A systematic literature review on co-design education and preparing future designers for their role in co-design

As emphasised by various researchers, the role of designers is now less about 'designing for' and more about 'designing with' users and other stakeholders. The main reason behind this shift relates to the importance of the active involvement of 'people with lived experience' in co-design. Now, designers are also expected to facilitate the active participation of non-designers in co-design processes. However, it is noted that the importance of co-design and the role of designers in co-design have not been widely integrated into design education. Thus, a systematic literature review is conducted to find out the necessity and prevalence of co-design education in higher education programs and its instructional methods. This paper presents the outcomes of the review of seventeen (n = 17) studies, published between 2007 and 2021, analysed through thematic analysis via NVivo. The findings of this study shed light on the necessity, structure, and challenges of co-design education, as well as evaluation, gaps, and opportunities in this area. Specifically, the significance of motivating students to acquire the necessary mindset for co-designing, which can potentially initiate a meaningful co-design process through game-based approaches and self-learning, is underlined.

Keywords: co-design education; designers' role in co-design; design education; co-designing mindset

1. Introduction

The role of the design field used to be seen only as form-giving. Today, it has been gaining a broader, more holistic, and societal scope due to the increasing globalisation, complexity, and uncertainty of the problems. Providing innovative solutions to the "wicked problems" (Rittel and Webber 1973) requires multidisciplinary and collaborative approaches (Hasanin 2013; Augsten and Gekeler 2017).

Correspondingly, the new role of design is to promote and foster collaboration among various disciplines (Sanders and Stappers 2008; Hasanin 2013; Manzini 2015;

Augsten and Gekeler 2017; Detand and Emmanouil 2018). It is no longer enough to only empathise with users without actively involving them in the design process (Taffe and Barnes 2009; Yalman and Yavuzcan 2015; Augsten and Gekeler 2017; Aguirre, Agudelo and Romm 2017). Researchers (Sanders and Stappers 2008; McKercher 2020) suggest that fully comprehending people's needs and wishes is impossible without co-designing with them, as they are the experts of their lived experiences. Therefore, the active involvement of "people with lived experience" (McKercher 2020, 81), starting from the early stages of the design process, seems imperative. Hence, there has been a shift from user-centred design to co-design approach, as designers need to comprehend the tacit knowledge and latent needs of users (Stappers and Visser 2007).

Often, the terms *co-design* and *participatory design* have been used interchangeably despite the nuances between them (Mattelmäki and Visser 2011). *Co-design* originates back to the tradition of *participatory design* in the 1970s in Scandinavia (Simonsen and Robertson 2013) and in the 1960s in the United States (Sanoff 2007). As recently explained by Bødker et al. (2022), it refers to the active involvement and empowerment of people in decision-making processes through creating a mutual learning environment democratically. Looking from this lens, the term *co-design* has been used throughout the text to refer to the *active involvement* of people with lived experience and other stakeholders in design processes.

1.1. The role of designers in co-design

Due to the shift towards co-design in design practice, the role of designers and design educators has been changing. The literature pertaining to the new role of designers strongly suggests that (in addition to the other roles they have in a design process)

designers today are increasingly expected to take the facilitator role in co-design (Light and Akama 2012, Minder and Heidemann Lassen 2018) and act as the bridge among people from different disciplines for creative idea generation (Lee et al. 2018; Christiansson, Grönvall and Yndigegn 2018) as "enablers" (Thomson and Koskinen 2012, 77).

Although designers' facilitator role is gaining significance (Antaki and Petrescu 2023, Costanza-Chock 2020), this does not mean that designers should not provide any input to a co-design process other than aiding the process (Mattelmäki and Visser 2011, Manzini 2015). As Manzini (2015, 66) puts it, the facilitator role of designers should not be diminished to *post-it design*, which makes designers only administrative actors asking people their ideas and writing them on sticky notes and/or visualizing them. *Post-it design* is a reaction against *big-ego design*, which stands on the other end of the spectrum. As an approach from the past century, *big-ego design* considers designers the only experts in the design process. This approach contradicts today's definition of design, where everybody designs (Manzini 2015) and can be creative if provided with suitable tools (Sanders and Stappers 2008). Therefore, both *post-it* and *big-ego design* should be avoided, and designers need to bring their "creativity, design culture and dialogic collaboration capabilities" to co-design (Manzini 2015, 67).

Originally, designers' facilitator role conforms to democracy, active involvement, and empowerment (core principles of co-design). A close connection can be seen between this role and the mindset needed in a designer for the initiation and execution of co-design. Although facilitation is merely one of the various roles of designers (Mattelmäki and Visser 2011), without this mindset shift and awareness, designers may just ignore others and design on their own or people's participation can be only minimal and tokenistic. Designers may make assumptions on people's behalf

without their involvement and verify and/or impose their own ideas (*big-ego design).* However, designers' *only-expert mindset* widens the distance between designers and users in co-design and causes the exclusion of users, violating the co-design principles (Ho, Ma and Lee 2011). Similarly, Roger Hart's (1992) Ladder of Participation considers the first three rungs as *non-participation,* indicating the importance of power given to people to enable meaningful participation. However, what a group can achieve together is beyond what an individual could have achieved alone (Kvan 2000). Thus, the balance and degree of participation and facilitation are essential aspects for distinguishing co-design from traditional design (Sanders and Stappers 2008; Surá and Kun 2021).

Co-design facilitation is "setting up proper conditions for co-designing and ensuring productive co-design processes" (Ylirisku, Buur and Revsbæk 2016, 1727). One of the core principles of co-design is to give voice to people by providing them with suitable tools for expressing their creativity (Sanders and Stappers 2008). For instance, designers as facilitators can provide people with lived experience (non-designers) with the "Representational Ecosystem" (e.g., analogue and/or digital 2D, 3D or 4D sketches, diagrams etc. accompanied by physical mock-ups) to externalize, discuss and evaluate design ideas (Dorta, Kinayoglu and Boudhraâ 2016, 164). Similarly, they can benefit from generative tools and techniques (e.g., 3D models, Lego blocks, 2D collages), which are creative elements used for idea generation, to facilitate people's participation by helping them better express their needs, experiences, ideas, and dreams, even if they might not be aware of them (Sanders and Stappers 2008). Predan (2021) explains that designers should also let all participants participate equally in co-designing, define a clear goal, give them a structure but also freedom for creativity, manage time well, and make co-design enjoyable for all. Another essential

role of designers in co-design is “enter(ing) into a dialogue with relevant people from within, to better understand the topic and to explore their practices and interactions” (Salmi and Mattelmäki 2019, 105). With this respect, the elements of “Design Conversation” explained by Dorta et al. (2011, 67) and designers’ ability to communicate not only verbally but also through gestures and representations become important in co-design for more efficient collaborative ideation with non-designers (Dorta et al. 2019; Safin and Dorta 2020).

1.2. Educating future designers on their role in co-design

Obviously, for design students, who are future designers, learning to enable meaningful participation of people in co-design by avoiding both *post-it* and *big-ego* design is essential (Manzini 2015). If future designers learn only about individual designing skills, they might have the *only-expert* mindset. This issue has been also raised by Costanza-Chock (2020, 197): “Students in the process of professionalization who have certain kinds of skills, especially... industrial design skills are often unreceptive to the idea that in a co-design process, they might not be the only ‘expert’ at the table”. This causes disrespect towards the knowledge of people with the misconception that their skill sets are superior to those of non-designers. Thus, cultivating the necessary mindset/skills in design students through integrating co-design into design education requires attention.

This triggers the question of to what extent and how co-design has been integrated into design education in higher education programs to prepare future designers for their role in co-design. Although numerous systematic literature reviews exist about co-design, co-design education has not been reviewed yet. Therefore, the following research questions were formulated:

RQ1: Why might co-design education/pedagogy be necessary?

RQ2: How integrated is co-design education into higher education programs?

RQ3: What are the instructional methods in co-design education?

RQ4: What are the future opportunities for co-design education?

2. Materials and Methods

This paper presents a systematic literature review of studies on co-design education published between 2007 and 2021. Journal and conference papers that explicitly focus on co-design education have been selected. The keywords used for the search were "co-design education", "participatory design education", "teaching co-design", "teaching participatory design", "PD pedagogy". The study was carried out using the following databases: Web of Science, Google Scholar, ScienceDirect, SAGE Journals, and JSTOR. Studies that use co-design in various contexts (e.g., K-12 education) to cultivate specific student skills (e.g., collaboration) and studies that are not in English have been excluded.

Seventeen studies (n = 17) met the inclusion criteria for this systematic literature review. The dominant focus of these studies was on design education. However, studies from other higher educational settings also have been included in this review due to the multidisciplinary nature of co-design. The publications reviewed (Figure 1) can be grouped into three main categories as: 1) courses to teach co-design (12 papers); 2) investigation on the changing role of designers and design education (3 papers); and 3) discussion on how to teach co-design (2 papers).

These publications are analysed through thematic analysis using the qualitative analysis program NVivo. The codes and themes are generated following both deductive and inductive approaches (Saldaña 2013). Four parent codes were predefined (deductive

approach) concerning each research question. For instance, for RQ1 (Why might co-design education/pedagogy be necessary?), a theme called ‘the necessity of co-design education’ was created. Table 1 demonstrates that one of the codes under this theme is ‘preparing designers of the future for their role in co-design’, which comes from the thematic analysis of the quote shown next to it. Four more themes and codes were generated while reviewing the publications (inductive approach).

Table 1. An example from the coding process via NVivo

Quotes	*Codes*	*Themes*	*Research Questions*
“This paper is about educating designers as codesigners and reflective practitioners. It is argued that an important goal in design pedagogy is learning the students’ strategies and tools for how to involve various stakeholders in designing, and how to deal with uncertainty and open design agendas. It is important in order to prepare students for a career as designers.”	Preparing designers of the future for their role in co-design	The necessity of co-design education	RQ1

3. Findings

Thematic analysis yielded eight parent codes and 66 child codes. According to the analysis, the main themes (Appendix A) that emerged from this systematic review are:

- The necessity of co-design education (1)
- The structure or method for co-design education (2)
- Challenges in co-design education (3)
- Evaluation in co-design education (4)
- Lessons learned, gaps and opportunities in co-design education (5)

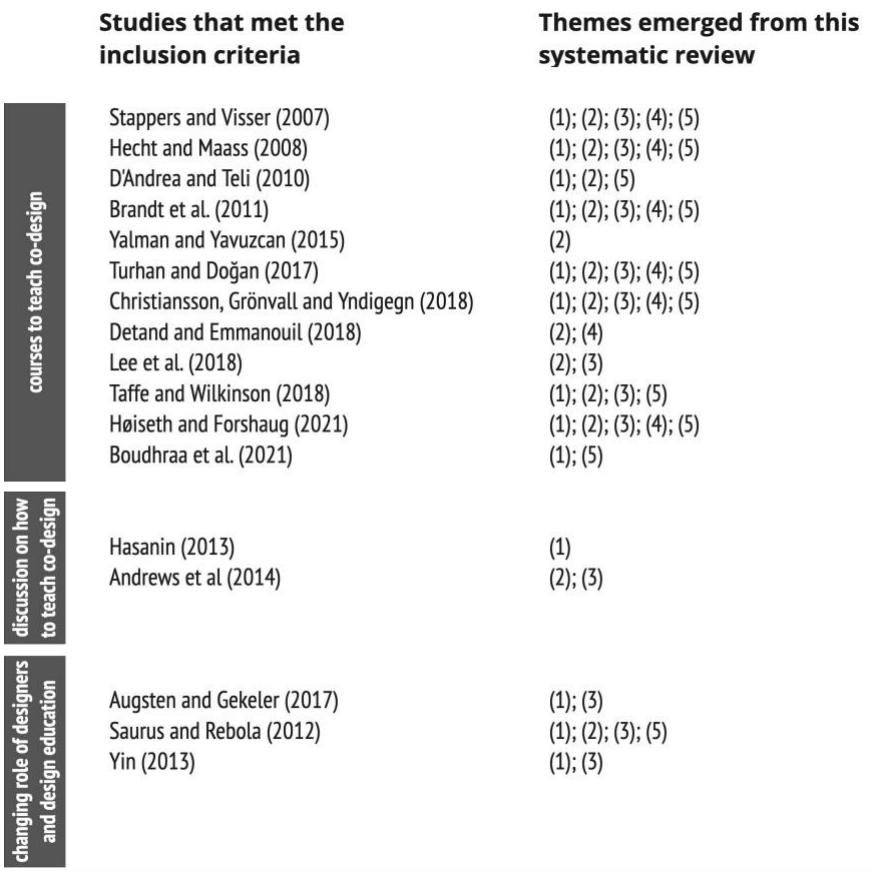

Figure 1. Seventeen studies (n = 17) that met the inclusion criteria and their connection to the themes mentioned above

Twelve out of seventeen papers report on a course or educational model through which co-design was taught to undergraduate and/or graduate students at various institutions around the world. Figure 2 shows detailed information about these courses.

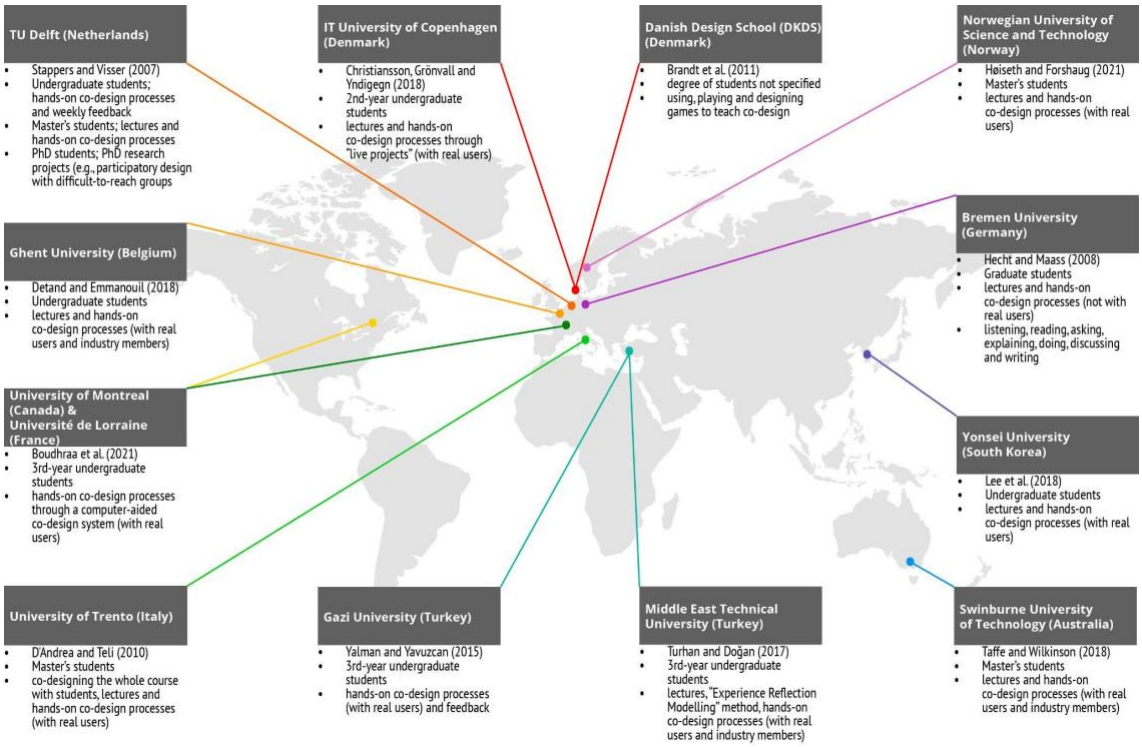

Figure 2. Studies reviewed that report on a co-design course (author (year), institution, degree, teaching method)

4. Discussion

In this section, themes emerged from this systematic literature review are discussed in detail.

4.1. The Necessity of Co-design Education

This review revealed that the need for teaching/learning co-design has been associated with the changing role of design (Stappers and Visser 2007; Hasanin 2013; Augsten and Gekeler 2017). Traditional design education does not fully prepare future designers to meet the needs of society as there is a discrepancy between what design students are taught and what will be expected from them after graduation (Augsten and Gekeler 2017). Researchers argue that conventional design education focuses more on individual design skills (Augsten and Gekeler 2017; Boudhraa et al. 2021) rather than facilitation, choreography, empathy, translation (Yin 2013), visualisation (Brandt et al. 2011, Yin

2013), and collaboration skills (Brandt et al. 2011; Hasanin 2013; Augsten and Gekeler 2017; Turhan and Doğan 2017).

Despite its importance, co-design has rarely been taught (Saurus and Rebola 2012). There is a lack of discussion and resources on co-design education (Hecht and Maass 2008; D'Andrea and Teli 2010; Høiseth and Forshaug 2021). Also, teaching/learning co-design is needed from the beginning of design education so that students most likely acquire the necessary mindset for co-designing (i.e., "the belief that all people are creative") (Sanders and Stappers 2008, 16). The demand for co-design facilitation by designers has also been received from industry and businesses, as prospective workplaces of designers. Interviews conducted by Augsten and Gekeler (2017) with representatives of business and industry to find out which skills are necessary for employees in the design field showed that facilitation and collaboration skills are of paramount importance. If design education can be adapted, future designers might have more realistic expectations about their career paths and this might be beneficial for both sides of this equation. Thus, design students need to be provided with opportunities to acquire the necessary mindset to be able to also facilitate co-design (Stappers and Visser 2007; Hasanin 2013; Augsten and Gekeler 2017; Lee et al. 2018).

4.2. The Structure or Method for Co-design Education

All authors mentioned in Figure 1 agree that co-design education requires a constructivist approach. Only lectures about co-design are not sufficient, it is advised to combine theory with practice for a better understanding and application (Stappers and Visser 2007). Christiansson, Grönvall, and Yndigegn (2018) state that their co-design

course starts with lectures about the history and recent developments of co-design, examples, methods/tools to co-design, empowering marginalised people, documentation and analysis of co-design sessions, and challenges of facilitation. Then, students are expected to conduct their own co-design processes (learning-by-doing) and construct their own knowledge through experience.

Moreover, researchers emphasised the significance of allowing students to reflect on their co-design experiences, since students learn about co-design also through discussion, reflection, and debriefing (Hecht and Maass 2008; Andrews et al. 2014).

Numerous studies claim that students should be confronted with real-life settings during their hands-on co-design projects in the co-design course. They argue that when students face the challenges of conducting co-design (e.g., high degree of uncertainty), they will develop skills to cope with them and thus, become more prepared. In these studies, real users, transdisciplinary projects, and/or industry members were involved in co-design to provide students with first-hand experiences (Stappers and Visser 2007; Turhan and Doğan 2017; Christiansson, Grönvall, and Yndigegn 2018; Detand and Emmanouil 2018; Taffe, Pedell and Wilkinson 2018; Boudhraa et al. 2021). Another angle on this debate suggests that in a co-design course, working with real users is not convenient due to the difficulty of finding and convincing users to participate in co-design processes (e.g., busy schedules, time limitations during a course). Hecht and Maass (2008) emphasised that it was hard enough for students to conduct co-design among themselves.

It is found that some researchers used unconventional teaching methods during their co-design courses. Brandt et al. (2011) provided students with an opportunity to utilise games, which are often used for constructionist learning, during co-design

education. From their perspective, games can be a way to "enter 'as-if' worlds", and thus, would be useful in co-design. In their course, students played games and reflected on them as the starting point for designing their own games. The games designed by students were used as a generative technique to facilitate the participation of people in co-design. Similarly, Turhan and Doğan (2017) have utilised generative techniques in their course. They developed a method called 'Experience Reflection Modelling (ERM)', including several generative tools, interviews, video recordings, and analysis techniques to better understand the needs of users by ensuring their active involvement. They presented ERM to the students and asked them to customise the tools for their own co-design projects. Normally, designers (in this case, design students) are responsible for designing the generative tools according to user needs to facilitate active participation in co-design. However, Turhan and Doğan (2017) scaffolded their students' learning process by providing them with a structured and adaptable method (ERM).

Another essential aspect in co-design education is power relations between students-instructors. Studies support the facilitator role of instructors and active role of students while learning co-design. D'Andrea and Teli (2010) advocated lowering the hierarchy by giving voice to students about their co-design course including course name, structure, syllabus, and evaluation method. Their motto was allowing "the least possible intervention of the instructors" (D'Andrea and Teli 2010, 225), they put extra effort to not jump back into the leader role. Their rationale is to teach students the core philosophy behind co-design: democracy. Several researchers (Turhan and Doğan 2017; Christiansson, Grönvall and Yndigegn 2018) state that students should be given the authority to recruit participants in their co-design process. They encouraged students to take initiative and responsibility as part of their learning process to prepare them for

real-life challenges of co-design and create a sense of ownership. Consequently, the role of instructors in co-design education is deemed as teaching students to *fish* rather than giving them the knowledge in a pre-packaged way.

According to this review, when to start co-design education varies from Bachelor's to PhD degree. Some of these courses were mandatory, whereas others were elective. Highlighting the fact that D'Andrea and Teli (2010) want to integrate democracy in every stage and enhance student engagement, they argued that making theirs an elective course was intentional in the sense that the students taking this course will express self-determined interest in it.

The topic of the co-design projects might vary, too. Students have focused on health-related problems (e.g., fibromyalgia (Høiseth and Forshaug 2021)), societal issues (e.g., the transition of the Danish Design School (Brandt et al. 2011)), sustainability concerns (e.g., 'Making Tea as an Engaging Practice' (Turhan and Doğan 2017)) in co-design courses.

Although the topic might change, certain principles apply to all co-design processes. In a co-design course, students need to iterate (Brandt et al. 2011; Yalman and Yavuzcan 2015; Christiansson, Grönvall and Yndigegn 2018; Taffe, Pedell and Wilkinson 2018) and have more than one encounter with the users regarding their hands-on co-design projects to enhance users' familiarity with the design process and students' understanding of co-design (Christiansson, Grönvall and Yndigegn 2018). Using generative techniques prepared by students to facilitate meaningful participation of non-designers in their co-design projects, is another indispensable part. There is no 'one-fits-all' in generative techniques, they can be in the form of a game (Brandt et al. 2011), 3D models (Turhan and Doğan 2017), or other creative ways that provide non-designers with ease and familiarity in expressing themselves.

4.3. Challenges

The inherent complexities of the co-design process cause issues in teaching and conducting co-design. No recipe for co-design is provided (Hecht and Maass 2008; McKercher 2020), as there is more than one correct way for it (Christiansson, Grönvall and Yndigegn 2018). Moreover, time-intensiveness (Stappers and Visser 2007), communication barriers, power imbalances (Hecht and Maass 2008), and the 'degree of participation' complexity (Saurus and Rebola 2012), are other challenges of co-design.

4.3.1 Challenges of Instructors

There is no clear-cut recipe for how to teach co-design (Hecht and Maass 2008). Furthermore, the ego of the designers as the only author/creator in design causes an obstacle in co-design education (Augsten and Gekeler 2017; Lee et al. 2018). This can be associated with *big-ego design* (Manzini 2015) and the *only-expert mindset* of designers as 'celebrities', who become famous with their designs. The fear of "losing the glory of creativity" creates resistance to the mindset change needed for co-designing (Yin 2013, 151). However, today, designers are expected to "leave their ego at the doorstep" when facilitating co-design (Augsten and Gekeler 2017, S1064).

Instructors' *only-expert* mindset and power imbalance between instructors-students lead to problems in co-design education, too. When instructors tell students exactly what to do and present the knowledge pre-packaged, it contradicts the co-design principles and hinders students' co-design learning process (D'Andrea and Teli 2010; Augsten and Gekeler 2017; Christiansson, Grönvall and Yndigegn 2018). The changing role of design also affects the role of design educators, and now, less hierarchical

approaches are needed (Augsten and Gekeler 2017). The hidden cost is that students' active role requires more time and effort (D'Andrea and Teli 2010; Christiansson, Grönvall and Yndigegn 2018).

Another difficulty in co-design education is balancing theory with practice (Andrews et al. 2014). As further explained in section 4.2, combining lectures with hands-on projects is recommended. However, finding the right ratio of these two (so that they can feed each other), is found to be critical. Lastly, a mono-disciplinary way of education, which does not allow idea exchange among different disciplines, is also seen as an obstacle in the path of co-design education (Augsten and Gekeler 2017). This translates to that co-design education requires multidisciplinary, interdisciplinary, and transdisciplinary approaches.

4.3.2 Challenges of Students

Students' difficulties at every stage (before, during, after) of their co-design projects have been reported. Even gaining access to users was burdensome for students, especially in sensitive contexts like healthcare (Høiseth and Forshaug 2021). Christiansson, Grönvall and Yndigegn (2018) explained that their students procrastinated in communicating with the users as convincing people to commit time and effort to co-design was difficult.

During co-design sessions, some students' expectations from their participants were high. They anticipated that participants would do certain activities on their own without help (Christiansson, Grönvall and Yndigegn 2018). Other challenges evident in the publications included: students' difficulty in creating activities to foster active involvement of people in co-design (Turhan and Doğan 2017; Christiansson, Grönvall and Yndigegn 2018), providing participants with freedom but also structure, giving all

participants an equal voice (Brandt et al. 2011), and coping with the language barrier (Høiseth and Forshaug 2021). Students also struggled with connecting the dots between multiple co-design sessions (Christiansson, Grönvall and Yndigegn 2018) and time management both during (Brandt et al. 2011; Christiansson, Grönvall and Yndigegn 2018) and after (e.g., analysis of findings) the co-design sessions (Turhan and Doğan 2017). After the sessions, interpreting the data and connecting it to design solutions was also challenging for the students as the abundance of data makes it hard to identify and eliminate the redundant parts (Lee et al. 2018).

4.4. Evaluation

Evaluation in co-design education is classified under two topics: evaluating students' understanding of co-design and evaluating the instructional methods in co-design education.

4.4.1. Evaluating Students' Understanding of Co-design

Evaluating students' learning in co-design is found tricky. Nevertheless, it is necessary to have certain criteria or learning outcomes in a course setting.

Assessing whether students grasped the theoretical part of co-design, such as the historical and societal background of participatory design and methods to use during co-design (Hecht and Maass 2008), might appear an easy task. Assessment becomes complex regarding the practical part of co-design because there is no single way, right/wrong, success/failure in co-design, but only grey areas. Since the practical part of co-design education is more about skill development (e.g., soft skills), it was harder for instructors to trace (Hecht and Maass 2008). Moreover, it is impossible for instructors to

be present in all students' co-design sessions (Christiansson, Grönvall and Yndigegn 2018).

According to researchers, students need to be capable of selecting, combining, and applying methods in a motivating way. Furthermore, they should be able to develop, plan, and facilitate (Brandt et al. 2011) (e.g., engaging participants in co-design (Christiansson, Grönvall and Yndigegn 2018)) and document co-design processes (Brandt et al. 2011; Detand and Emmanouil 2018) including the analysis, in which students make connections between a series of co-design sessions and their impact on the final design outcome. Researchers claim that evaluation should be based on the process rather than the outcome of students' co-design processes (Christiansson, Grönvall and Yndigegn 2018). Lastly, students should be capable of applying it to real-life projects (Hecht and Maass 2008). To measure/evaluate students' competencies in co-design courses, instructors have utilised methods such as students' presentations (Detand and Emmanouil 2018) and students' written/oral reflections on their co-design experiences (Stappers and Visser 2007; Detand and Emmanouil 2018; Høiseth and Forshaug 2021) both from a theoretical and practical viewpoint (Christiansson, Grönvall and Yndigegn 2018).

4.4.2. Evaluating the Instructional Methods in Co-design Education

This review demonstrates that it is crucial to keep evolving and improving the instructional methods in co-design education considering students' feedback. Several researchers asked students' opinions about their course setting through surveys/interviews for further improvement. The evaluation includes the motivations and the frustrations of students (Turhan and Doğan 2017; Christiansson, Grönvall and Yndigegn 2018), whether students found the course relevant for their future profession

(Christiansson, Grönvall and Yndigegn 2018), how students rate the course (Hecht and Maass 2008), and suggestions for improving the instructional methods (Turhan and Doğan 2017). In some cases, expert instructors were involved in the evaluation of the educational prototype of co-design education to assess it from the perspective of design education and collaboration (Lee et al. 2018).

4.5. Lessons Learned, Gaps and Opportunities

To resolve students' difficulties during co-design, researchers suggested rehearsing and empathising with participants before sessions (Turhan and Doğan 2017; Christiansson, Grönvall and Yndigegn 2018). Defining the roles (e.g., participants, facilitator) might help students conduct co-design in a smoother way. Making connections between theory and practice (Andrews et al. 2014) and preparing students for possible challenges or problems that might occur before, during and after co-design, would be useful approaches.

Co-design education requires support from universities and industry. Universities can contribute to creating an interdisciplinary environment for students to experience co-design (Augsten and Gekeler 2017). Stronger university-industry collaboration (Augsten and Gekeler 2017; Detand and Emmanouil 2018; Taffe, Pedell and Wilkinson 2018) can pave the way for mutual learning (Yalman and Yavuzcan 2015).

This review emphasised the crucial role of instructors in the effectiveness of co-design education. Power relations between students-instructors might strongly affect students' learning process about co-design. Hence, it is advised to avoid telling students precisely what to do (Augsten and Gekeler 2017; Christiansson, Grönvall and Yndigegn

2018), but allow for self-learning, which is a way of learning initiated by learners' own efforts, by students (D'Andrea and Teli 2010) accommodating instructors' facilitator role. Students' active role should be encouraged, though this requires instructors' mindset shift first. Yet, different profiles of instructors have been discussed (Quayle 1985; Goldschmidt 2002; Goldschmidt, Hochman and Dafni 2010; McDonnell 2016). In those studies, 'instructor as a facilitator/coach' has been portrayed as one of the profiles. Likewise, the attitude of instructors when giving feedback to students in design education was also denoted (Scagnetti 2017). Rather than giving directive and judgmental feedback, it is encouraged to give investigative and suggestive feedback to help students construct knowledge through meaning-making and facilitate learning. Obviously, the facilitator role of instructors is not new. However, this review shows that co-design education particularly requires instructors to acquire this mindset. Otherwise, it contradicts the philosophy behind co-design (democracy), and negatively affects the learning process. Thus, following a meta-level process and co-designing co-design education is recommended for efficiency.

For effective co-design education and a smooth mindset shift for co-designing, students should not feel overwhelmed while learning (Hecht and Maass 2008). With this respect, generative techniques and games would contribute to creating a flow state in students. Game-based learning, based on intrinsic motivation and student engagement, has enormous potential to intrigue and encourage students to learn about co-design and their role. Instead of waiting to be taught, students can be motivated to learn about co-design independently as active actors, not passive listeners. Furthermore, the time to teach co-design during design education is important (Saurus and Rebola 2012). If students can be motivated and curious enough about the role of designers in co-design, through self-learning and game-based learning, their mindset may change earlier.

There is no single way to get students acquainted with co-design and their role (Hecht and Maass 2008); not necessarily in the format of a course but engaging ways to teach co-design are needed (Turhan and Doğan 2017; Boudhraa et al. 2021). This review revealed that flexibility/adaptability are outstanding features (Andrews et al. 2014; Christiansson, Grönvall and Yndigegn 2018). It is strongly recommended to constantly involve students in the design process of 'the way of teaching/learning co-design' to achieve more responsive solutions to students' needs.

5. Conclusion

The aim of this systematic literature review was to explore the reasons behind the need for co-design education, to what extent and how co-design is currently being taught, and to detect gaps and future opportunities.

This review revealed that design students demonstrate a lack of experience and confidence in co-design and have difficulties facilitating the participation of non-designers in co-design. These highlighted that the need for attention to this matter is of increased significance in 21st-century design education. Thus, it is essential to find ways to cultivate the co-designing mindset in design students (RQ1).

Despite the scarcity of studies, it is found that co-design has been taught in various countries at different levels. Even though the importance of co-design is widely acknowledged, it is seen that co-design education is not fully integrated into higher education. One of the reasons for that might be the challenges instructors and students experience. Thus, having a closer look at those might help solve these issues and increase the prevalence of co-design education (RQ2).

Current studies highlight the importance of a constructivist approach in co-design education. How to teach co-design might depend on the context, but there is still

a need to adhere to certain principles (RQ3). For instance, co-design education should not be one-sided, which is given or presented to students by the instructors. Instead, students as active learners may initiate their co-design learning process. Yet, more attention is needed towards self-learning about co-design by design students. It might be the responsibility of design educators to prepare students accordingly for this emerging new role of design/designer. However, students take more initiative in their learning process through the development of more unconventional ways of teaching/learning co-design. For further studies, using games and generative techniques might be a fruitful opportunity to intrigue design students in acquiring the co-designing mindset. For instance, in a meta-level approach, a game about co-design can be co-designed with design students, designers, and design educators to help students learn about co-design and their role. The co-design process of this game as well as its content and openness to modification by students might allow them to be more proactive and engaged, and positively affect their learning process (RQ4).

Lastly, there is a need for follow-up studies on co-design education and cultivating the necessary mindset in design students. It is seen that most of the co-design courses are mainly clustered in Europe (Figure 2), which emphasises the need for further studies on co-design education from other regions of the world as well. It is believed that this study may contribute to the debate on teaching/learning co-design to/as the next generations by creating awareness regarding current challenges and enriched opportunities.

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