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## Educating Designers for the New Era: Current Challenges

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## Educating Designers for the New Era: Current Challenges

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**Abstract:** The role of design is evolving rapidly, requiring new skills and roles for future designers to adapt to the new era of design that began with the increasing globalisation, complexity, and uncertainty of the problems. One of the emerging roles of designers is the facilitator role, which allows designers to bring people with lived experience together, and create a common ground for them to communicate and express their needs easily to better understand those needs and wishes. In addition, one of the key skills future designers would need to be armed with is critical thinking, which is essential for future designers to tackle complex challenges and create innovative, sustainable products and/or services. Design education needs to prioritize the development of critical thinking skills, making them explicit in teaching methods and shifting away from traditional approaches (e.g., only teaching technical knowledge, teacher-centred education) to support students in applying critical thinking effectively. Further exploration is needed to understand what critical thinking for designers entails. This paper focuses on a workshop carried out with design students, designers, and design educators (n = 33) to understand their perception of the facilitator role and critical thinking skills. The findings of this study yielded information regarding the challenges of incorporating these two concepts into design education such as the difficulty in facilitating a co-design process and dealing with complexity. As it is needed to detect these challenges first in order to provide solutions, this study may contribute to preparing and educating future designers for the new era.

**Keywords:** *design education; designer as facilitator; critical thinking skills; future designers; challenges in design education*



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## Introduction

Today, design is increasingly becoming a multidisciplinary field. This derives from the necessity for understanding the complex needs of various stakeholders to generate innovative solutions to design problems. Once upon a time, design used to be predominantly about aesthetics, but today it has a more comprehensive meaning (involving tailored functions, contemporary techniques, and new technologies such as digital tools). Moreover, the design process has gained significance with an emphasis on more varied voices from potential users. Thus, clearly, the role of designers needs to expand just as the definition of design expands (Tosi, 2020, p. 130).

As a response to the changing definition of design and, consequently, the expectations from designers, the new roles and skills needed for designers require its reflection in the design education curricula. However, design education found to be not yet ready for the challenges in this respect (Brosens et al., 2023). Similarly, co-design education is still not fully integrated into design education curricula and the role of designers in co-design as facilitators has still not been widely taught to design students (Örnekoğlu-Selçuk et al., 2023). The current situation of design education is explained by Meyer and Norman as follows:

When we examine what and how our system teaches young designers, we discover that the most valuable elements of the designer's perspective and process are seldom taught. Instead, some designers grow beyond their education through their experience working in industry, essentially learning by accident (Meyer & Norman, 2020, p. 13).

Thus, although there are several studies that have placed emphasis on the design process across a variety of design disciplines, widespread design education does not seem to be covering these new concepts (Hasirci & Demirkan, 2007; Adiloglu, 2011; Park & Lee, 2022). This might lead to frustration and disappointment in future designers when they graduate and do not feel competent in these areas. Therefore, this paper reports on a case study that focuses on understanding what industrial design engineering students, industrial design engineers, and industrial design engineering educators think about these two new concepts and what the current challenges are. This paper does not cover all the roles and skills required from future designers, but it focuses on two essential concepts: 1) designers as co-design facilitators, and 2) designers as critical thinkers.

### Designers as co-design facilitators

In the past century, design used to be seen as a rather siloed discipline, where only designers had a say in the design process. However, this issue has been raised by researchers who advocate the importance of involving people in the design process (Sanders, 1992; Manzini, 2015), since they will be affected by the end outcome (Sanoff, 1988). In a more recent study, McKercher (2020) also explains that making decisions on behalf of people is a way of ignoring their knowledge and skills. Nevertheless, people with lived experience are experts in their own needs, wants, and wishes (Bang, 2009; McKercher, 2020). Without involving people in the design process thus, shaping the design outcome according to the assumptions of designers, can be seen as only *designing for people*, reflecting the only-expert mindset of the designers who make educated predictions for the user. According to this approach, the user is considered only as the *subject* of the inquiry in a passive way. However, as the name suggests, *designing with people* requires taking the user as a *design partner* through promoting their active involvement in the design process, necessitating a mindset shift in the designers as facilitators as well. This derives from the increasing significance of the *co-design* phenomenon, a democratic approach that advocates the meaningful participation of people, who will be influenced by the design outcome, in the design process as the source of firsthand experience (Mattelmäki & Visser, 2011).

In co-design, designers might have various roles, but one of them is the facilitator role (Manzini, 2009; Mattelmäki & Visser, 2011; Minder & Heidemann Lassen, 2018), which refers to making the participation in design process easier for non-designers. Nowadays, the demand for the design facilitator role is rapidly increasing (Granholt & Martensen, 2021). Light and Akama (2012) explain that today it is more common for designers to take the facilitator role rather than the design expert role in a collaborative project. Moreover, as Smeenk et al. (2019, p. 54) put it, "the boundaries between the designers, users and stakeholders blur." Since everyone can be creative as long as they are provided with suitable tools (Sanders and Stappers, 2014; Vaajakallio & Mattelmäki 2014), creating generative tools to allow for active and meaningful participation of the stakeholders, is one of the responsibilities of designers as facilitators. This is further explained by Sanders (2000) as follows:

Designers will be trained to go beyond the individualized expression of visual communication and learn how to become involved in the creation and construction of generative tools. The creative spirit of people in the design profession is essential for the exploration, development and analysis of the new tools (Sanders, 2000, p. 12).

According to Minder and Heidemann Lassen (2018), the responsibilities and contribution of designers as facilitators can be grouped under six areas, namely, project management, creative methods and techniques, external information, creating acceptance, creativity, and interplay. From another point of view, Predan (2021) explicates the key characteristics and skills needed from designers as facilitators, such as being clear on what is expected from people, setting up and guiding the process, having an open attitude, enabling participation in a creative way, and creating a safe environment for everyone to express themselves.

### **Designers as critical thinkers**

As stated above, a rapid change is occurring within the field of design due to the increasing demands of dealing with new technologies, sustainability, and an equitable world. Although many variations in scale, intensity, and technique within the design process can be observed across different design disciplines in terms of participation, the current state of communication and connectedness with higher user demands reflect a similar trend. To address these complex challenges and equip students with the necessary information and updated skills, adaptation of design education presents itself as one of the major issues in design. In a previously conducted systematic literature review, Brosens et al. (2023) already call for a shift towards fostering domain-specific knowledge as well as skills.

One of such highly important skills is critical thinking. The importance of this skill is stressed by the nature of design where a design process is navigated encompassing analysis, problem solving, evaluation, and reflection. In order to make judicious and well-informed decisions within this process, critical thinking is argued to be an essential skill (Barnes & Preez, 2011). Within design education specifically, this importance has been translated into the need to prepare students for future challenges, which according to researchers also includes a focus on critical thinking (Meyer, 2020). This emphasis is motivated by the fact that critical thinking empowers designers to engage with intricate challenges and to conceive innovative and sustainable products and systems (Meyer, 2020).

As the imperative role of critical thinking within the discipline of design becomes increasingly evident, it is crucial to attain a comprehensive understanding of the strategies and approaches employed in integrating this pivotal skill within the framework of design education. Trilling and Fadel (2009) found out that designers who repeatedly exercise their critical thinking are better able to engage with the design process. According to Alt, Raichel, Naamati-Schneider and Jarvis (2022) critical thinking can be stimulated during critique. Behar-Horenstein and Niu (2011) argue that novices in design need higher-order cognitive skills, specifically critical thinking, to move beyond guesswork and belief and rely on criteria or standards for evidence generation and evaluation. They suggest that critical thinking is both an attitude and a logical process that can be taught and mastered. Moon (2007) similarly highlights the importance of critical thinking as a skill that can be developed, starting with reflection on-action and thinking critically about someone else's argument. Therefore, critical thinking also has been stated to relate to Schön's theory on the reflective practitioner (Schön, 1983). To cope with complexity in wicked problems (Buchanan, 1992), designers will need to more often align themselves with new ways of thinking to be more action-oriented. In short, this requires both a reflective and critical approach.

Critical thinking is thus an essential skill for future designers, enabling them to tackle complex challenges and create innovative and sustainable products and systems/services. An adaptation of design education to equip students with critical thinking skills might be necessary. By doing so, designers will be better prepared to address the issues facing society and create a more equitable and sustainable future. However, fostering skills, such as critical thinking, has been said to be hard as these skills often represent thought modes that have become routines for more experienced designers. To teach these skills to novice designers, current education modes often rely on tacit knowledge transfer (Gudur, 2016). However, Van Merriënboer et al. (2002) state that it is crucial to make these complex skills as explicit as possible because it allows designers to clearly define the learning outcomes and ensure that the instructional materials effectively address them. Furthermore, making skills explicit can enhance the relevance and transferability of the learning experience for students, as they would be able to better understand the practical applications of the skills they are learning.

Within design education itself, researchers too have been calling for this shift. Traditional teacher-centred pedagogies may not be effective in preparing students to tackle complex social issues (Souleles, 2017). Especially because these traditional pedagogies highly rely on tacit knowledge transfer (Van Dooren et al., 2014). Ken Friedman (2012, 2019), and Donald Norman (2016) have already acknowledged the need for change in the design discipline, especially in relation to supporting students. Subsequently, Noël (2020) suggests that design engineering education should train students to move beyond know-how by enabling them to pursue a constant path of learning and questioning. This too, in turn, relates to critical thinking. However, still, it remains uncertain what future modes of design education for this skill may then look like (Brosens et al., 2023).

## Case Study

The integration of the two important concepts (designers as co-design facilitators and designers as critical thinkers) into design education concerns not only design educators but also design students, and designers who are currently working in a design agency or industry. Hence, a case study is conducted to bring the representatives of these groups together to exchange ideas and understand how they see the facilitator role and critical thinking skills and whether they have experienced them in their academic and/or professional lives. By carrying out this study, it was aimed to see the bigger picture and have a better understanding of the obstacles that stand in the way of the smooth integration of these concepts into design education. Identifying those challenges are essential to overcome them.

### Setting

The aforementioned case study is conducted in the format of a workshop, which was organized in the scope of an event called 'WONDER Kortrijk Creativity Festival 2022' in Kortrijk, Belgium (Wonder, 2022). Since the future of design was the main focal point of this event, it was found to be suitable for the aim of the workshop, which is in close connection with the future of design education. Moreover, it provided an opportunity to reach out to industrial design engineering students, industrial design engineers, industrial design engineering educators and even people from other disciplines at the same time.

The workshop was held at the BUDA::lab open makerspace (Figure 1), open makerspace, a public prototyping lab where designers, makers, children, students and citizens can engage in creative activities (Design regio Kortrijk, 2023). This place was arranged for the workshop with seven tables surrounded by chairs to allow for group discussions. In total, the event took approximately two hours without any breaks, but after the workshop, some participants stayed in the festival area to have a drink in the bar.



Figure 1. Workshop setting at the BUDA::lab open makerspace (Photography: Corresponding author).

### Participants

Before the workshop, the first two authors of this paper (who will be referred to as 'workshop organizers' throughout the text) made a 10-min presentation each regarding the importance of critical thinking skills and the facilitator role of designers, respectively. In this way, the terms used in the workshop questions were introduced to the participants. Then, for the workshop, participants ( $n = 33$ ) were divided into as diverse groups as possible including design students, designers, design educators, and in some cases, people from disciplines other than design to create a discussion and mutual learning environment among them.

The workshop and the presentations regarding the workshop topic were open to the public. This event was announced online on the website of the WONDER Kortrijk Creativity Festival 2022 (<https://wonderkortrijk.be/2022>), a poster was shared on the social media accounts of Ghent University (UGent), and an email was sent to university

networks to attract the attention of design students and educators and invite them to the workshop. Anyone interested was welcome to join and there were no criteria predetermined by the workshop organizers about the selection of participants. However, most of them were from the field of design, either academia (students and educators) or industry. The language of the workshop was a mixture of English and Dutch, where participants were more comfortable expressing themselves in their native language. Since one of the organizers was a native Dutch speaker, this was not an issue. Before the workshop, informed consent forms were distributed and explained to participants in Dutch and English. The ones who volunteered to participate in the workshop and research signed the informed consent form. In total, 33 participants attended the workshop including 11 design students, 15 designers, 5 design educators and 2 people with a background other than design. Except for one participant, all participants were native Dutch speakers, and they were divided into seven groups.

## Methodology

The tools used during the workshop allowed the workshop organizers to collect and document data as well as to create a discussion among group members. Each group was provided with a set of four A3 paper templates prepared in English, having a question with some sub-questions on each page. While the first two pages were about the facilitator role of designers, the other two pages concerned critical thinking skills. The questions presented to the participants through these templates are as follows:

1. How do you see your role as a designer?
  - a. Why?
2. Have you ever facilitated a co-design session?
  - a. How was your experience?
  - b. What were the difficulties/challenges?
    - i. How did you cope with them?
3. What is your current level of critical thinking? (See Figure 2)
  - o Why?
4. Have you encountered knowledge and skills you are missing to carry out your current job?
  - a. Which ones?
  - b. Did you aspire to learn them?
  - c. What were the difficulties/challenges in learning them?

- I am a designer/engineer in industry
- I am a design/engineering educator
- I am a design/engineering student
- I have another background

### 3. What is your current level of critical thinking?

Paste the dot somewhere on the line below. The color of the sticker represents your occupation (student, designer, educator)

habitual thinking

critical thinking

**Why?**  
Paste your answers below on sticky notes:

Figure 2. The third page of the workshop template with the first question and its subquestion (prepared by the workshop organizers)

The levels mentioned in the 3rd question (Figure 2) were based on a scale previously used by TU Delft to describe four levels of reflection (Lousberg et al., 2019). Although it is called a reflection scale, it is mainly based on the four levels of abstraction that anyone can go through in any situation. Therefore, it was suited as a means to probe the participants' level of critical thinking as well. The first level is habitual action, which involves no abstract thinking and deals only with what is required. The second level is understanding, which indicates a level of comprehension of concepts. At this level, individuals can explain their thinking and discuss their point of view, but they may not consider other perspectives. The third level is basic reflection, which involves applying concepts within a certain context and recognizing that there may be multiple valid perspectives. The final level is critical reflection, which requires awareness of the actions within a wicked real-world context. This level may involve challenging previous assumptions and establishing a personal position, leading to the creation of new knowledge by engaging with real-world problems.

In addition to the paper templates, each group was also presented with a set of sticky dots in four different colours (red, yellow, blue, and green). Each colour represented a different group, namely; design students (blue), design educators (yellow), designers (red), and people with another background (green), and the legend was given on the right top of the template. Participants were asked to use the sticky dot in the colour that represents their occupation to paste somewhere on the line to express their thoughts. In this way, the templates were filled in anonymously, but at the same time provided more specific data to the workshop organizers to analyze after the completion of the workshop. Furthermore, the participants were provided with sticky notes to write down their thoughts. During the workshop, organizers walked around the groups to answer the questions of participants regarding the template but did not actively participate in the discussion in order not to affect their responses.

## Analysis

At the end of the workshop, all groups submitted the templates that they filled in during the workshop to the workshop organizers. In total, 28 A3 papers were collected from seven groups. Then, these papers with the sticky notes and dots were photographed and compiled in the digital working environment Miro, one by one for simultaneous qualitative analysis by the workshop organizers. The data was analyzed through thematic analysis by the workshop organizers on this platform over the span of two months. Themes were generated according to the notes of the participants on these templates. For example, Figure 3 demonstrates a screenshot from the Miro board analysis, where the theme (challenges of co-design facilitation) and the quotes related to that theme are given on the right-hand side.

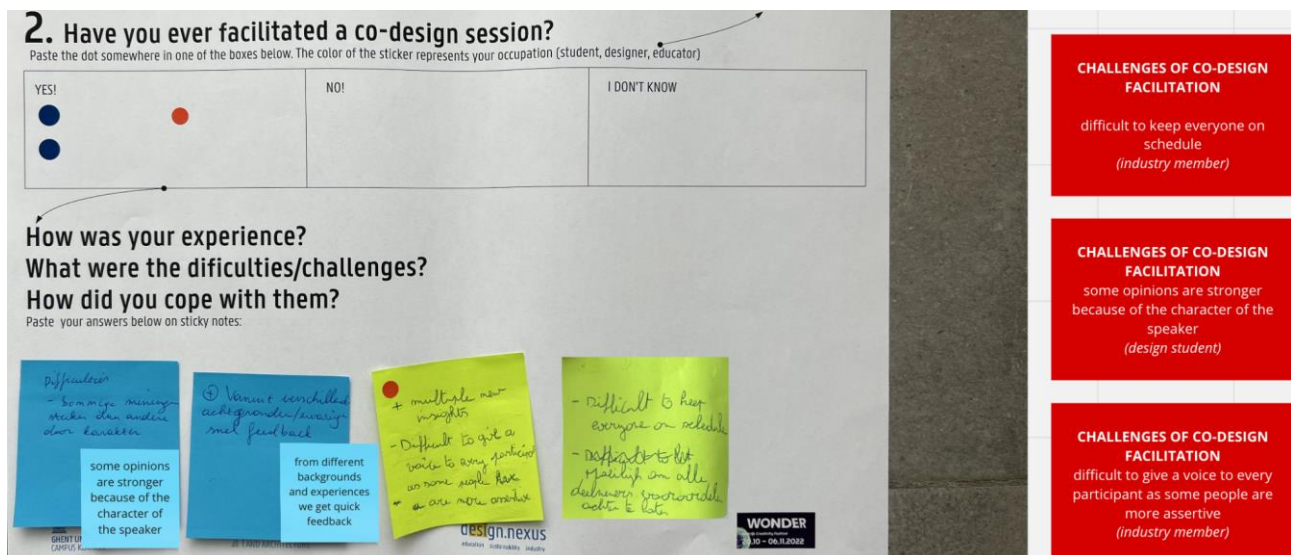


Figure 3. A screenshot from the analysis on Miro

Since the participants were free to fill in the templates either in English or in Dutch, the sticky notes filled in by the participants were a mixture of these two languages. As one of the organizers is not fluent in Dutch, the other organizer, who is a native Dutch speaker, translated the Dutch notes into English on Miro (Figure 4), and was asked to confirm the analysis of the translated parts to prevent the data from getting lost in translation.

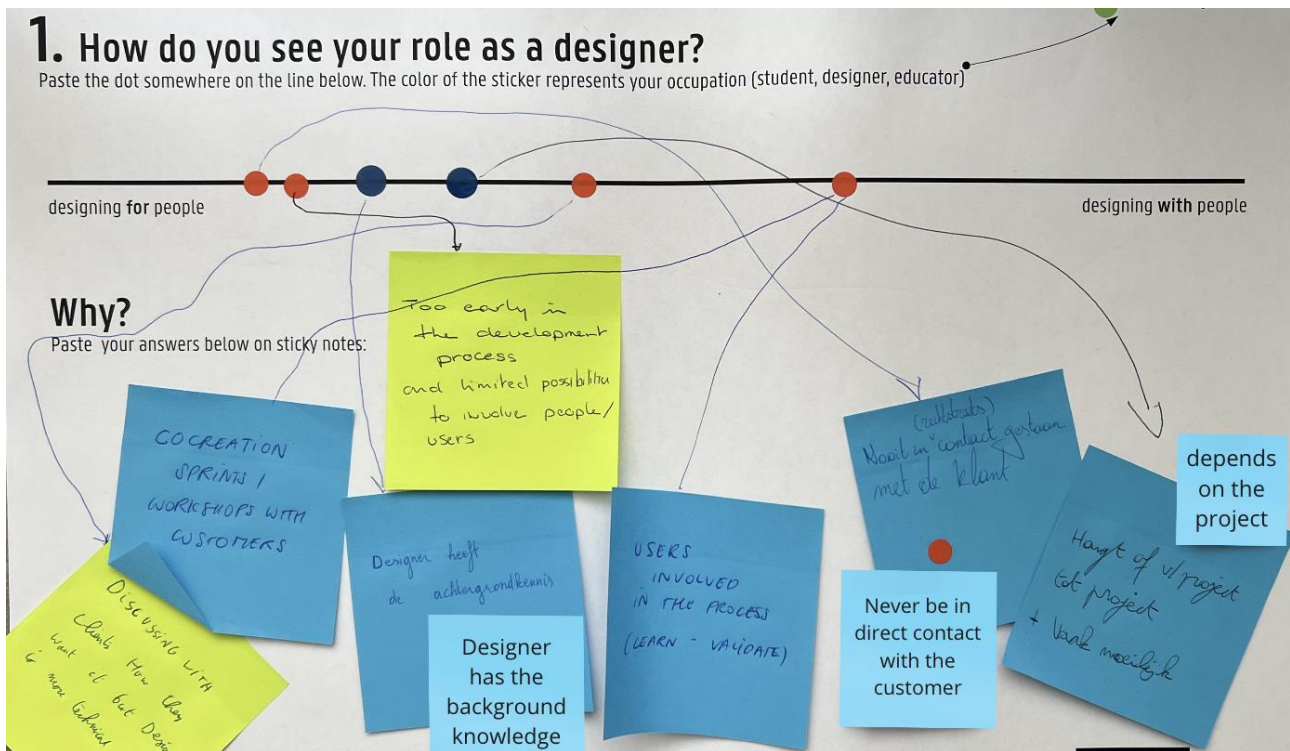


Figure 4. The notes that were in Dutch were translated by one of the workshop organizers into English on Miro to allow for the other organizer to understand and analyse the data

## Findings and Discussion

The thematic analysis of the data collected during the workshop mainly addresses the challenging aspects of designing with people (instead of designing for people), facilitating a co-design process, and thinking critically as a designer.

### Designing with vs. for people

Sixteen out of 33 participants positioned themselves on the spectrum with dots as a designer who is closer to designing with people, only 4 of them strongly supported designing with people by pasting their dots very close to the right end of the spectrum (Figure 4). For instance, a designer mentioned, “I facilitate subjects with people, and together we come to a plan of action”, showing that they are aware of the importance of user involvement in the design process. Similarly, another designer stated their thoughts as, “Without people you do not have to design anything”, accepting the significance of users for designers. The **motivation to design with people** is explained by a design student as being able to design a “**more enjoyable and easy-to-repair product**” with the help of people with lived experience. In addition, a designer participant drew attention to the end result, “Designing with the user creates a **more pleasing result** for the user. It comes in handy when in doubt of a feature”. Another motivation is explained by a design educator as, “Simply because I don't have the same experiences, needs, wishes, abilities, etc. of the people, I intend to design something with them”, admitting the fact that it is nearly impossible to fully empathize with people.

The findings show that one of the designers has a **misperception of designing with people** in a co-design process, mentioning that it aims to *validate*, “Users involved in the process through co-creation sprints/workshops with customers (learn - validate)”. Even though it seems to be a positive approach towards designing with people, diminishing co-design to *validation* of designers' own ideas is a misinterpretation of the definition. Instead, it is closer to *testing* or *designing for people* rather than *facilitating their participation* and *designing with people*. This demonstrates that in some cases co-design is only applied because it is becoming popular to organize workshops with people, without actually understanding and embracing its mindset and values. This situation proves that proper co-design training should be provided not only in the territories of academia but also in industry.

The discussions also revolved around the **difficulty of co-design and facilitation**. In some cases, these difficulties were given as an excuse to design for people, not with them. One of the designers noted that democracy, which is the core of co-design facilitation, might not be solely sufficiently practised in design, “Belief that a **pure democracy does not work**. There is a need for a vision and insight into what is valuable”. According to another designer, the **design process is a black box** for non-designers and it requires the designers to decide on behalf of people, “We design industrial



installations to the needs of our customer (so together with them) but for a lot of our customers, things are a black box, so we need to make decisions for them". Moreover, the reason for designing for people is justified by a designer stating that, "**Too early** in the development process and **limited possibilities to involve people/users**". Another challenge of designing with people claimed by a designer is that "design is more technical", believing that design is beyond the capabilities of non-designers. In addition, a designer noted, "Because people most of the time don't know what they need" as a reason to design for people.

### Difficulties with co-design facilitation

From another perspective, a participant with a background other than design explained that, "Consumers often expect things to be designed by them; putting them at the centre is necessary **for further innovation**" addressing a **demand by consumers to be actively involved** in the design process for more innovative idea generation processes. A design student also advocated that, "Customer demands increase, it becomes almost impossible to design without an end customer". On the one hand, it is stated that the active involvement of people in the design process might help designers to understand their requirements better, but it might be hard for people to put these requirements into words. This points out the need for a facilitator to help people understand what they actually want.

On the other hand, the **designers' incapability to facilitate** a co-design process is emphasized by another participant, "Nowadays, most of the designers are not fully capable of fulfilling the facilitator role", indicating a need for cultivating the necessary mindset and skills in design students to facilitate a co-design process. This argument is also supported by a design student stating that, "[I have] never been in direct contact with the customer". Similarly, another design student agreed that "A lot is focused on designing with users, but I think this is not applied enough within our projects". Furthermore, some design students believe in the comprehensiveness of their background, "Designer has the background knowledge" as an excuse to design for people, not with them. However, as explained by several researchers (Sanders & Stappers, 2014; McKercher, 2020) in the field of design, multidisciplinary co-creation is quite critical and designers have a lot to learn from people with lived experience. Having an illusion of being self-sufficient as a designer who designs for people might lead to frustration and disappointment for designers in their future careers when their employers expect them to design with people and facilitate a co-design process. Correspondingly, another design student explained the role of designers as follows, "Customer comes to explain the problem, the designer makes a personalized machine" showing a strict distinction between the role of the designer and the user. Nonetheless, in today's world, allocating more power to people with lived experience in a design process, this distinction is becoming more and more blurry (Smeenk et al., 2019). According to a designer participant, "Main focus should be on designing with people for understanding the needs. Until a certain level, this should be taken into account, but the designer should also be able to have a voice and give his *expert* opinion", pointing out the fact that designers do not have to be fully invisible to allow for non-designers' participation in the design process. In relation to that, one of the design educators stated, "As Viktor Papanek nicely describes it, 'everyone who has an impact is a designer' and as a teacher, I do feel that I am shaping the skillset of the future with my students". However, it was also found that not all design educator participants were aware of the facilitator role of designers, co-design or designing with people.

According to the participants, facilitating a co-design process is challenging for various reasons. First, a designer participant stated the difficulty of objectivity as, "Keeping your role distance in the process: facilitating vs. problem-solving", referring to **multiple roles of designer** in a co-design process. Other challenges mentioned regarding co-design facilitation are time management, thinking outside the box, requiring more time, assigning everyone a clear task, attracting the attention of people and keeping them focused, creating a balance in multidisciplinary teams, aligning different goals of people, encouraging people to take notes in order not to lose any information, not being able to use the output of a co-design process, keeping everyone on schedule. Another issue during co-design facilitation is explained by a designer to be "difficult to give a voice to every participant as some people are more assertive". This is also raised by a design student, "Some opinions are stronger because of the character of the speaker", emphasizing how hard it is for facilitators to **enable equal participation** of people with different character styles.

### Challenges in thinking critically

The other questions, on the topic of critical thinking revealed equally interesting results. Related to the level of critical thinking that was self-reported by the participants, most stated to have a high level and situated their dots around the 75% mark. There were no particular differences within the different groups we probed (students, educators, industry designers). However, the participants attending with a different background particularly placed their dots slightly closer to the middle of the axis between habitual thinking and critical thinking. This might mean that these **design**

**practitioners seem highly confident in their abilities to think critically.** However, research that actually measured the ability of students to think critically showed less optimistic results. In on-going research by the second author, it was found that the majority of participants scored at the habitual thinking level before engaging with a learning activity tailored to foster these skills. This observation is consistent with the results of a study conducted at King Faisal University in Saudi Arabia (Al-arfaj, 2011), where design students' scientific reasoning abilities were evaluated using a comparable scale. The scale ranged from empirical inductive (low-level) to transitional (average) to *hypothetico* deductive (high-level). Similar to our findings, the study also discovered that most students scored the lowest (empirical inductive) level. These studies hint at the fact that designers (in these studies still students), might **overestimate their abilities to think critically.**

With regards to how critical thinking is perceived, most of the participants relate it to **questioning**. There is a slight difference in perception between designers in industry who phrase it as “critical thinking is about questioning what is known”. Whereas students state critical thinking relates to “questioning why to design a certain way”. With regards to obstacles they encountered, students added more notes to the templates. That might be expected as they are still training to overcome some of the stated obstacles. A few participants stated quotes that relate to how **difficult it is to move away from routine thinking patterns towards critical thinking patterns**. To illustrate this, some quotes from students are as such; “I myself notice that I sometimes work and act on autopilot when I do know I can do better. With some things I do think critically but find it difficult to apply it” or “It is difficult to think critically when you are unaware, when you are aware, you are already a step ahead”. There was even one participant who just added a note with only “critical thinking is difficult”, so it seems that it is even difficult for some students to name the difficulty. Two other students were able to frame the difficulty as “**dealing with complexity** and a lack of knowledge on critical thinking” or that it is “difficult to define the level of reflection and go deeper than an understanding level”. Educators and industry designers seemed to have different difficulties. They stated that when critiquing others, it is difficult to remember everyone has a **common goal of making the work critiqued better**. Specifically, they state that, “Open, critical communication is sometimes difficult” (industry designer) or “I am lacking exercise techniques to stimulate critical thinking for students” (educator).

Regarding the question of whether the participants (n = 33) encountered knowledge and skills they were missing in order to carry out their current job, 29 dots were placed in the yes answer. No one answered no, and only 1 dot was placed next to the I do not know the answer. This means that three participants refrained from answering this question. The things named by the participants as missing include a variety of skills and domain-specific knowledge. Related to **general soft skills** (including critical thinking) some stated to be missing “patience, flexibility, and imparting knowledge in a fun way”, and “the ability to think critically”, which according to this participant requires “dedication and structure”. Mostly people from industry stated that they were lacking **business skills** like leading people, project management, legislation or “dealing with change management”. This change management closely relates to another answer by someone from industry who states to be lacking “future thinking abilities”. Students more often stated to be **lacking knowledge and skills closely related to the design profession**. This includes things like, “I feel the spectrum of design can be so broad of design skills, but I am nowhere profoundly good at” or “I find it hard to deal with design testing, practising, trial and error”. Lastly, two types of skills and knowledge were defined as missing by educators, students, and industry designers. **Life-long learning skills** seem highly relevant for all profiles as a student added, “It would be sad if I learned everything I needed to know at school”, while an industry designer stated, “You can never know everything, there is always new knowledge to know”. Related to this new knowledge, both students and designers in industry stated that they are **lacking knowledge on “technical practicalities”** or more specifically “AI, blockchain, coding”, “sustainable materials and designing with them”, “new CAD programs”. They furthermore state that “an absence of the necessary learning material complicates the learning process” to acquire these skills.

## Conclusion

This study drew attention to the challenging aspects of the facilitator role and the critical thinking skills of designers to be able to cope with those challenges and allow for a smoother integration of these concepts into design education.

Although it was found that participants were mostly aware of the importance and necessity of co-design, various **difficulties of co-design** were the main topics during the discussions. For instance, the **limited abilities of non-designers** in expressing their needs were mentioned as an excuse to design for them without actively involving them in the design process. However, this should not be an excuse and designers should be educated towards how to design generative tools and techniques for non-designers to express even the needs that they are not aware of yet, as explained by Sanders and Stappers (2014).

Another point that requires attention is the **power relations** between designers and non-designers during a co-design process. Since it is a sensitive issue and the designers' dominant voice as an expert might intimidate non-designers and lead to passive or tokenistic participation, which is not intended in a co-design session, designers should be specifically educated on how to **find the right balance** in their different roles (e.g., facilitator vs. expert role). Clearly, the smooth integration of these concepts into design education requires prior awareness in design educators. Furthermore, this study also indicates that **co-design training** should not be reserved only for academia but also needs to become more widely applied in industry. However, this can be even more challenging than educating design students as it might be harder to change the fixed mindset of designers who have designed for people (not with them) for years.

With regards to critical thinking, this study revealed that participants seem highly confident in their abilities to think critically. This invokes the need to further research the **self-reported critical thinking levels** and match these with objectively scored levels. Looking at the obstacles, the need was uncovered for targeted interventions to foster critical thinking skills in students and designers. The findings also highlight the importance of **addressing specific knowledge gaps** and **acquiring relevant skills** to meet the demands of the design profession, particularly in areas such as business, future thinking, and emerging technologies. Encouraging lifelong learning and providing adequate learning resources might support the development of critical thinking and enhance the overall competence of individuals in the design field.

In terms of limitations of this study, it was not possible to fully record the discussions in each group, though this could have provided more insights into the perceptions and perspectives of participants. Further studies may involve checking all sticky notes at the same time and asking for more explanations from all participants about their responses. Furthermore, while the participants were provided with contextual information and theoretical underpinning via the presentations, the self-reported evaluation of their own critical thinking capacity by the participants might not entirely be deemed impartial. However, the significance of this research lies in the subsequent exploration of the underlying cognitive rationale linked to this self-assessed measure of critical thinking, addressing the fundamental question of 'why'. In this sense, the data collected from participants were more dependent on the studied interpretation of the researchers. In order to increase reliability, the workshop organizers cross-checked the data analysis of each other. Having another facilitator in the team to only read each sticky note simultaneously and ask questions to participants and take notes may have supported the process. Moreover, for some questions, some irrelevant answers were given by a few participants. They might have forgotten or misunderstood the meaning of the terms used in the questions. For improvement, a short definition of the terms can be given under each question.

In conclusion, it is believed that this study contributes to educating future designers for the new era by pointing out current difficulties and challenges. These aspects require further attention, especially from design educators, for their smooth adaptation in design education.

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