate concepts per stakeholder (figure 5).

### 3.3 Final program

Based on the insights from the workshop variations and insights from feedback collection and analysis, the first author concludes the final co-design workshop format with a duration of ca. 2 hours. Table 3 below details the various activities, its duration and form, a short description of the activity as well as visual impressions.

Table 3. The final co-design workshop format.

Activity	Duration / form	Description	Exemplary visual impressions (images by authors)
Agenda & Introductions	Ca. 15 minutes	The educator explains the upcoming activities as visualized on the whiteboard. Students introduce themselves, mentioning their study program and background. Each student group shares their current status of the lab assignment. This short introduction round enables the educator to customize examples in activities to their lab assignment, for example to name specific stakeholders so that students recognize familiarity and relevance.	
Brainstorm about co-design	Ca. 10 minutes / (same as above)	The educator invites students to individually share their experience in collaboration (e.g. student project). The educator clusters keywords in a mind-map on the whiteboard. The goal is to activate prior knowledge, provide bridges for the activities to come, and showcase to students that they enrich their previous experience.	
Multiple perspectives – explanation	Ca. 10-15 minutes (same as above)	The educator provides 2 post-it notes in 3 different colours to each student. Students write keywords to their answers on the post-it notes. The educator asks plenary: - Q1: How do you feel about your assignment? What is your own experience? (pink - 1 <sup>st</sup> perspective) - Q2: What did you learn by users/target group of your assignment when you spoke to them or observed them? (blue - 2 <sup>nd</sup> perspective) - Q3 Based on your desktop research/literature, what did you find surprising about the assignment? (green - 3 <sup>rd</sup> perspective) Next, students categorize their input on a whiteboard, forming a simplified triangle. The educator then elucidates the theory of multiple perspectives, using students' keywords to bridge theory and practice regarding their lab assignment. The triangle symbolizes an iceberg with a stylized water line indicating the visible 3rd perspective, and the less apparent 1st and 2nd perspectives. The left side represents the self (1st perspective), while the right side denotes others' perspective (2nd perspective).	
Stakeholder mapping – explanation and application	Ca. 10-15 minutes (same as above)  Students sitting in project groups	The educator checks prior knowledge about stakeholder mapping or analysis. The educator instructs each student to draw three large circles on A4 paper. Hence, the educator explains stakeholder mapping and the difference of inner, middle and outer circle. Students individually fill in all relevant stakeholders of the lab assignment in the applicable circle. Then, students get together in their group and exchange their maps, aiming at merging all individual maps into one complete map.	
Break	Ca. 10 minutes	-	-

Stakeholder mapping – prioritisation	Ca. 5-10 minutes / (same as above)	Starting from the inner circle outwards, student groups analyze their map by circling five stakeholders they have not spoken to yet.	
Co-Design Canvas - explanation	Ca. 20-25 minutes / students standing around Canvas	Students and the educator gather around a 6sqm PVC-printed Canvas, its section headers covered. Through a playful activity like ball-tossing, students share past teamwork experiences. The educator links their input to Canvas sections, illustrating successful collaboration in complex projects. Practical examples or a case study are shared to help students grasp how to utilize the content as a support tool for their lab assignments.	
Break	Ca. 5 minutes	-	-
Co-Design Canvas application	Ca. 15-20 minutes / Students sitting in project groups	Student groups examine the canvas, picking three pertinent questions to pose to the five pre-selected stakeholders, aiding in choosing questions beneficial for their status and goal. They devise an action plan detailing task delegation, and the how, when, and where of contacting these stakeholders soon, to align on expectations, interests, impact, and goals.	
Conclusions & wrap-up	Ca. 5-10 minutes / students standing in circle	Evaluating Learning: The educator poses yes/no questions about understanding and applying the Co-Design Canvas to the lab assignment. Students step forward for each 'yes' answer, enabling a swift assessment of learning and identification of gaps, which are clarified. The session concludes with a reminder of the homework assignment (executing the action plan).	

## 4. Conclusion and discussion

Co-designing is complex (Sanders & Stappers, 2008). Working in living labs on societal challenges is demanding for novices to complex co-design processes. Moreover, our lab staff lacks knowledge in addressing societal challenges through co-design, and are untrained in utilizing the Co-Design Canvas. However, their familiarity with stakeholder analysis, design thinking, and project collaboration serves as valuable prior knowledge to leverage.

To effectively guide students, educators must first establish a solid foundation. This entails activating prior knowledge and guiding students and staff/coaches to understand which stakeholders are involved in their societal lab assignment. The perspectives exercises of our workshop format helps them see the value of involving and considering multiple perspectives, while awareness of potential bias reinforces this involvement. Secondly, educators/lab staff/coaches need guidance in creatively developing workshops to facilitate students' introduction to, utilization of, and reflection on the Canvas within their co-design process. Thirdly, the authors stress the interdependence of effective learning, communication, and alignment among lab staff. Ensuring the Co-Design Canvas's application throughout the semester requires the commitment of lab staff. In summary, a "learning by doing" approach, complemented by fostering a playful attitude through embodied exercises, has proven instrumental in enabling students to effectively engage with the Co-Design Canvas.

In this study, we adopted a human-centered, exploratory research design that evolved organically. A key advantage was our responsive and adaptable approach to emerging needs and requirements as they arose. For future research, while preserving this flexible and creative research approach, we aim to integrate a more rigorous pretest-post-test group design, with baseline and post-measurements, predetermined questions and independent researcher to mitigate potential bias in our findings.

## 4.1 Contribution

The central research focus of this study revolved around the effective introduction of the Co-Design Canvas to students in a living lab setting and its knowledge and expertise requirements for students and educators.

We addressed the first research question (How to introduce the Co-Design Canvas to living lab students in a way that fosters understanding and encourages its practical application in their lab challenge with other stakeholders?) by advocating a shift from cognitive explanation to a hands-on, experiential learning approach, ensuring a deeper understanding and practical application in lab assignments. Utilizing interactive techniques significantly engages students, improving retention rates and facilitating effective interaction with stakeholders.

The second research question (Which prior knowledge and expertise is required to effectively introduce, understand and embrace the Co-Design Canvas to novices in co-design?) yielded insights on the importance of clearly communicated workshop goals. It is pivotal to link the practical applications of activities to the lab assignment, forging a connection between the Co-Design Canvas functionalities and students work. Additionally, we emphasize the Co-Design Canvas's role as a tool for insight, collaboration, and alignment.

We addressed the third research question (Which prior knowledge and expertise is necessary to effectively teach the Co-Design Canvas to students?) by considering the prior knowledge and experience of students, tailoring the didactic approach and materials consequently (Centre in Excellence for Teaching and Learning, n.d.). The canvas is not a goal, but a means to enable a successful lab assignment. Dynamic adjustment of the workshop format based on context and student learning progress is a crucial requirement for (design) educators. The training provided to lab staff facilitated a more profound integration of the Co-Design Canvas into the lab's educational and pedagogical framework. Consequently, teachers began to view the Co-Design Canvas as an alignment tool for all educational activities related to the theme of regenerative placemaking.

Our Co-Design Canvas workshop format for novices contributes to students' comprehension and practical application of the Canvas in lab challenges by combining the Canvas with specific assignments regarding stakeholder mapping and adopting multiple perspectives. The authors invite (design) educators to investigate and expand upon the final co-design workshop format as described in table 3. Further exploration to augment this work includes application to master or bachelor students from other programs with traditional teaching methodologies.

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