Designing for Sustainability: Emerging Professional Roles and Capabilities for Designers in the 21st Century

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Abstract

Design Practice is shifting towards transdisciplinary, collaborative and problem-based approaches in response to complex challenges of a changing world including societal issues and the climate crisis. However, the nature of emerging roles for designers aiming to contribute to sustainability transitions, and the capabilities that empower designers to act in these roles, remains uncertain. This research draws from 26 in-depth, career-focused interviews with graduate designers from four higher education sustainability-focused design programs across four continents. Using grounded theory as a methodology, it identifies emerging sustainability-focused professional design roles and their corresponding design capabilities. This paper integrates findings with existing research on design roles, agencies, actions and tools relevant to sustainability transitions, examining their implications from a higher education perspective. It explores the potential for emerging design roles and capabilities to inform the development of higher education design programs. This study emphasises the need for design curricula to become responsive to the evolving scope of design practice, ensuring that graduates are equipped to drive change towards sustainable futures.

Keywords

design, design capabilities, designer roles, education for sustainability, graduate capabilities, sustainability transitions

DOI: 10.1111/jade.12592

Introduction

Sustainability, as recognised by most educational structures and institutions, needs to be an integral aspect of Higher Education design courses to equip future designers with capabilities that are relevant to a changing world. Design as a discipline has expanded and its relevance in tackling complex contemporary challenges, from societal issues to the climate crisis, is now widely recognised (Williams & Rieger, 2015; Meyer & Norman, 2020; Tsekleves *et al*., 2021). Design practice is undergoing pivotal shifts and designers are deviating from discipline-based and output-based approaches, instead adopting transdisciplinary, problem-based approaches involving collaboration with a variety of stakeholders to address complex issues (Irwin *et al*., 2015; Ceschin & Gaziulusoy, 2016). Some recent studies have explored the roles of design in sustainability transitions projects (Gaziulusoy & Ryan, 2017; Falay von Flittner *et al*., 2022; Lähteenoja *et al*., 2023). Yet, the nature of emerging professional roles for designers contributing to sustainability transitions remains understudied, as are the capabilities that enable them to act in these roles, and the ways in which these can inform higher education design programs (Kessler, 2022).

Using grounded theory as a methodology, this research draws from 26 interviews with designers working in sustainability-related design practices across diverse geographical and cultural contexts to define emerging sustainability-focused design roles and the capabilities that underpin them. By integrating these findings with existing literature on design roles, agencies, actions and tools for sustainability transitions, the study underscores the necessity of shifting from traditional, discipline-specific expertise towards collaborative, transdisciplinary approaches to design practice. Defining these professional design roles and capabilities is essential to developing responsive higher education design programs that prepare design graduates to contribute to sustainability transitions. This paper discusses opportunities to integrate these roles and capabilities into current higher education design curricula to reflect the evolving nature of sustainability-centred design practice. Reforming curriculum development processes is key in ensuring that design programs equip graduates to meaningfully engage with complex societal challenges and contribute to positive change towards sustainable futures.

Literature Review

Definitions of design for change seem to converge towards design as a practice capable of addressing complex problems and facilitating sustainability transitions. Design interventions that enact change are plural, collaborative and transdisciplinary, transcending traditional design boundaries beyond the realms of manufactured commodities and aesthetics (Ceschin & Gaziulusoy, 2016; Friedman *et al*., 2014; Irwin *et al*., 2015; Norman & Stappers, 2015).

As decision-makers able to transform relationships between humans, material environments and ecological systems, designers must develop capabilities empowering them to take responsibility for their practice and lead transformative change towards sustainable futures.

Design education, fundamental in this endeavour, is facing criticism for lagging behind 21st-century requirements and clinging onto a persistent yet outdated paradigm of practice rooted in an era of industrial mass manufacturing (Meyer &

Norman, 2020; Davis & Dubberly, 2023). Academics globally are advocating for a shift in design education for the curricula to better align with emerging roles in design practice that are relevant to sustainability transitions (Brogden *et al*., 2022; Carlisle *et al*., 2022; Gaziulusoy & Ryan, 2017; Sanders, 2017; Kessler, 2018, Kessler, 2022).

Higher education design programs typically employ a top-down approach to curriculum development guided by constructive alignment principles (Houghton, 2004; Biggs & Tang, 2007). Graduate outcomes are defined as 'generic learning outcomes that refer to transferable, non-discipline specific skills that a graduate may achieve through learning that have application in study, work and life contexts' (Australian Government Tertiary Education Quality and Standards Agency (TEQSA), 2021, Graduate attributes section). These translate into different levels of learning outcomes, from program level to course level outcomes, constituting the basis upon which both curriculum content and teaching strategies are developed.

In Australia, government funding for universities depends on graduate employment, student experience, success and equity (Australian Government Department of Education Skills and Employment, 2019). These performance criteria shape graduate outcomes and education quality assessment. However, they often contrast with the need for universities to consider their responsibility in sustainability transitions (Barrie, 2006). Concerns have arisen regarding whether performance criteria align with societal priorities beyond industry and government employability agendas (Barrie, 2006; Davis & Dubberly, 2023).

The notion of global citizenship is another important component of graduate outcomes (United Nations Educational, Scientific and Cultural Organization, 2022). Graduate outcomes should contribute to shaping responsible citizens in a democratic society (Anon, 1997), preparing graduates to act as 'agents of social good in an uncertain future' (Bowden *et al*., 2000, Executive summary section) and enhancing disciplinary knowledge for societal betterment (Arvanitakis & Hornsby, 2018). For employability to not come at the expense of global citizenship, university performance criteria should align with current societal priorities (Barnett, 1994; Oliver & Jorre de St Jorre, 2018; Ryan & Tilbury, 2013).

On a backdrop of climate crisis, this paper opts to use the terms *graduate capabilities* and *design capabilities* over *graduate attributes* or *outcomes* to better reflect the need for higher education to prioritise global citizenship, and therefore, sustainability. It draws from Sen and Nussbaum's *Human Development and Capability Approach* which positions well-being as a central value of human existence, challenging economic models that associate quality of life with Gross Domestic Product (GPD) or living standard with economic growth (Nussbaum, 2011; Sen, 2009).

Nussbaum (2011) argues for a shift in education priorities away from narrow marketable skills that generate short term profit, emphasising citizenship and well-being instead. Similarly, the Organisation for Economic Cooperation and Development (OECD) (2005) underscores that key competencies for well-functioning societies imply that individuals should be able to achieve their potential while respecting others and contributing to producing an equitable society.

In the design context, Boehnert *et al*. (2022, p. 2) suggest that universities should prioritise 'producing responsible, socially aware, and ecologically attuned design graduates that can exhibit good global citizenship'. Design education should

empower graduates to develop capabilities enabling them to reshape societal narratives, re-imagining and actualising sustainable futures (Dewberry, 2011). This paper suggests that *graduate capabilities* should enable graduates to pursue a life they value while contributing to sustainable societal models and futures. Therefore, *Design capabilities* should empower graduates to make decisions leading to a life they value while aspiring to create different ways of being and acting in the world (designing), in turn enacting transformative change towards sustainable futures.

While the literature contributes to clarifying the purpose of *design capabilities*, their nature remains uncertain. The disconnect between how *design capabilities* are defined in higher education and the evolving nature of design practice constitutes a major concern (Carlisle *et al*., 2022; Sanders, 2017). The perspectives of relevant stakeholders, such as design practitioners working in sustainability-related practices, remain mostly absent from this inquiry. This issue is exacerbated by a lack of empirical research into the changing landscape of design practice. Although the role of design in catalysing sustainability transitions has been established, further research is needed to understand emerging designer roles in this context (Gaziulusoy & Ryan, 2017; Lähteenoja *et al*., 2023).

While existing research on emerging design roles and capabilities provides valuable insights, it often focuses on specific design sub-disciplines or project-based case studies. This highlights the need for broader exploration of design roles and capabilities within the expanding scope of design practice and its contributions to sustainability transitions.

For example, some research focuses on emerging areas of design practice such as design for social innovation (Manzini, 2015) and design for policy and governance (Lähteenoja *et al*., 2023). Additionally, Ceschin and Gaziulusoy's (Ceschin & Gaziulusoy, 2016, p. 143) *Design for Sustainability Innovation Framework* identifies five key levels for design intervention towards sustainability including material/-component, product level, product-service system level, spatio-social level and socio-technical system level.

Others have focused on identifying capabilities required for designers to create change towards sustainable futures. McMahon & Bhamra (2015) gathered experts' insights to define design competencies for social sustainability. While their research highlights the value of context-specific frameworks for defining graduate capabilities, relying on predetermined competencies may affect the emergence of competencies associated with new design roles. While not primarily focused on capabilities, Faludi *et al*. (2023)'s propose fundamental topics encompassing knowledge and actions for sustainable design. These include sustainability fundamentals; circular economy; whole systems thinking; sustainable innovation strategies; impact assessment; laws and standards and communication, collaboration and leadership.

Few studies explore emerging professional roles of designers in design for sustainability and their corresponding capabilities together. Recent inquiries explore the role of design in sustainability transitions projects operating at the socio-technical system level. Gaziulusoy & Ryan (2017) identify roles pertaining to inquiry, process and outputs, most of which were later observed by Falay von Flittner *et al*. (2022) in multiple case studies. These include assisting with analysis and synthesis of different knowledge forms in vision development; facilitation of participatory inquiry and deliberation; visual communication of alternative futures; formulation of scenario prototypes pre-negotiated with the stakeholders, human-centric inquiry iteration; prototyping and experimentation and dealing with uncertainty and complexity. Lähteenoja *et al*. (2023) investigate both the emerging role of

design in supporting policy governance and its associated design competences. They identify novel design agencies including communication (preparation of materials and communication) and (visual) construction, facilitation of co-design workshops (action), strategic planning (connecting outputs to guide further action) and systemic integration (integrate contextual and material boundaries).

This research investigates emerging designer roles in sustainability-related practices and the capabilities enabling them to act in these roles. In contrast with project-focused inquiries, it draws from interviews with multiple designers actively engaged in various sustainability-related design practices. The study deliberately encompasses diverse aspects of design for sustainability, positioning the pursuit of sustainable futures as a shared goal while recognising the existence of multiple pathways to achieve this.

Methods

This research employed Constructivist Grounded Theory as a methodology (Charmaz, 2014), aiming to generate 'theory that explicates a phenomenon from the perspective and in the context of those who experience it' (Birks & Mills, 2015, p. 17). Twenty-six designers working in sustainability-related design practices participated in 60 minutes semi-structured career-focused interviews. Interview guides were crafted to gain an in-depth understanding of the participants' professional roles and the capabilities they considered essential to these roles.

Participants were recent graduates from four sustainability-centred higher education design programs actively engaged in sustainability-related design practices. The programs were respectively located in Australia, Colombia, Finland and the United States, ensuring maximum contextual variation in the data (Birks and Mills, 2015). After gaining ethical clearance, potential participants were identified through digital platforms in the public domain. After gaining consent from the participants, the interviews were conducted in person or online, transcribed and all data was de-identified. In the results section of this paper, interviewees will be referred to as 'Dn' (Designer—number).

Data analysis involved iterative processes with three rounds of coding according to Grounded Theory guidelines (Charmaz, 2014). Initial coding using software NVivo aimed to categorise and summarise each piece of data, describing actions using the participants' vocabulary. Focused coding was used as a way of identifying patterns through initial codes and relevant categories from an analytical point of view. This revealed patterns, categories and relationships in the data, facilitating successive levels of analysis and theory development. The use of constant comparative analysis and theoretical sampling ensured that emerging analytic categories remained grounded in the data and enabled continuous refinement of codes and validation of their relevance. Data collection and analysis occurred simultaneously, enabling the researchers to investigate the boundaries and properties of coding categories until saturation was achieved, that is when gathering fresh data no longer sparks new theoretical insights, nor reveals new properties of these core theoretical categories.

The findings section of this paper presents a section of the theoretical framework that emerged from this study, comprising seven emerging designer roles along with 14 corresponding capabilities labelled using terminology extracted from the interviews.

Results

Emerging roles for designers

The data revealed seven categories of professional roles for emerging designers in design for sustainability. Most interviewees did not exclusively align with a specific design discipline. Instead, they often engaged in various professional activities across disciplines. Interestingly, these roles were not confined to a single research location or programme.

Social innovators focused on community development, collaborating with vulnerable communities, empowering stakeholders to create lasting positive change. *Social innovators* worked with NGOs, in the public setting or in social enterprises. D6 stated: 'We call our business a consultancy, or an innovation laboratory where we are trying to develop system-focused solutions. One project was a participatory mapping with communities where we developed different workshops with stakeholders that were working with vulnerable communities'.

Several participants described themselves as *infiltrator change-makers* with the professional objectives of 'creating change towards sustainability from the inside' (D18) or 'trojan horsing, spreading ideas from the bottom up' (D25) in existing businesses. The businesses in question ranged from large digital media and product development companies to user experience design firms. Designers in this context aimed to 'poke the conversation and ask uncomfortable questions' (D10) to push the sustainability agenda both at company level and in client projects. D23 explained: 'I infiltrated a very large company and slowly move the needle from within to make their products more sustainable. I directly affect what manufacturers are producing for my company. It is my responsibility to ensure that I can slowly but surely make a business case for them to produce more sustainable products'.

Other interviewees worked as *policy/government influencers*, highlighting the agency of design in policy making and governance. Professional settings included a think tank focusing on transformative governance, independent research labs advising large businesses and government, and a state-owned research lab with activities varying from carbon-neutral solutions to sustainable products and materials, as well as digital technologies. *Policy/government influencers* worked on 'suggesting projects valuable to government and organisations often contracted by states, putting case studies and interactive pieces out into the world for state leaders to learn from and take on strategies' (D21). D8 worked on 'wide impact, system-level projects trying to improve processes related to different sustainability related legislations that ministries are handling'.

Entrepreneurship emerged as a professional avenue for designers working in sustainability-related practice. For *entrepreneurs*, creating a business was often performed among other professional activities. Businesses included design for the public domain (public spaces, cities, municipalities), participatory design for community development, sustainable material innovation and design projects related to the circular economy.

Research and innovation have become another key employment area for designers. *Researcher-innovators* were employed in university research labs focusing on a range of topics such as sustainability in early childhood education and sustainable energy technologies adoption. Others worked in private or independent

research labs respectively in the domains of business innovation, sustainable materials research and development and accessibility.

Several interviewees worked 'on the side' (D7) as *educators*, teaching in the higher education context, in courses related to design and sustainability.

Several designers described themselves as *insiders*, working for companies with an established sustainability focus. These included design consultancies (digital media and marketing, spatial/urban design, transdisciplinary design), a clothing label and a large product development firm. Others worked in start-ups with different foci such as composting, food or material innovation. Several participants held roles in sustainability-oriented companies that had primary focuses beyond design including an ethical superannuation fund, non-profit organisations and workers' unions.

Corresponding design capabilities

Fourteen *design capabilities* considered essential by the participants to act in their roles emerged from the data. These were consistent across the majority of designers interviewed, irrespective of their role.

Understanding, visualising and intervening in systems emerged from the data as a key capability for designers to 'think systemically' (D5), 'understand how problems are interconnected' (D22) and 'view problems and systems at a high level and zoom in to make sense of them' (D21). Representing systems, including mapping through 'constellations' (D15) to 'frame the problem, map the stakeholders and draw the many parts of a system' (D10) was considered essential. This also included 'an analytical mindset' (D24) to identify 'leverage points to help along paradigm shifts' (D27) which enabled designers to 'make the right decisions or pull the right ropes when it comes to sustainability' (D12).

Developing a *sense of care* encompassed empathy and inclusivity as fundamental values of design practice. This capability involved 'listening to the stories, not from an encyclopaedia but rather from the voices of people' (D19) and 'seeing things outside of your own bubble; a sensibility that allows one to relate differently to contextual issues' (D19). It implied respect, inclusivity and empathy, which D13 defined as 'putting yourself in other people's shoes, but trying to understand without colonising the other, understanding why that being see things, thinks or works in a certain way in a particular context'.

Developing a personal and professional sustainability ethos surfaced as key capability. Designers discussed the importance of 'having their own personal manifesto for what they want to achieve in terms of sustainability' (D1) and 'putting every decision through their own ethical filter' (D6). The interviewees raised the importance of being 'driven by climate considerations, no matter of what path they choose' (D26) and of 'self-reflective practices' (D8), that is 'looking critically at your own doing and how it relates to the world' (D11).

Lifelong learning was considered a key capability by the participants to constantly update their knowledge base and keep up with the rapidly evolving domains of sustainability innovation. *Lifelong learning* was defined as 'a learning mindset' (D3), 'willingness to learn' (D8) and 'in-built curiosity [and] a commitment to continuing professional development' (D3).

Researching was perceived as fundamental for designers to continuously update their own knowledge but also as an integral aspect of the design process. The interviewees highlighted 'the importance of research using the right tools' (D15) among 'many research processes' (D27) to not only 'research a territory,

community or person' but also to understand 'material aspects, and design strategies that are happening elsewhere, not to replicate but rather to use as reference point' (D16).

Speaking the various languages of sustainability involved persuading individuals with diverse professional backgrounds about sustainability choices. Effective communication and negotiation skills were deemed essential to promote behaviour change. This involved 'using the language and the world that stakeholders are familiar with' (D2), remembering that 'beyond convincing people; it's about helping people to convince themselves'. D10 emphasised the importance of 'understanding why things are not done in a more sustainable way, being aware of underlying decisions, and being strategic in trying to bring change little by little in the already existing structures and habits'.

Developing sustainability-focused business cases implied 'being able to approach the subject with business partners, speak to why sustainability might be beneficial for a company, and do it in an inoffensive way' (D23). An understanding of design economics was deemed essential, along with 'sourcing, itemising and quantifying skills and knowledge' (D4) to 'measure the economic impact of sustainability' (D21). The interviewees used 'financial modelling' (D24) and 'broadened the discussion beyond long-term savings associated with sustainability towards savings as revenue' (D1). A 'cursory knowledge of policy' (D27), sustainability certifications and an 'understanding of governance' (D26) emerged as essential in the realms of design for sustainability and justice.

Collaborating in a transdisciplinary context emerged as a crucial capability with designers working in projects where 'disciplinary boundaries dissolve' (D20). Designers were perceived as mediators who can 'really listen to people' (D27), 'collaborate and facilitate collaboration horizontally across disciplines' (D8). At times, this involved 'solving collaboration issues between different stakeholders' (D6) and 'promoting community building and engagement with multiple parties such as communities, businesses, government, corporates, and consumers' (D5).

Critical thinking not only involved 'a questioning mindset' (D3) but also 'the ability to read and write critically' (D27). The interviewees raised the importance of being able to 'question and understand the people involved and the systems that they are using' (D10) and to 'critically analyse projects that have an emphasis on sustainability' (D17).

The interviewees often had to deal with complex, wicked problems involving 'many people, and having to go back and forth to find consensus' (D10). In this context, *being comfortable with the uncomfortable* was considered an important capability. Designers need to be comfortable with uncertainty, recognising 'there are going to be difficulties and challenges' (D18), that 'there can be a lot of confusion which is part of a normal process' (D8). The participants raised the importance of an 'actionable approach to sustainability' (D5), of 'strategic thinking to get the project going forward along with a mindset to understand that a lot of small streams make up a river and create change' (D11).

The participants highlighted the importance of *leadership and decision making* with 'designers increasingly being involved in decision-making positions' (D12). This included 'being autonomous in making decisions' (D19) and 'being able to manage projects' (D6), but also 'the ability to rally a team and set goals that translate into action' (D21).

Storytelling and *communicating visually* were considered key capabilities for designers to 'synthesise and crystallise information' (D10) using illustrations, videos,

infographics and posters. Storytelling was considered 'an important method for engaging people into the topic of sustainability' (A4) to 'help people imagine your stories and connect the dots' (D21) and to 'understand the narrative around a design that currently exists and create user stories to vision the narrative that you want to exist and where design fits' (D26).

Future-thinking was mentioned by many interviewees who found 'creating a future vision' (D21) and 'back-casting' (D24) valuable. This enabled designers to 'create conditions to generate desirable futures in relation to the environment, but also other aspects such as dignity and happiness' (D14) and 'make strategic plans for the future, and adapt companies' business models to keep up' (D24).

The interviewees discussed several sustainability-specific design methods and tools grouped under the umbrella of *designing* as a capability. The list provided is not exhaustive. This included *Life Cycle Analysis* to think practically about design impact through materials extraction, manufacturing processes, distribution, use and post-use of tangible artefacts. The need for a thorough *understanding of manufacturing processes and supply chains* was also perceived useful by the interviewees to 'drive down the carbon footprint of each design and continue to keep pushing the needle to develop a sustainable supply chain' (D23). *Understanding materials* and keeping up with material innovation was considered essential. This involved knowing 'how a product can be made either out of reusable materials or adjusted or cared for to last longer' (D23), 'how to design products to reduce their mass or the amount of material used' (D11) and 'how to design for disassembly' (D2). *Computer and technology literacy* emerged as essential, both to communicate visually and to adapt to technology as it evolves. Designers working in practices related to information technology found an understanding of coding valuable 'in the technical space of computer science and engineering' (D26).

Discussion

This study identified seven emerging sustainability-focused designer roles: *social innovators*, *infiltrator change makers*, *policy/government influencers*, *entrepreneurs*, *researchers-innovators*, *educators* and *insiders*. These roles and their corresponding capabilities illustrate a shift towards transdisciplinary approaches to designing, as highlighted in the literature, with designers increasingly working collaboratively with professionals from other fields including science, social sciences, production and consumption, politics and engineering (Friedman, 2019; Meyer & Norman, 2020; Wrigley & Mosely, 2022). In this context, designers are no longer experts working 'for people', but rather 'with people' to respond to complex problems (Myerson, 2016, p. 291).

This project drew from the literature and from existing theories including Sen (2009) and Nussbaum's (2011) *Capability Approach* to define the aim of graduate capabilities in the Design context, that is *design capabilities*. *Design capabilities* aim to not only enable design graduates to make decisions that will lead to a life they value without devaluing others', both on a personal (ontological) and on a professional (employability) level but also to empower them to create different ways of being and acting in the world (designing), in turn creating change towards sustainable futures.

Reviewing existing theories allowed us to define what the aim of *design capabilities* should be. This research contributes to identifying the nature of *design*

capabilities while recognising that these will continue to evolve. In doing so, the project responds to the lack of existing research to define relevant sustainability-focused capabilities specific to the design field (Dewberry, 2011; McMahon & Bhamra, 2015).

Additionally, this paper contributes to synthesising and integrating existing research on the topic of design roles in sustainability transitions. Gaziulusoy & Ryan (2017) organise the roles of design throughout various facets of the design process encompassing *inquiry*, *process* and *outputs*. Using these main categories as a framework, Figures 1–3 systematically compare and align new agencies for design (Lähteenoja *et al*., 2023), roles of design in sustainability transitions projects

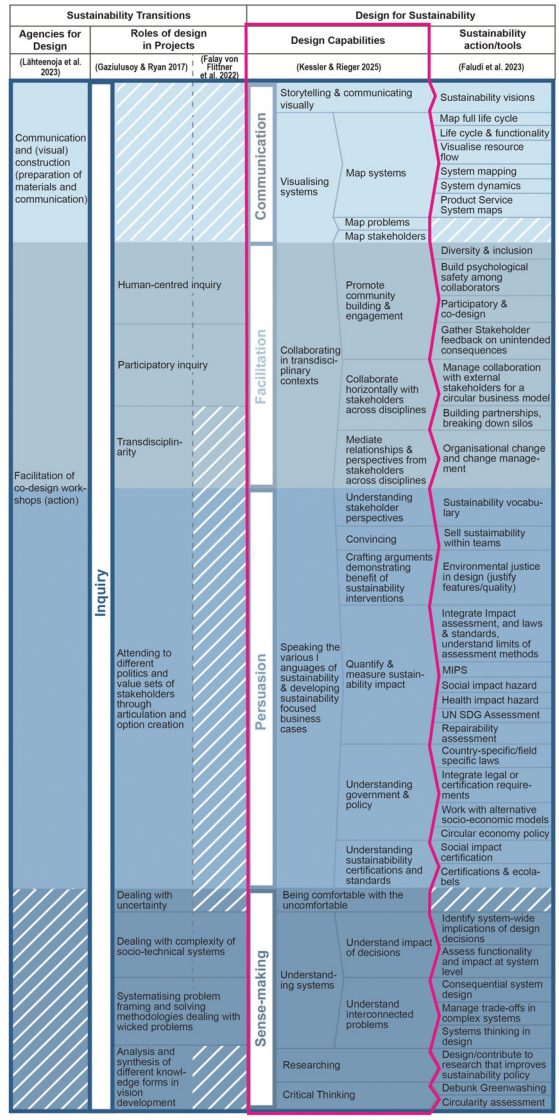

Figure 1
Design Agencies, Roles, Capabilities and Tools in *Design Inquiry*.

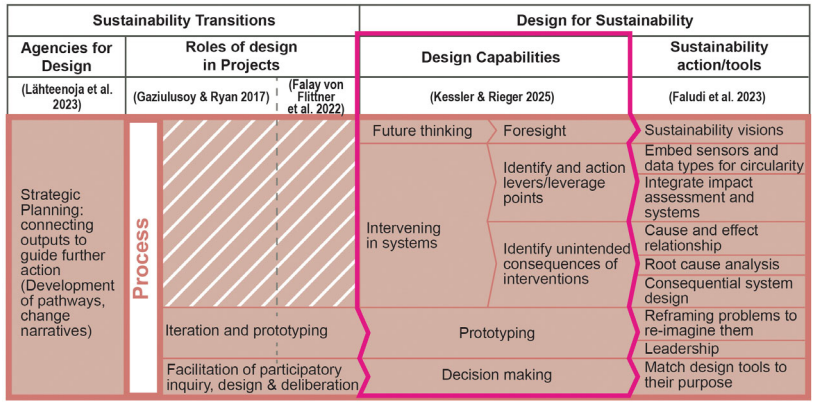

Figure 2
Design Agencies, Roles, Capabilities and Tools in *Design Process*.

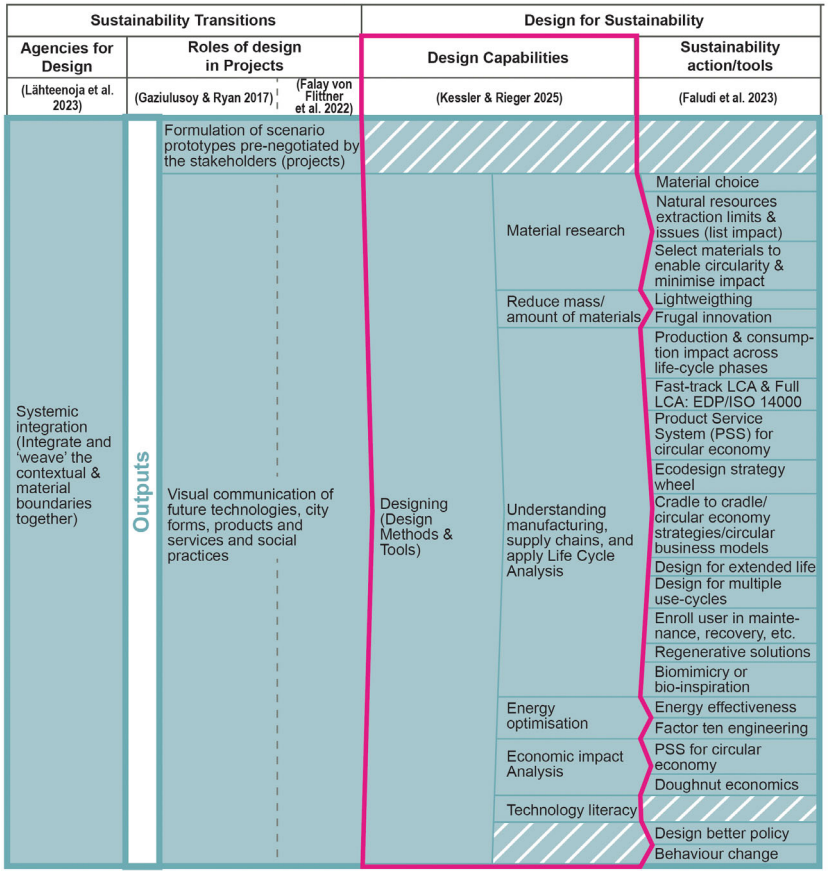

Figure 3
Design Agencies, Roles, Capabilities and Tools in *Design Outputs*.

(Gaziulusoy & Ryan, 2017; Falay von Flittner *et al*., 2022), *design capabilities* (as identified in this research) and design actions and tools pertinent to designing for sustainability (Faludi *et al*., 2023). Defined as the ways design functions as an active force within complex transition processes, *design agencies* encompass the collaborative, participatory and adaptive dimensions of design, recognising the contributions of various stakeholders in navigating sustainability challenges and enhancing policy processes (Lähteenoja *et al*., 2023). As higher order concepts, design agencies encompass the roles of design in sustainability transitions projects, while design capabilities enable design professionals to actualise these roles, in turn enacting change towards sustainable futures.

Despite some studies focusing on sustainability transitions specifically and others looking at practices related to design and sustainability more broadly, juxtaposing the findings reveals alignment and complementarity between the studies.

Lähteenoja *et al*.'s (2023) agencies for design, key in supporting governance of highly complex policy processes, encompass *communication and (visual) construction (preparation of materials and communication)*, as well as *facilitation of co-design workshops (action)*. These align with the roles of design outlined by Gaziulusoy & Ryan (2017) in the context of *inquiry*, many of which were also observed by Falay von Flittner *et al*. (2022). We propose that *design capabilities*, as expert design action enablers supporting *inquiry*, can be effectively categorised into *communication*, *facilitation*, *persuasion* and *sense making* (see Figure 1).

As seen in Figure 2, *strategic planning* as a design agency (Lähteenoja *et al*., 2023) aligns with the *iteration and prototyping* and *facilitation of participatory inquiry* roles of design within the *process* category (Gaziulusoy & Ryan, 2017). This could also be defined as ideation. While Gaziulusoy & Ryan (2017) position *vision development* as part of design *inquiry*, we locate *future thinking* and *intervening in systems* as key capabilities pertaining to *process*. This subtle difference emphasises that the roles of design can manifest at various stages of the design process.

Figure 3 shows that *systemic integration*, as a design agency (Lähteenoja *et al*., 2023), coincides with Gaziulusoy & Ryan (2017) third design role category, namely *outputs*, which include the *formulation of scenario prototypes pre-negotiated by stakeholders* and the *visual communication of alternative futures*. The *designing* capabilities outlined in this paper not only resonate with both these roles, but also with *sustainability actions/tools* proposed by Faludi *et al*. (2023).

As seen in Figure 4, the only category of capabilities identified in this research that is not reflected in sustainability transitions studies pertains to *designer ethos*, including *developing a sustainability ethos*, a *sense of care* and *lifelong learning*. In the same vein, Faludi *et al*. (2023) refer to a *personal code of conduct* for designers as an important aspect of designing for sustainability. Capabilities related to *designer ethos* are embodied in nature, elucidating why these are primarily observed in studies that are not directly tied to applied design projects. Additionally, capabilities pertaining to both *designer ethos* and aspects of *communication* seem to be integrated throughout various aspects of the design process.

Together, these studies depict a clearer picture of the roles of design and the capabilities enabling designers to work in the various professional roles associated with sustainability-centred design practices.

By bringing the missing voice of designers who work in sustainability-related design practices back into the conversation regarding what working as a designer in the 21st century looks like, this research responds to the 'urgent need for curriculum development planning and implementation in educational institutions which

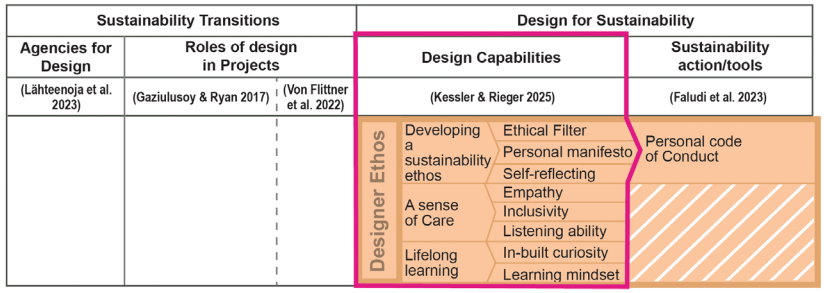

Figure 4
Designer Ethos as an Encompassing, Embodied Category of Capabilities.

take into account the new roles of design relevant for societal transitions' (Gaziulusoy & Ryan, 2017). Identifying emerging sustainability-centred design roles and their corresponding capabilities has the potential to bridge the gap between what designers are taught—with higher education design curricula based on outcomes defined in a way that largely fails to engage relevant stakeholders—and what role they play in practice (Kessler, 2022, Kessler & Rieger, 2024; Sanders, 2017).

Defining emerging designer roles and the design capabilities that are required of these roles offers an opportunity for design educators to instigate change in higher education design programs, making these more attuned to the needs of 21st century designers and the evolving landscape of design for sustainability. However, this shift also demands a greater consideration of both designer roles and corresponding design capabilities in curriculum development processes. This change represents a substantial departure from prevailing approaches to curriculum development in higher education wherein graduate outcomes are typically determined at university level and heavily influenced by performance criteria that may not align with current societal priorities (Barrie, 2006; Davis & Dubberly, 2023). For design curricula to cultivate these capabilities, it is recommended that design educators place a larger emphasis on co-creation in curriculum development processes, finding ways to involve their alumni and design professionals that align with the key educational goals for their programs.

Additionally, the dynamic nature of design roles and capabilities underscores the importance of ongoing monitoring to ensure that higher education design programs remain responsive to the rapidly evolving field of design for sustainability. As such, establishing continuous feedback loops in curriculum development frameworks to enable better connections between design education and professional practice is essential.

Conclusion

While design practice is shifting towards transdisciplinary approaches to tackle complex societal challenges, emerging roles for designers remain understudied.

Drawing from interviews with designers who work in sustainability-centred practices across four continents, this research pointed to emerging roles for designers as agents of change towards sustainable futures. These included *social innovators*, *infiltrator change makers*, *policy/government influencers*, *entrepreneurs*, *researchers-innovators*, *educators* and *insiders*. Design capabilities enabling designers

to act in these roles were organised in seven categories, including *communication* (visualising systems, storytelling and communicating visually), *facilitation* (collaborating in transdisciplinary contexts), *persuasion* (speaking the various languages of sustainability and developing sustainability-focused business cases), *sense making* (being comfortable with the uncomfortable, understanding systems, researching and Critical thinking), *process* (future-thinking, intervening in systems, leadership and decision making) and *outputs* (designing).

Defining emerging designer roles and their corresponding capabilities has the potential to contribute to bridging the gap between rapidly evolving models of design practice and higher education curricula that tend to stagnate. This is, however, indivisible from a more pronounced emphasis on design capabilities in higher education curriculum development processes. Design capabilities should not only enable design graduates to make decisions that will lead to a life they value without devaluing others', both at a personal (ontological) and professional (employability) level, but also to empower them to create different ways of being and acting in the world (designing), in turn creating change towards sustainable futures.

The dynamic nature of design practice suggests that the roles of designers engaged in sustainability-focused practices will continue to evolve. This underscores a limitation to this research and the imperative for curriculum development processes to actively engage with design practice. Adopting iterative approaches, wherein higher education curricula and professional design practices continuously inform each other, would ensure that higher education design programs remain responsive to a changing world (Kessler, 2022).

We acknowledge that future research could include a wider range of sociocultural contexts, enabling a deeper exploration of how these contexts might relate to emerging data patterns from a quantitative perspective. Additionally, participatory action research presents an opportunity for future research to practically implement and assess sustainability-focused design roles and capabilities in higher education curricula.

Acknowledgements

The authors wish to thank Professor Jill Franz and Professor Gavin Sade for their valuable insights into this project. We also acknowledge that this research was funded through an Australian Government Research Training Program Scholarship. Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australian University Librarians.

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