Design and Technology Education: An International Journal

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Table of contents

Editorial

Reflection

Research Articles

"Glocal" Design and Technology education: sharing disparate local insight that informs and enriches global understanding and inspiration

Kay Stables, Goldsmiths, University of London, UK
Lyndon Buck, University of Southampton University, UK

This first Issue of the 29th Volume of Design and Technology Education: An International Journal presents a diverse assemblage of articles focusing across the breadth of design and technology education and providing opportunities to pause and reflect on the value created by such diversity. The issue is made up of five articles from five countries – China, Ireland, Norway, Turkey and USA spanning understandings from mainstream schooling, higher education and professional practice, presenting insights from makerspaces to industrial design culture to visualising research. From an editorial viewpoint the range re-enforces the vision of the journal as an inclusive, open space for contributing and sharing diverse perspectives.

The first article in this issue falls under the heading of "Reflection" but in reality it goes far beyond being merely reflective. Niall Seery from The Technological University of the Shannon in Ireland opens up a topic that the editorial board has been considering for some time – that of the value of visual research articles. The topic can be seen as contentious, particularly by those who value communication via the written word as being above all other means, but in this immensely thought provoking article the value of communicating through graphic and visual language both in itself and as an enhancement when combined with written words illuminates ways of enhancing understands of research and enables greater opportunities for research to be applied. The topic is one that we are keen to explore further in future issues of the journal, so watch this space! We are also keen to receive feedback, insight and ideas related to visual research articles.

The first article in the Research section, purely by chance, has resonance with Niall Seery's article through the authors' approach to providing encouragement for students to use visualisation as a pedagogic tool. In *Reflect, Assess, Visualize: Cultivating Skill Development in User Experience Education*, Emma J. Rose from the University of Washington Tacoma, USA, Cynthia Putnam from DePaul University, USA and Craig M. MacDonald from the Pratt Institute, USA present research from an exploratory study that focuses on the use of a pedagogical intervention that helps students who are aspiring to be User Experience (UX) designers to identify, assess and cultivate the disparate skill sets needed. The research was conducted within both graduate and undergraduate programmes. Based on their previous research into the needs of UX professionals, they focused on technical skills such as research, design and process thinking, human skills such as approach problems, communicating and storytelling, and dispositions such as independence, flexibility, curiosity and passion. Drawing on established research from educational theory such as learning and reflection, metacognitive strategies, cognitive processes and schema-based learning, they created a pedagogic tool developed as an "advanced organiser" that could be used as a reflection tool. Through the article they provide insights into the use of the tool across the three programmes involved at an initial stage

structured on inventory, visualisation and reflection and a final stage repeating reflection and visualisation. Fascinating detail is provided from the analysis of the students' reflections and the variety of approaches used for visualisation such as charts, graphs, illustrations and cartoons and from the insights of students at the end of the project reflecting back on their journeys and learning through the stages. The authors provide insight into the key helpful aspects of the intervention and additional considerations for implementation. The richness of the research, undertaken over three years, in three institutions with three different courses, makes an invaluable contribution to pedagogical approaches in higher education and also holds value for educators working with students in the final years of mainstream schooling.

The next article in this issue is of particular value for insights into the growing introduction of makerspaces into mainstream schooling *The Influence of Teachers' Perception of Creativity and Makerspaces on Their Practice in Norwegian Compulsory Schools* by Brynjar Olafsson from the University of South-Eastern Norway and Gisli Thorsteinsson from the University of Iceland explores the impact of maker-centred learning on creative capability and digital competences. Based on semi-structured interviews with teachers, the research focused on how teachers conceptualised creativity in respect of makerspaces and on their reflections on pedagogy and management of learning. Following a broad perspective of informative insights into both maker education and creativity drawn from literature, the authors present their research questions, asking how, in Norwegian compulsory education, teachers define creativity and makerspaces and how teachers' understanding of creativity and makerspaces affect their work. Interviews were conducted with nine teachers working with 14-16 year olds in schools that had established school-based makerspaces. Whilst being quite small scale, the research provides some extremely useful insights into the value of makerspaces in mainstream schooling. There were common views across the teachers in certain respects, such as the value of a makerspace as a place to be creative, but also differences in understandings of creativity. For example there was a difference between the use of ready-made kits and more open-ended creative processes. Interesting perspectives on pedagogical approaches are highlighted – for example contrasting traditional classrooms with makerspaces in respect of a teacher's role being more observer and facilitator, less instructor and more asking questions than providing answers. The inclusion of makerspaces in mainstream schooling across countries is varied and for those considering the introduction the research presented is extremely interesting and valuable.

In *Formation of Industrial Design Culture from Education to Professional Life*, Doğan Can Hatunoğlu from Atılım University, Turkey and Pınar Kaygan from Art Academy of Latvia explore how the professional culture of industrial design developed through design education, relates to the working practice of professional designers, in the context of Turkey. Their research is conducted through semi-structured interviews with 15 industrial designers (8 women and 7 men) who studied and worked in Turkey in manufacturing companies and who had graduated between two and six years previously. Drawing on literature focused on research on cultural forms of professions and organisations, the framework for the study was shaped through five overarching categories: stories, physical space and artifacts, language, dress and appearance norms, and social relations. Through the interviews the designers reflected on their experiences in design education, suggesting a difference between themselves and, for example, engineering students, highlighting their culture as students "being a community, having flexibility in time and space, and working long hours" – as they reflected on the way in which their studio became a 'home' for them. Shifting to their professional life in manufacturing companies there was a

focus on working with engineers whose culture involved, for example, noticeably different approaches with greater disagreement and greater levels of formality in aspects such as work spaces and dress norms. The research highlighted the value of flexibility amongst the designers and the importance of work experience in manufacturing sectors to prepare students before entering the workplace. The article has resonance with the concept of 'academic tribes' where differences between related disciplines, such as design and engineering, become apparent, and highlights the importance of raising awareness that results in positive working relationships.

Finally, In *Anonymous Modern Design Education in Western China: A Case Study*, Zhiyong Wang from Chongqing Technology and Business University, China provides a fascinating case study of design education drawn from one of the many "anonymous" design education institutions as a contrast to the "well-known" "celebrated" universities and their "heroic" figures, highlighting both the challenges and contributions of the former. Taking a stance from design historians who have critiqued the concept of the "hero designer", such as Adrian Forty Clive Dilnot and Penny Sparke", Wang focuses on the contributions of less well known institutions, typically located in Western China. The case study focuses on the present situation of the institution, the key features in terms of achievements, disadvantages and problems and prospects for improvements. Information is based on document analysis, questionnaires and interviews. Participants include undergraduate and postgraduate students who answered questionnaires, and interviews with five teachers from the design department, the deputy dean and senior academics from environmental, fashion and communication design. The author provides both a historical perspective on the development of the institution and, whilst highlighting challenges in making this shift provides insight into the growth of the institution and development of the curriculum from a traditional art and art history approach to a modern design curriculum and the introduction of a more international experience. Despite challenges, the author remains positive in respect of the future for the institution and for design education. The case study provides and important reminder of the numerous institutions within and beyond China, that consistently develop and advance the experience being provided for design students – the unsung design education heroes ensuring a sound and quality experience for their students.

Reflection: Graphical Journals as a means of increasing research impact

Niall Seery, Technological University of the Shannon

These reflections were born out of several professional discussions that have surfaced through shared practices, perspectives, scholarly teaching, and research endeavours with members of the Technology Education Research Group (www.TERG.ie). The multiple perspectives and experiences that influenced these reflections include engagement with professional design practice, teaching practices, visuo-spatial research, and developments in initial technology teacher education (ITTE). These reflections are not meant to be conclusive, but rather intended to question the status-quo in the pursuit of enhancing the translation of research to practice and by increasing the projection of the voice of practice in the direction and development of research endeavours. The dominance of a single definition of scholarship is challenged in support of a broader recognition of the relevance and potential of graphical journals.

Position and context

This contribution sets out to reflect on the potential of graphical journals as supplementary media to support research and progressive discourse within the disciplinary area of Design and Technology education. The irony of a written reflection to capture the utility of graphical journals is acknowledged and accompanied by a growing awareness that the written approach taken may be a product of conditioned professional assumption, an acquired skill deemed appropriate for this purpose, or an outcome of a hegemony. While this paper can be argued as being ironic as a medium for its objective, it remains an artefact of thought. Exploring thoughts, sharing thinking, facilitating discourse, and furthering insight are not intended to be medium exclusive, yet, written articles are largely the medium that frames the dominant means of disseminating research and thinking in our discipline. The alignment of the message and medium is central to these reflections. It is the disciplinary context that is a critical consideration in the nature of the discourse and the capacity to broaden the audiences that can participate in the discussion.

While a graphical journal is not a new concept, they are peripheral to the dominant means of sharing research evidence and perspectives in technology education. It is difficult to say if this is appropriate or not, or if the current practice could be enhanced. But the speculative driver imagines the world as it would be and wants to question: If there is meaning lost in translation? What is the nature of the meaning that may be beyond the written medium? Is translation to scholarly output accessible to everyone that wants to access contemporary thinking and evidence? Can everyone contribute to the prevailing discourse? What constitutes scholarship in the dissemination of design and technology education research? Could graphical journals develop the disciplinary contributions of research activity?

The purpose of this reflection is not to make a binary argument of ‘better’ or ‘worse’, but to consider utility and the augmentation of translating research to practice. Therefore, it may be useful to consider graphical journals as having the potential to add value to the existing model of research practice and reflect on the evolution of how researchers can affect meaningful

translation to practice and be supported in impactful research. To advocate for a broader conception and utility of research communication, specifically as it applies to design and technology education research appears sensible.

The know-how to skilfully produce graphical media that harness the richness, complexity, and power of the visual can have a transformative impact on practice – after all this is the fundamental objective of educational research. This position is not naïve about the significant skill required to master the visual language, but is encouraging 'mark making' in all its forms as a medium that can support broader, deeper, and more sustained engagement in evidence-based practice and practice-based evidence.

Graphicacy and Modelling

As the central medium of design and technology practice, visual imagery is encouraged and seen as in-keeping with the ethos of this Journal. Seeing graphics as the language of technology and modelling as the language of design, there is an apparent argument to consider graphic journals as disciplinary appropriate and universally comprehended within design and technology. Graphicacy captures the ability to comprehend, represent and present information in graphical form and broadens the reach to audiences. Reflecting on the IDATER Graphicacy and Modelling conference 2010 (Norman and Seery 2010), it's now recognised that more should have been done to sustain the importance of these discussions. While significant contributions were made at the time (for example Lane, 2011 and Danos, 2012), the need to develop our thinking, research agendas, and practices associated with the importance of the visual is still (if not even more) relevant.

Many disciplines are now beginning to embrace the graphical format as a means of shifting focus. The emergence of Graphic Medicine (Conference site www.graphicmedicine.org) is a good example of how the medium helped give voice to patients, enabling a narrative account of the complexity of dealing with medical diagnoses and conditions. Graphic Medicine described as the interface between medical humanities and graphics has given voice to the patient, carers and loved ones, that share experiences and challenges, through a medium that can communicate complex and emotive narratives. Graphics as a medium affords the opportunity to personalise, narrate, connect (emotively and empathetically) and be situational and context adaptive. These are affordances that could be very useful when supporting more designerly activity, driven by volition in pursuit of changing the made-world.

Affordances: Suspension of time and space

Inherent in graphical representations are affordances that can support deep and emotive engagement, stimulating a response that is mediated by the individual's knowledge, experience, and interpretation. While the sensory stimulus can be both static and dynamic they are invariant. Variation comes from the personal assimilation of information and that can be formed instinctively as a result of experience or through explicit meaning making of discipline specific literacy. The comics format is a good example of how to support narrative enquiry through a speculative lens. The affordance of the comics format enables personal, interactive, and reflective engagements that are built through interpretation. Connecting with characters and their experiences enables perspective-taking that shares alternative world views that are often accompanied by clearly communicated emotions. Due to their structure and dominant use of graphics supplemented with text, they can **c**reate content that deals with complex

learning and development, particularly in how empathy might be experienced by readers. The structure of the narrative and the communication of complex ideas can efficiently simplify the message by sharing what is being said, what is being thought, where it is happening, and the chronology of actions and consequences. In addition, the power of the format is that all these aspects can also be positioned in an alternative reality, one that may be more speculative, moves between past, present, and future thinking and can manage the 'what if' questions meaningfully. Our capacity to use symbolism is critical to sharing meaning and modelling details that can often be difficult in other forms. The graphical medium in comics form is effective in engaging readers from a range of backgrounds and literacy levels, making the dissemination of information more accessible and engaging.

Scholarship: Sharing artefacts of thought

Information processing theory positions the visual and verbal channels as the means by which information is processed. The combination of both is critical to support meaning-making and it is this relationship that is supported in this reflection. The inherent affordance of these channels forms an interesting perspective depending on the epistemological position taken in relation to design and technology as a discipline area. Where technical information is the primary focus, the sequential nature of verbal information is satisfactory in narrating the order of logic and the graphical media support the technical depictions in an efficient and effective medium. While understanding technology education as 'volition' the synchronous nature of the visual affords a more interpretative, flexible, and speculative input, relaxing constraints not usually afforded through sequential narration. There are excellent examples of how the graphical medium can provide a more experiential engagement and can deal with sophisticated ideas and thinking. One obvious example is 'unflattening' by Nick Sousanis (2015), which originated as an academic output and later published book. This work clearly depicts the capacity to share complex narrative in an efficient, effective, and engaging way. He examines the spectrum of graphicacy, images, and their relationship to understanding and demonstrating how text and images are dependent upon each other and are equal partners in meaning-making. This work goes a long way in defining the scholarship of graphic media as a comparable academic output.

Subject matter

In recent years much emphasis has been placed on the nature and treatment of technological education. The associated research focus has largely reflected the epistemological challenges and the theories surrounding practice and observing practice itself. The transition (or maybe more accurately the evolution) from technical education to technological education brings with it many philosophical debates about what is technology education, debates that are pertinent to the intentions of practice. Despite the variations in epistemological perspectives as they emerge in different treatments of technology education, they are unified by the centrality of designing and making. Models of capability and concepts of the goals of capability are important contributions to shape policy, but also reach practice. Conceptions of the goals (Doyle, 2020) of the subjects bring with it a vectored discussion that shape an applied understanding, where designing and making are central. With this 'constructionist' approach to learning, the physical output/artefact forms the basis of the modelled-thinking. The iterations use graphics to aid in the thinking associated with their meaning-making as applied to context, application case, agenda, and implications. Helping to navigate the territory of designerly activity and the appropriate use and application of new and future technologies requires the

capacity to view alternative worlds, personalise, narrate decisions, connect (emotively and empathetically) and adapt situations and context.

Interestingly both as a natural language and the genesis of communications amongst non-kin, the visual language transcends many of the barriers that exist with the written or spoken word. The mechanics of encoding depth, scale, danger, motion, etc are evolutionary capacities that require no codification. The influence these capacities have on the efficiency with which the message is understood is often unparalleled by alternative mediums. As far back as the seminar works of the Orange Series, the importance of graphicacy and modelling has been well supported. Acknowledging the descriptive power of graphics to capture and communicate embedded information that is not possible to capture by the written word is well argued and supported. The communication of scale, proportionality, relationships, motion, etc. can be presented through efficient representations without ambiguity. While more technical information may require a form of literacy to fully comprehend, there is an inherent effectiveness and efficiency in the use of the image. Moving beyond the apparent technology representation is when the idea of graphical journals become even more relevant. This is evident when considering the imagined image where mental models enable manipulations, treatments, and explorations of speculative acts and possibilities that require representation of future states and possibilities. This shift from a historic technical treatment to a more designerly volition requires increased emotive and empathetic understandings and a shift towards *becoming Ethnotechnologically Literate* (Dakers, 2022) - a more complete view of the nature of activity that considers the implications of technological decisions, practices, and outcomes.

In the context of the design and make activity, capturing the narrative of the journey is not as predetermined or prescribed as some perspectives would imply. Assessment calls for very specific evidence, where criteria is set to ensure a fair and standardised approach to evidence of student performance. While this is important and even essential, it may not reflect fully the nature of the activity, the decision making that is pertinent to the creative expression or the critical knowledge applied to the selection of materials, processes, and functions of the artefact that are the subject of speculative and critical thought. While this activity is complex in first principles, it is the rationale and agency that stimulates this activity and the volition of the creator to make change to made world. This voice is often not well supported in the narrative of research dissemination and yet is critical to defining a technological education, driven by designerly actions.

The role of design and its treatment have attracted much attention in technology education, with much focus on untangling the epistemological basis of both design and technology. This complexity is often shrouded in the language of philosophy and while important, worthy, and impactful, possibility makes it less accessible to practice. This is not to say a graphical journal can or will simplify the concept or sophistication of the thinking, but instead support the message in a way that can be interpreted with relativity and associated practice as being central.

For example, Figure 1 is an artefact of thinking about the lens that shapes the intention of learning activities. This image is not intended to be indicative of how graphical journal content would be developed, structured, narrated or depicted, but instead represent the capacity to

engage (as a starting point) with seminal works in technology education in a different graphical way. Mitcham's Typology of Technology frames the philosophy of technology education as object, activity, knowledge, and volition.

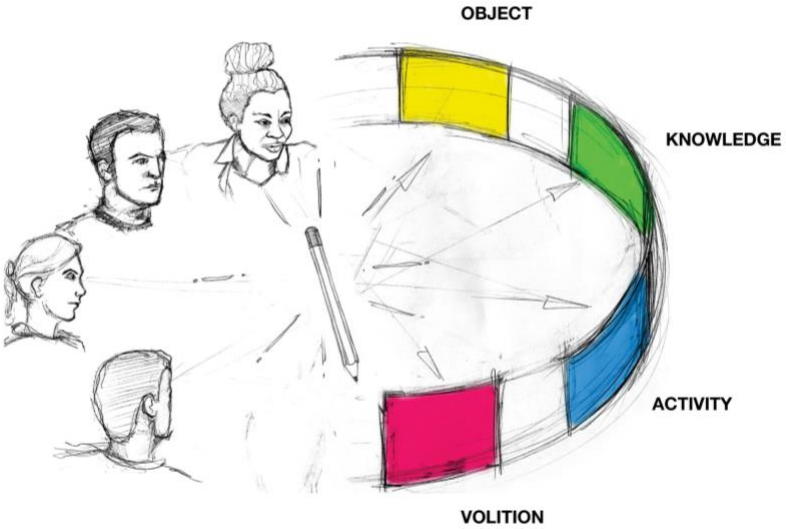

Figure 1. Mitcham's typology of technology (Sketch courtesy of D. Campbell)

This is not an attempt to simplify the complexity of the philosophical positions, but to demonstrate the capacity of such a medium to share the conceptual thinking that is critical to clarify the intentionality essential for effective teaching, learning and assessment and to increase the likelihood of these complex positions being transferred to practice.

Accessibility, digestibility, utility, and meaning

The idea of academic or research impact has been a topical discussion for over the past decade, with much focus on understanding the nature of impact, how activities lead to impact, the associated value of research and the qualification of what is impactful within and beyond academia. Consideration for what is impactful and what can be impacted are central to measures of attribution and metrics that have implications for priorities being set and resources being utilised. Design and Technology Education research has a sustained position over recent years and there is evidence that the discipline has had much impact on practice. Therefore, it is not to say that there is something broken, more a perspective that we could align activities to have a greater impact, particularly by embracing more fully the natural language of the discipline.

The primary aim of design and technology education research is to positively impact practice, a position that is central to the very origin and mission of this journal. Facing practice and having utility in practice can be a challenge, from the perspective of higher education, where the nature of output and the associated measure of performance indicators have historically been defined by bibliometrics. With the origins in library services as a resource planning instrument, bibliometrics can be limited in fully representing the impact of research output and more importantly reward a type of output that may not be relevant or appropriate to the fundamental mission. Where outputs do not reach the practice sphere, the idea of impact is challenged in first principles. There is a growing recognition that impact as a concept is shifting towards a broader conception of how to be impactful. Increasingly institutions are embracing

the altmetric concept and methodology, increasing awareness, collaboration, and the potential reach beyond that of traditional research outputs. While it is not the intention of this reflection to engage with the open access debate as it is not applicable to this journal, it is a debate that illustrates the support for making research more accessible.

There is an onus on the research community to at least explore ways of increasing the accessibility of research evidence and thinking. While production of a Graphic Journal should not be seen as a *'post process'* after the article is written, this approach could also be a useful exercise as an impactful output. Schools are busy environments, with increasingly complex contexts and challenges and many demands on the teaching profession. Engaging with research can be a time-consuming activity, one that often requires a significant lead time. Graphical Journals could serve as a useful medium to engage with research evidence in a more tangible way and reduce the dissonance that often exists in translating research to practice.

Research engagement is a central tenant in teacher professional development in Ireland. The National Teaching Council promotes and regulates the standards of the teaching profession and promotes a culture of research, shared learning, and evidence-informed practice through its Croí initiative (Collaboration and Research for Ongoing Innovation). To think that academic output in the format of a graphical journal could be supported by an international journal is useful in disseminating material that has direct relevance in practice. Furthermore, there is no reason why Graphical Journals are not seen as comparable to traditional university metrics, maybe even with the added advantaged of altmetric indicators.

The driver from much of the work of TERG research activity is its use-inspired nature. While the ideologies of teacher can differ from the teacher's need to seek out relevance and external validity, researchers tend to operate in a space where rigor and internal validity are the primary concern (Smith et. al. 2013). While these appears to be opposing, it is critical that they both reflect the use-inspired basic research agenda, where bi-directional dialogue becomes the norm.

Concluding comments

It would be a positive move for the discipline if everyone could engage in the seminal works, ideas, and thinking that relate to the subjects of design and technology. Considering what a graphical journal can contribute in this regard, there are two primary perspectives. One is the potential to transpose examples that link to existing articles to rearticulate the key messages, with the objective of increasing the reach of the research, ideally engaging practicing teachers. Secondly, original work that can be utilised in a different way. For example, imagine a graphical journal that can be deconstructed and displayed, becoming omnipresent in the environs of practice. If Figure 1 above was a poster in a technology room, what impact would it have on the intentional planning of teaching and assessment practices? Would practices be consciously derived from Mitcham's (1985) typology of treatments and as a result increase the constructive alignment of teaching, learning, and assessment? Extrapolating the same principle, could the ubiquitous nature of social media and the various similar channels that support limited 'space' for the publishing of a message utilise key depictions of central ideas in design and technology, maximising the affordance of graphical journals.

It is one thing to reflect on the potential that graphical journals may offer design and technology, it is another thing to create graphical artefacts that are thought provoking, useful, and can have impact. This is the challenge that members of TERG have embraced and will attempt to produce works, not as standard setting exercises but rather as the start of a conversation to establish feasibility, viability, and utility. If useful, these conversations may be a kickstart to develop, broaden, and champion a more mainstream advocation and recognition of this evolving concept of scholarship.

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29.1

Reflect, Assess, Visualize: Cultivating Skill Development in User Experience Education

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Abstract

In the field of user experience (UX), there is a wide range of skills that practitioners are expected to acquire and demonstrate as a competitive candidate for a job. Previous research identified three main skill categories of UX practitioners: technical skills, human skills, and dispositions. However, as educators, we have found that students often struggle to understand and incorporate the breadth of the skills they need into their learning and development. To help students identify, assess, and cultivate their skill sets, we designed a pedagogical intervention in the form of an 'advance organizer' that asks students to reflect on their initial and changing skill sets while enrolled in a UX-focused course. In this article, we present the basis of the intervention, including background on learning theories that supported its design. The intervention asks students to read and reflect on an academic article about the desired skills of aspiring UX practitioners, conduct an inventory of their existing and desired skill sets, and design a visualization to represent their current and future skill levels. We report on how the intervention was implemented in three different programs related to UX (one undergraduate, and two graduate programs). An analysis of the resulting assignments suggests the intervention was effective and valuable and helped give students a better sense of the range of skills required in industry. We conclude with considerations for implementing the intervention.

Keywords

user experience, UX, skills, reflection

Introduction

The field of user experience (UX) has grown and changed a great deal over the past 40 years and is projected to continue to grow at an even brisker pace over the next 30 years (Nielsen, 2017). As a result, the market and interest in UX education have also blossomed. UX is taught in a variety of interdisciplinary academic programs and disciplines in design, computing, and the humanities. There is also a plethora of online programs that include self-study and for-profit boot camps. The demand to learn about UX has never been higher; however, the field itself is in flux, shifting, and changing (MacDonald et al., 2022).

As instructors in academic programs, we see how students struggle to understand where they might fit in the broad and multifaceted field of UX. In our research, we have conducted several studies to better understand the UX industry, how it is changing, and what kinds of skills aspiring UX professionals might need to be successful. Based on our research, we designed a classroom intervention to help students inventory and reflect on their skill sets related to UX. In this paper, we explain and assess how the intervention worked across three different academic

programs that prepare students for careers in UX. The key contribution of this paper is to bring together industry research and educational theory to help students gain more understanding and agency about their individual learning within the large and complex interdisciplinary field of UX.

In a 2020 paper, we reported the results of this research that demonstrated the disparate skills that UX practitioners are expected to acquire and demonstrate competency (Rose, et al., 2020). The study included interviews with 71 senior UX practitioners. We identified three main categories of skills professionals need to succeed in UX: technical skills, human skills, and dispositions. We defined technical skills as observable, standard skills a person is expected to perform on the job and include research, design, process thinking, and information architecture, to name a few. We described human skills as those demonstrable when a person must directly engage with others to achieve goals. Human skills include approaching problems, communicating, collaborating, and storytelling. The third category is dispositions, which we defined as character traits that define a person's internal motivations to act or behave in certain ways. Examples of dispositions include independence, flexibility, curiosity, and passion. These last two categories, human skills and dispositions, are seen as differentiators by employers and are more highly valued than technical skills (Rose, et al., 2020). Our participants emphasized human skills and dispositions as particularly important in UX because practitioners are expected to engage in sophisticated and nuanced communication practices on the job and communicate for a variety of purposes and in a variety of ways.

While it is helpful to understand the broad swath of skills needed to be successful in UX, we have found that our students often feel overwhelmed by how much they need to learn. To help students identify, assess, and cultivate their skill sets, we designed a pedagogical intervention that asks students to reflect on their initial and changing skill sets while enrolled in a UX-focused course. In this paper, we report on the intervention and its impact on students in three different degree programs focused on UX. This was an exploratory study to assess the effectiveness of the intervention across multiple contexts. The article is structured as follows: first, we discuss metacognitive strategies, namely reflection and 'advance organizers' that prompted the intervention, and the relevant learning theories that guided the design of the intervention. Next, we describe our intervention in which students assessed their existing skill set at the start and end of a term. The intervention included reading an academic article, conducting a skill inventory, visualizing their existing skill set, and reflecting on areas they would like to continue to work on. We then discuss the findings, which include gaining a deeper awareness of industry expectations and the importance of human skills, in addition to heightened awareness of their personal growth. We conclude by presenting the implications of the study by describing the impact of the assignment, its effectiveness, and suggestions for additional improvements or changes.

Background: Creating the opportunity for reflection

In this section, we highlight literature from educational theory that situates the aims and goals of the designed intervention. We first drew from Argyris's and Schön's theories on learning and reflection.

A key component of learning is the ability to detect and correct errors by differentiating between single and double loop learning (Argyris 2002, Argyris 2003). Single loop learning is

described as “when a mismatch is detected and corrected without changing the underlying values and status quo that govern the behaviour” (Argyris 2003, p. 1178). In contrast, double loop learning occurs when those underlying values are corrected. A key feature of double double loop learning is that “understanding, insight, and explanations are connected with action” (Argyris 2003, p. 1178). Taking action and simultaneously reflecting on that action, according to Argyris and Schön, is a prerequisite for learning and similar to learning a skill (1974). Both theories emphasize that “it is essential to practice, to develop and draw on tacit knowledge, and to be in a learning situation that permits a reinforcing cycle of feeling and performance" (Argyris and Schön 1974, p. 14).

For Schön, the idea of professional competence is always shifting, and how to learn “requires developing one's own continuing theory of practice under real-time conditions" (Schön 1983, p. 157). Both Argyris and Schön agree that cultivating awareness of what a person does not know and reflecting on that awareness provides the opportunity for growth.

Further, Schön’s theory of reflection emphasizes that the knowledge that professionals display is “knowing-in-action” (1983) which is tacit and routinized to the point where it cannot be fully articulated or explained. It is when something out of the ordinary, or “stimulated by surprise” that this implicit knowledge is brought to the surface. As he states,

> *Usually reflection on knowing-in-action goes together with reflection on the stuff at hand. There is some puzzling, or troubling, or interesting phenomenon with which the individual is trying to deal. As he tries to make sense of it, he also reflects on the understandings which have been implicit in his action, understandings which he surfaces, criti-cizes, restructures, and embodies in further action.” (p 50).*

Together, both Schön and Argyris assert that it is this combination of doing, encountering new circumstances and messy problems, and then reflecting on one’s experiences, is when learning and growth happen. In order to spur our students to experience this combination of doing, struggling, and reflecting, we wanted to explore how to create these circumstances in our UX classes.

Broadly speaking, the goal of our intervention was to help students improve their awareness or assumptions of what they do and do not know when it comes to UX skills through cultivating metacognitive processes. Metacognition can be thought of as an awareness of cognitive processes (see Brown, et al. 1983; Flavell, 1979; Zimmerman, 2002) and is connected to students’ ability to transfer their learning across contexts (Bransford, et al., 2000). Our intervention included two metacognitive strategies: an advance organizer and reflection. Both are described briefly below.

Advance organizers are pedagogical tools with roots in schema-based learning, which itself is informed by schema theory, a cognitive theory of human and artificial learning (Pirnay-Dummer & Seel, 2017). A schema can be described as a framework, i.e., when a learner is confronted with new knowledge, they will apply a previous knowledge framework (if available). As such, they can be seen as a recognition device to aid in the assimilation of new knowledge. Piaget (1937) characterized a schema as a means for a learner to organize concepts and their relationships. According to Anderson, “without a schema to which an event can be assimilated, learning is slow and uncertain” (1984, p. 5). Ausubel (1968) introduced the concept of advance

organizers as part of his theory of 'meaningful verbal learning' as a way to activate schemas to scaffold learning. Thus, the role of 'advance organizers' is to help learners bridge a gap between what they know and what they need to know.

The concept of advance organizers is not entirely new to the field of UX or to human-computer interaction (HCI), its closest related academic discipline. As explained by Blackwell (2006), after exploring the role of advance organizers in helping people learn programming languages throughout the 1960s and 1970s, the term instead "became common as an empirically justified formalization of the 'user model' or 'mental model'" (p. 505). When the graphical user interfaces (GUI) were first developed, the 'desktop metaphor' was viewed as an impactful (and lasting) advance organizer for helping novice users learn about and use computers effectively (Carroll et al., 1988; Mynatt & Macfarlane, 1987). From an academic perspective, advance organizers have been evaluated for teaching students programming (Macfarlane & Mynatt, 1988), but we found no examples of advance organizers used in the context of teaching UX or HCI.

The use of student reflection is a common pedagogical practice where students are asked to think about and articulate what they have learned. Reflection dates back to education theorist Dewey (1910, 1916, 1933) and is synonymous with thinking and learning. Dewey's conceptualization of reflectivity has four key criteria, as read by Rodgers (2002). First, reflection is a continuous meaning-making process, a means to "essentially moral ends" which is connected to the purpose of education, which is to educate not just an individual but in support and evolution of a democratic society. These educational experiences happen not at the individual level but during interactions with others and are continuous. As Rodgers states, "we make sense of each new experience based on the meaning gleaned from our own past experiences, as well as other prior knowledge we have about the world—what we have heard and read of others' experiences and ideas" (Rodgers, 2002, p. 846). Second, reflection is systematic and rigorous and is a cyclical process that includes an experience, a description of the experience, an analysis of that experience, and intelligent action and experimentation. Third, reflection happens in the community and with interaction with others, which "serve as a testing group for an individual's understanding as it moves from the realm of the person to the private" (Rodgers, 2002, p. 857). Finally, reflection is a set of attitudes that value the growth of oneself and others. In sum, reflection is key to metacognition which is an awareness of how to learn and awareness of oneself as a learner.

Designing and Evaluating an Intervention for UX Skill Reflection

Given the variety of skills that UX practitioners need to be successful in their jobs, we designed an advance organizer that could be used as a reflection tool at the beginning and/or end of a course related to UX. In this section, we will describe the intervention and the three settings where we implemented it.

Three learning contexts

We each implemented the intervention examples presented in this paper in classes in either 2020 or 2021. It should be noted that these courses were disrupted, as most things were, due to the COVID-19 pandemic. We opportunistically chose these three settings because they were the classes we were teaching. As instructors teaching UX, we wanted to explore in this study how the intervention could support students' self-assessment and reflection.

1. Undergraduate course: This is an upper-level undergraduate Design studio course in an Interdisciplinary Innovation and Design minor. Before this class, students have taken a prerequisite course that introduces them to user-centered design. The goal of this course is to work on a specific design project in groups, and the projects can be for community partners. The course is capped at 20 and meets for ten weeks. Students come from different majors and enroll in the minor to add design expertise to their disciplinary focus. The class typically is a hybrid course, but met completely online due to COVID-19. In this class, the intervention was an assignment embedded in the course and students completed it in the first week of class and the last week of the class.
2. Graduate course: This is an introductory design course required for students studying User Experience Design, who typically take it in their first semester. The goal of this course is to introduce students to user-centered design methods through a semester-long responsive website redesign project. Relevant topics include user research, information architecture, sketching and wireframing, prototyping, and formative usability testing. The course typically enrolls 15-18 students (capped at 18) and meets for 15 weeks. It is offered entirely in person.
3. Graduate course: This is the advanced design course required in a Human-Computer Interaction program. Prerequisites include an introductory design course and an HTML/CSS course; both prerequisites can be waived. The bulk of the course work is dedicated to building a mini-design system of a website of their choice (most choose to focus on their portfolio). Other topics include typography, color theory, logo design, animation principles, and an introduction to information visualization. The course typically has 30-36 students enrolled (capped at 36). Post-COVID, the class is taught using a mixed model, in which all lectures are recorded with weekly synchronous meetings for discussion, workshops, and design critique. The synchronous meetings are held using a mix of in-person and remotely (using Zoom); all are recorded for those students who choose to watch the meetings asynchronously. The course meets for 11 weeks (quarter system).

Details about the intervention

While advance organizers can be presented in multiple ways (UNIT 2008), we adapted our advance organizer from a 'KWL (Know, Want, Learned) Chart' (Ogle, 1986). In a typical KWL chart exercise, learners are introduced to a new topic and expected to reflect on what they **Know** about the topic, what they **Want** to know about the topic, and then what they **Learned** about the topic.

During week 1, students were given a recent academic article about desired skills for aspiring UX professionals and the following directions:

Initial inventory, visualization, and reflection

1. Read the article on Preparing UX Professionals posted on the course website.
2. Define the three types of skills and conduct an inventory of your current skill sets and what areas you would continue to grow.
3. Draw a visualization of your skill sets. You can use the metaphor of the T-shaped skills or find another way to show the relationships between what you know and what you hope to learn.

4. Reflect by writing a short paragraph on what this exercise has helped to show you by answering the following questions:
    - What have you learned from reading the article and doing this exercise?
    - What, if anything, is surprising or eye-opening?
    - What questions do you have?

They were also given a slide template to complete that walked them through the four steps above.

Final reflection

At the end of the term, students in the first two academic contexts were asked to do the reflection and visualization a second time with the following prompt:

1. What have you learned from reading the article and doing this exercise?
2. What, if anything, is surprising or eye-opening?
3. What questions do you have?

In the third academic context students were not required to redraw the visualization but were asked to respond to the following prompt:

1. How was this self-reflection exercise AND the article I had you read at the beginning of the quarter helpful or not helpful in defining your UX aspirations?

Assessing the intervention

While the initial goal of this project was to explore the possible intervention as an educational tool, we decided to pursue the possibility of examining student assignments to assess its effectiveness. After consultation with the University of Washington's Institutional Review Board, this research project was deemed to not qualify as research as defined by federal and state regulations (STUDY00012513). To assess how the intervention worked, we anonymized all the assignment submissions and imported the written reflections into a qualitative coding tool (Atlas.ti) and the visualizations into a visual whiteboarding tool (Miro). The three authors then iteratively coded and categorized the data. As a group, we negotiated differences in codes to reach agreement.

Results of the student reflections

In this section, we present findings based on our analysis of the anonymized assignments to examine the value of using this assignment. First, we describe the impact of the initial reflections (reading the article, doing a skill inventory, and drawing a visualization of their skills). Next, we summarize the different types of visualizations students created as part of their skill inventory. Finally, we discuss how the students reflected on the totality of their experience based on their responses to the second assignment, submitted at the end of the term.

Initial reflections

In the initial assignment, students were instructed to (a) read the article on UX skills, (b) conduct a skill inventory of those skills by evaluating where they were currently and where they wanted to go in the future, (c) draw a visualization of their current skills, and (d) answer some brief questions reflecting on what they learned from the entire activity. We examined 71

student responses to the reflection questions (four students did not provide any answers) and categorized the themes as either outward-facing (i.e., focused on the UX industry and professional community) or inward-facing (i.e., focused on the self).

Outward: General awareness of industry expectations (n = 52; 73.2%)

The most common response among our students was gaining a better understanding of what the UX industry is looking for in new hires. For many students, it was helpful to hear directly from UX professionals about what they are looking for when evaluating job candidates because they found that information difficult to find. As one student explained:

> *"The article provides great insight into the skills needed as a UX student. I never really found the skillset so comprehensively laid out and explained with references in any other place. Furthermore, the most convincing aspect to the article is the fact that research was done with existing industry professionals who provided updated and current information." (P48)*

Other students described the article as "really insightful" (P15) and "an eye-opener" (P24), while another appreciated how the article "demystifies the UX field" (P12). Other students mentioned picking up specific pieces of information about the UX industry, with one saying "they did not know the concept of disposition" (P69) before the activity and another noting it was "the first time [they] have heard of T-shaped skills" (P45).

Outward: Importance of human skills and dispositions (n = 42; 59.2%)

The second most common response among our students was learning specifically that human skills and dispositions were so highly valued by the industry. Several students explained how the exercise challenged their assumptions about UX being a highly technical field by showing the importance of being collaborative, communicative, and empathetic. As instructors, we were encouraged to see that this realization was a comfort to many of our students as it helped reduce their anxiety about their lack of technical skills by highlighting other types of skills. Here is how one student reflected on this experience:

> *"I found it surprising that people who recruit employees in the field of UX design also hold equal weightage to people's dispositions and are willing to take time out to teach those who are passionate and yet lack the skillset. I found that finding to be extremely motivating and heartwarming." (P18)*

Other students described this experience as "reassuring" (P61) and "a confidence boost" (P63), while another said they were "relieved" (P65) to learn that soft skills were so valued.

Inward: Self-awareness and personal growth (n = 34; 47.9%)

Finally, students valued the opportunity to reflect on their own skills and dispositions. From doing a skills inventory to helping them create individualized learning goals, students felt that the exercise helped them discover where they were lacking and where they needed to improve. As P4 explained:

> *"This assignment really helped me evaluate my previous experience with and thoughts on UX and the design process. It made me analyze myself and the skills I have learned through my time at [university], particularly in relation to the aforementioned subjects.*

> *Perhaps one of the more important aspects of this assignment was identifying which areas of my knowledge and myself I wanted to improve by the end of this course." (P4)*

Other students described the activity as "really helpful" (P75), "kind of eye opening" (P43), and "a great guide for reflecting on my own skills" (P27). As a whole, students felt that the exercise was an opportunity to gain a better understanding of not just who they currently were but who they wanted to be in the future.

Initial visualizations of skills

Our instructions stated that students could "use the metaphor of the T-shaped skills or find another way to show the relationships between what you know and what you hope to learn." Students were not given any other guidance or suggestions about other formats for their visualization. They could use hand-drawn or computer-generated visuals and were encouraged to be creative.

We collected a total of 73 visualizations from students' initial submissions across the three courses (two students did not include visualizations with their submissions). We imported all the visualizations into an online whiteboard and grouped them into ten categories. Below, we briefly describe and provide visual examples of each category.

T-Shape (n = 36; 49%)

Roughly half of the visualizations (49%; 36 of 73) used the t-shape metaphor, though within this category, we noted two variations: simple and enhanced. Simple t-shape visuals were typically abstract and included minimal text and few, if any, visual flourishes (e.g., color). Many of these visuals were hand-drawn (Figure 1), though some were created digitally.

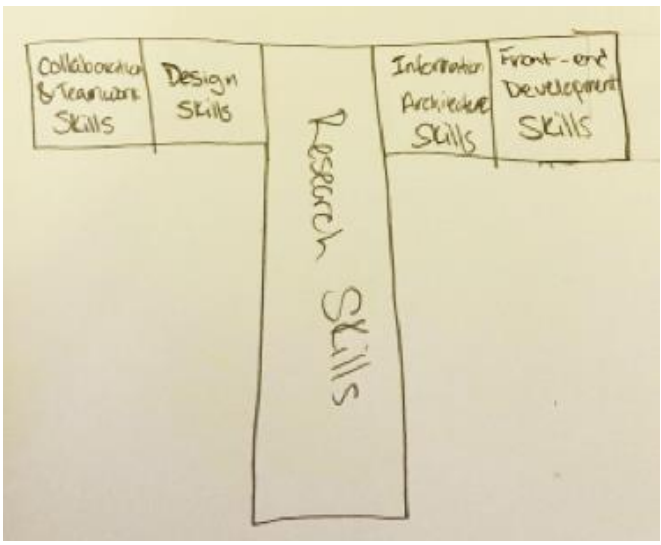


Figure 1. Examples of simple t-shape visuals (P40)

Enhanced t-shape visuals added additional layers of visual complexity to the t-shape. For example, P19 (Figure 2) used a modified t-shape ("pi-shape") and added bubbles of different colors to indicate skill type (technical vs. human/dispositions) and different sizes to indicate their current skill level. We categorized half of the t-shape visuals (47%; 17 of 36) as enhanced.

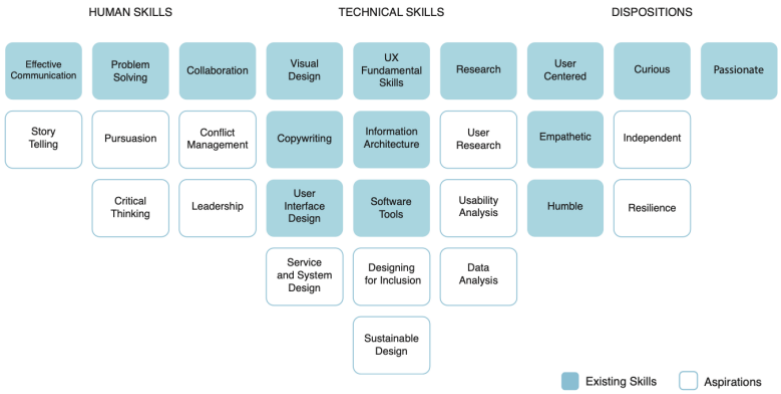


Figure 2. Example of an enhanced t-shape visual (P20)

Table (n = 8; 11%)

Visualizations in the table category were primarily text-based and had few, if any, visual elements. For example, in Figure 3 below, P34 created a table with the three skill categories as columns (human skills, technical skills, dispositions) and their skill level as rows (current standing vs. where to improve).

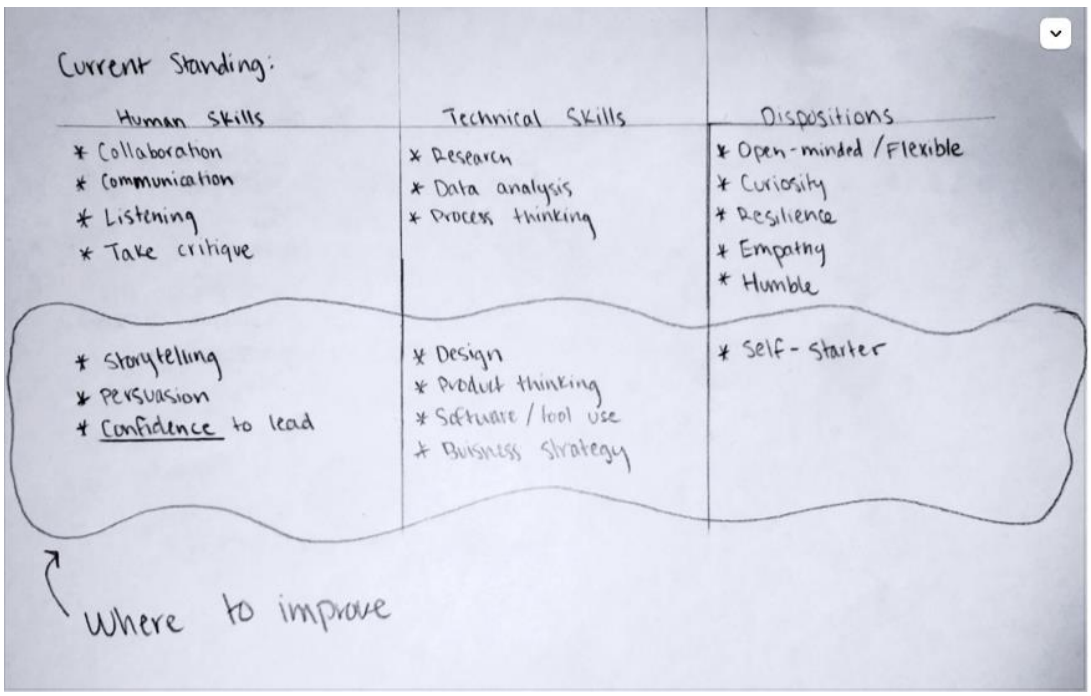


Figure 3. Example of a table visual (P34)

Bar Graph (n = 7; 10%)

Several students visualized their skills using a bar graph. For visuals in this category, most students used color to differentiate between different skills, and the size of each bar indicated their current or desired skill level. As one example, P53 (Figure 5) created a dotted line to indicate “where I want to be” and colored bars to show how far away they were from that line in each skill.

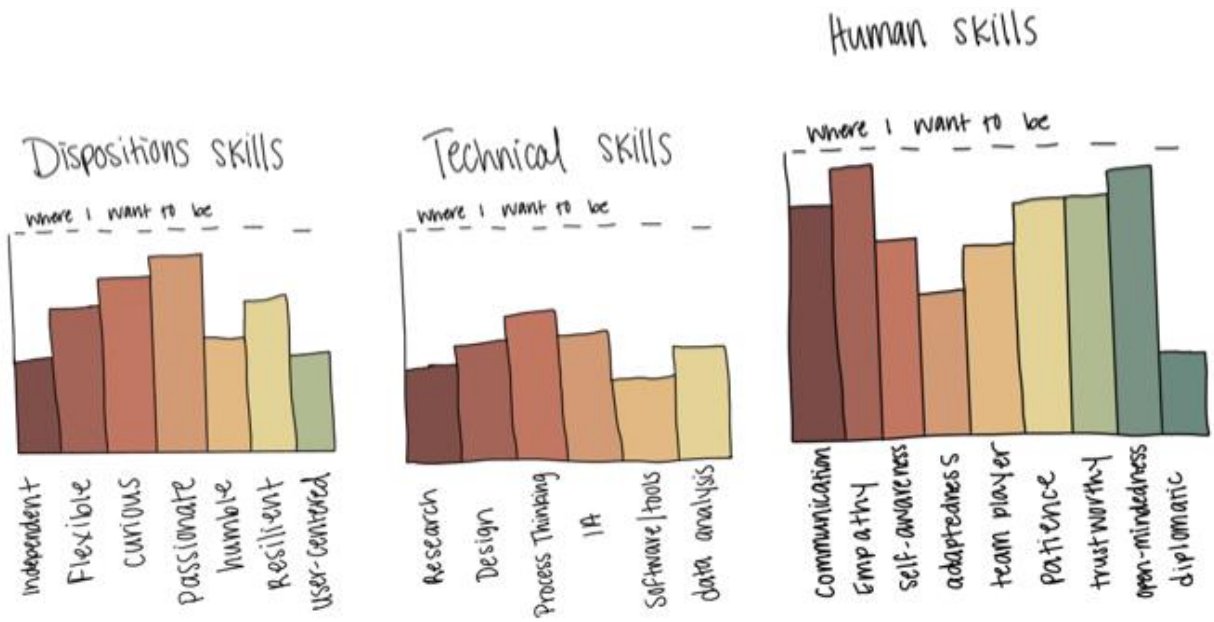


Figure 5. Example of a bar graph visual (P53)

Spider Graph (n = 5; 7%)

Some students used a spider graph to visualize their skills. In these visuals, students showed their skill level by mapping them on a radial axis; the higher the level of skill, the further it is plotted away from the center. Some visuals in this category included a single spider graph; others, like the example from P26 (Figure 6), created three spider graphs, one for each skill category.

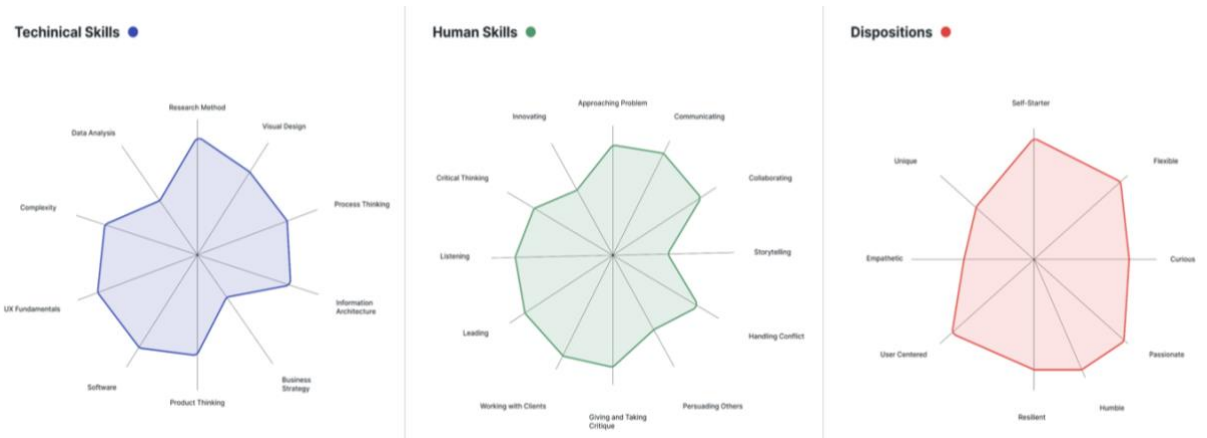


Figure 6. Example of a spider graph visual (P26)

Illustration (n = 4; 5%)

Illustration-style visuals were metaphorical and abstract drawings. These visuals included a scale representing a balance between technical and human skills, an apple orchard growing over time (where each apple represents a different skill), and a puzzle in which each piece is a different skill. In one of the more elaborate illustrations, P63 (Figure 7) used their drawing skills to create a gardening scene. In the scene, the "skills I know" are depicted as indoor houseplants, and the "skills I hope to grow" are depicted as an outdoor garden visible through the window.

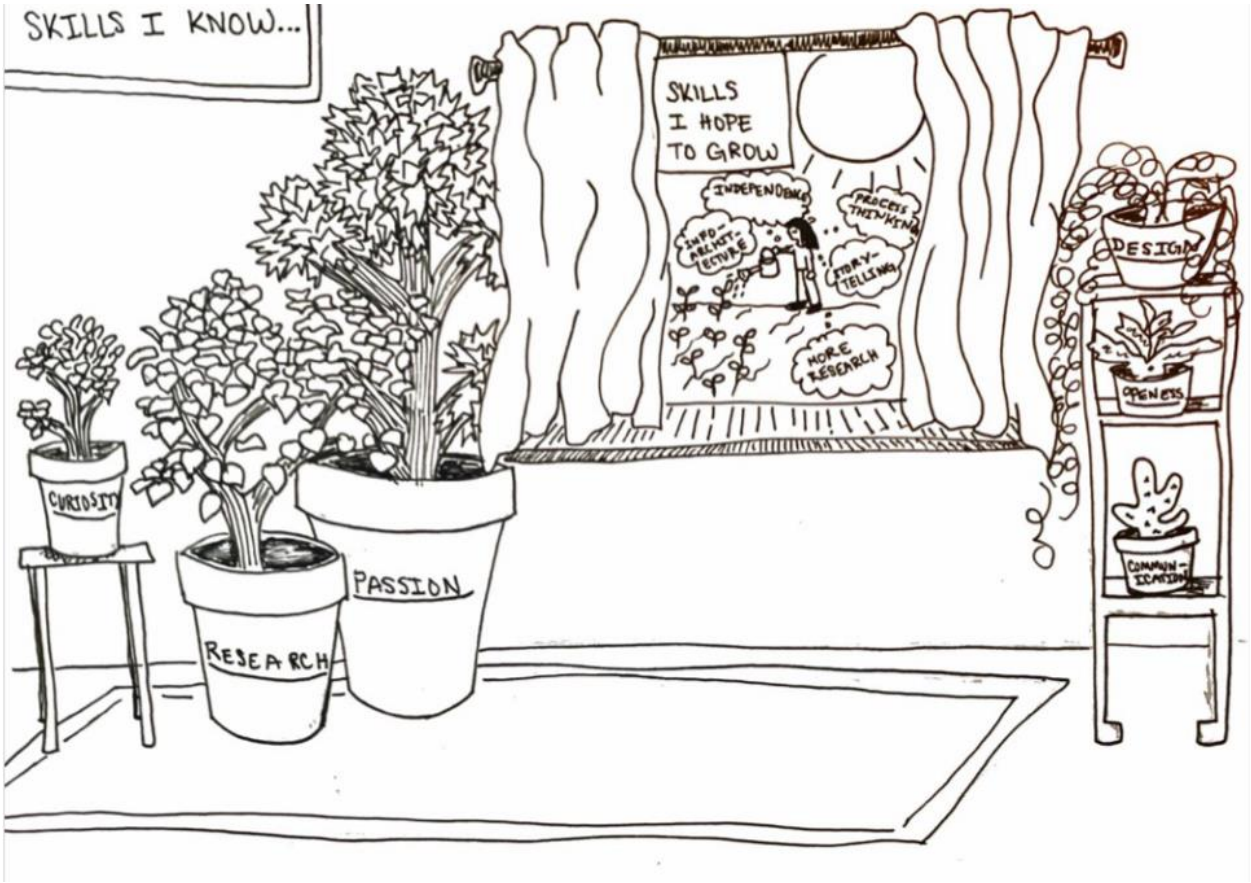


Figure 7. Example of an illustration visual (P63)

Bubble Chart (n = 3; 4%)

In the bubble chart style visual, students presented their skill levels by placing them inside filled circles ("bubbles") that varied in size according to their skill level, where larger circles indicated stronger skills and smaller circles indicated weaker skills. Some students also used color to represent either skill types or skill levels. For example, P24 (Figure 8) used color to differentiate skills by their current status ("what I know" vs. "what I hope to learn more") and created one bubble chart for each skill category.

Figure 8. Example of a bubble chart visual (P24)

Cartoon (n = 3; 4%)

Some visualizations took the form of a cartoon. In these visuals, students depicted themselves as a character going through some form of growth. For example, P57 (Figure 9) created a storyboard showing three different scenarios, one for each skill type. In each scenario, the first scene depicts their current self (marked "N" on the cartoon) expressing a desire to learn and the second scene depicts their future self (marked "F" on the cartoon) after they've made progress.

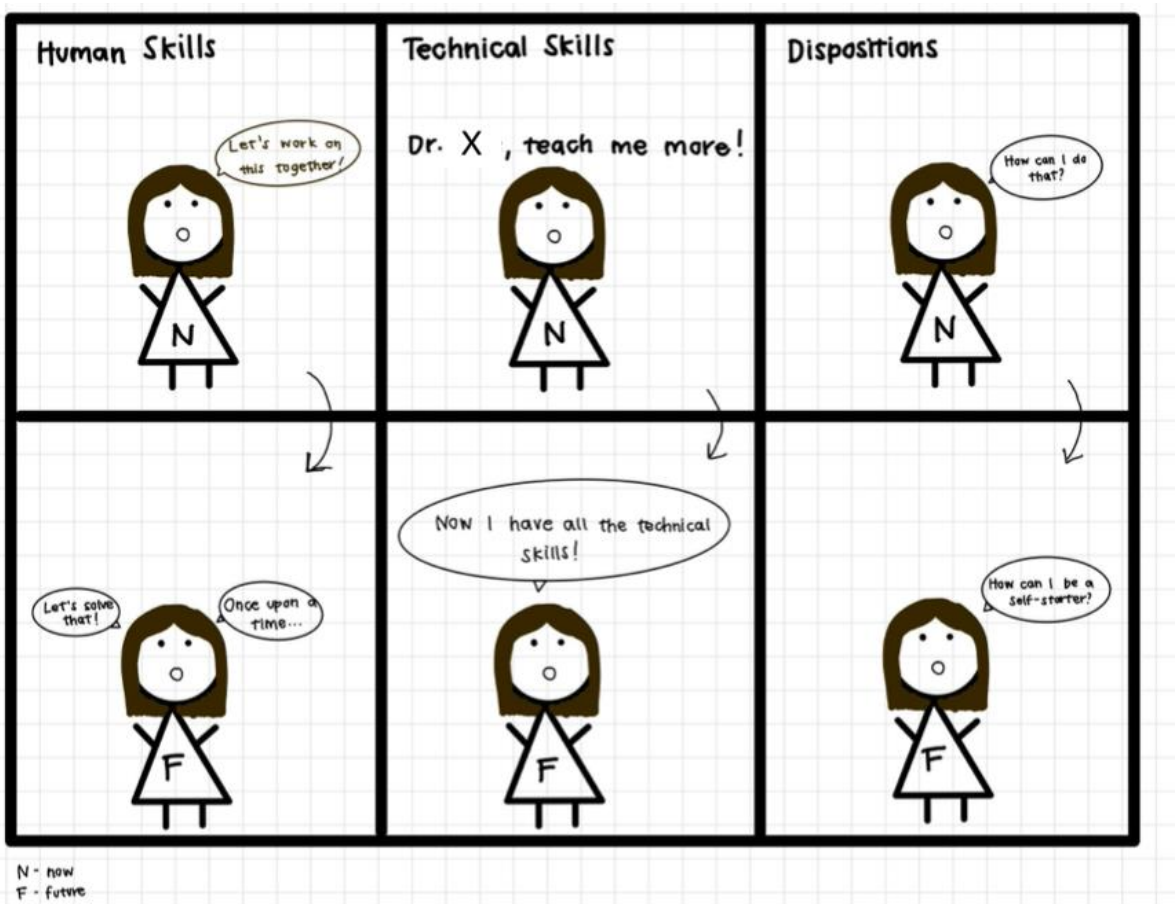


Figure 9. Example of a cartoon visual (P57)

Steps (n = 2; 3%)

Steps visualizations were a type of illustration that specifically used the metaphor of steps or a staircase to show learning. For example, P14 (Figure 10) depicts a 4-step process that starts with acquiring skills and ends with skills they hope to "constantly work towards even after graduation." Skills are highlighted in different colors based on the type (human, technical, and disposition) and the visual includes a cartoon depiction of the student at their current step.

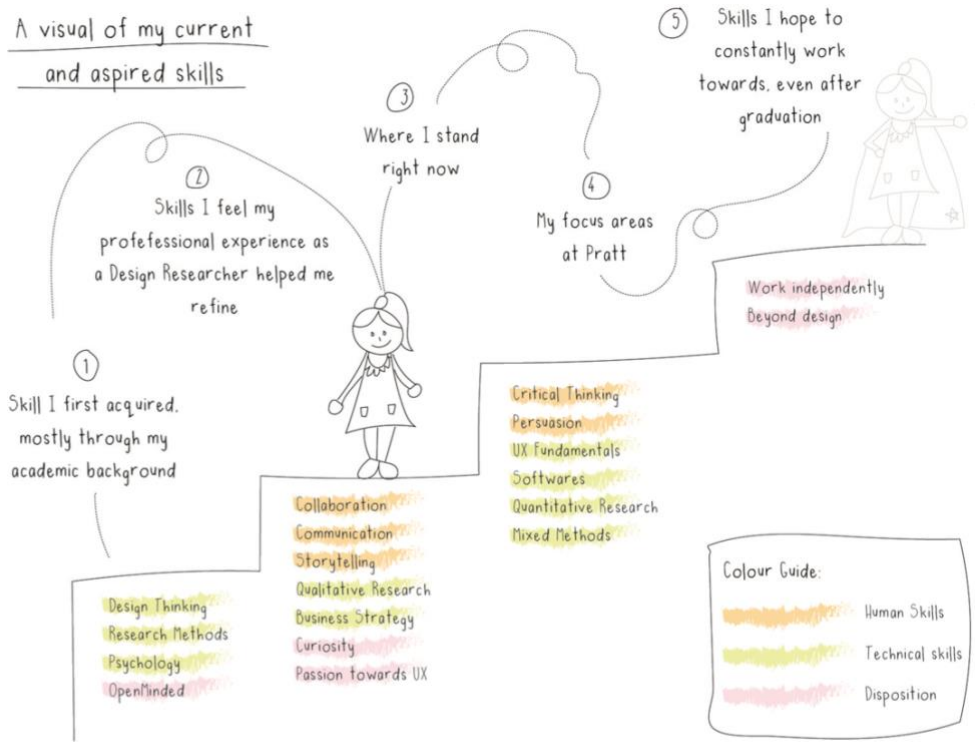


Figure 10. Example of a steps visual (P14)

Scale (n = 2; 3%)

Scale visualizations plotted the students' current skill levels on an abstract scale of expertise. Among the three visuals in this category, one student used a numerical scale from 1-10 and also summed all their ratings together into a summative score. Another student created a simple scale from Novice to Expert. On the scale below (Figure 11), P9 created a scale anchored by Expertise (E) on the left and Want to Learn (L) on the right, with Proficient (P) in the middle. They then plotted their technical skills, human skills, and dispositions on the scale.

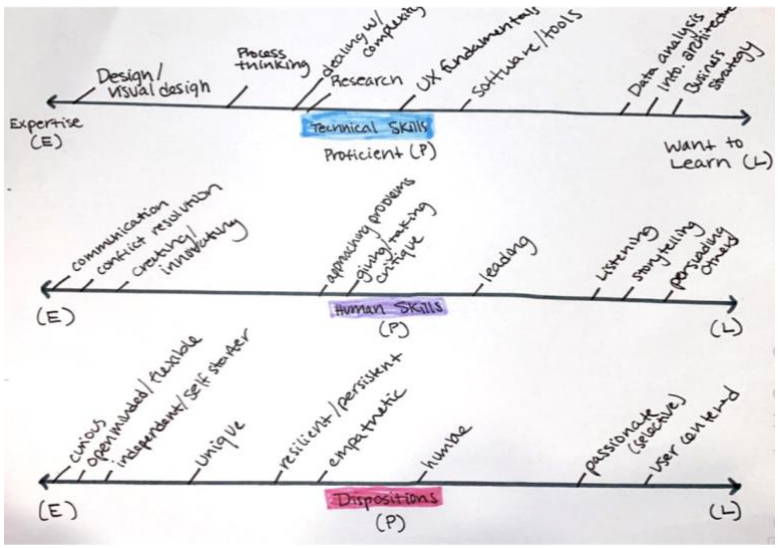


Figure 11. Example of a scale visual (P9)

Other (n = 3; 4%)

We grouped the remaining visuals into an "other" category as each one was unique. One visual showed a set of "skill cards" fanning out from a "UX" center, another was a Venn diagram with overlapping circles for each skill category, and the last showed two sets of nested circles (Figure 12), one representing "Where I am Today" and the other "Where I Want to be Tomorrow." In each set of circles, technical skills are the outer layer, human skills are the inner layer, and dispositions are nested in the center.

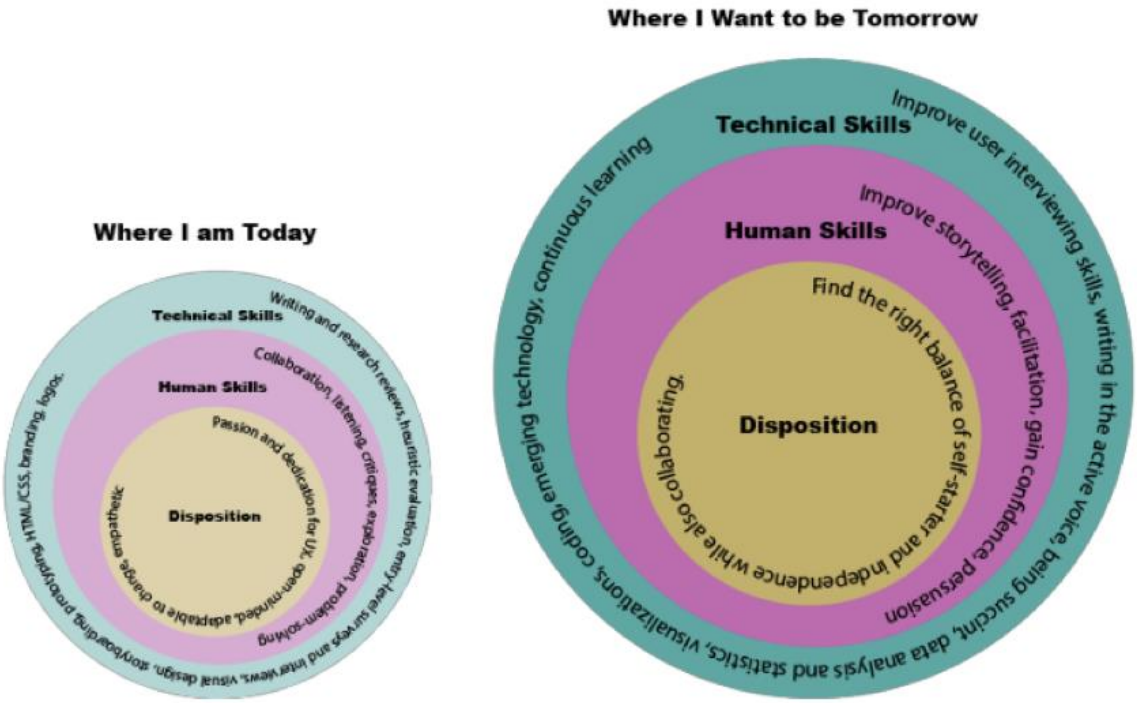


Figure 12. Example of an "other" visual (P51)

Follow-up reflections

At the end of the term, students were asked to revisit their initial submission and write a brief reflection on what they had learned. We again examined student responses and identified two common themes: a growth or change in their skill sets and reflections on the helpfulness of the intervention.

Growth or change in skills

Most students pondered their growth at the end of the term using the language of the article, i.e., specifically framing growth in their human and technical skills. Reported growth in human skills included communication (n = 12; 16%), collaboration (n = 12; 16%), storytelling (n = 7; 9%), critical thinking (n = 3; 4%), and problem-solving (n = 3; 4%). For example, P27 focused on collaboration in their reflection:

> *"I learned many important lessons about teamwork skills. I learned how to truly 'collaborate' with others, delivering my opinions to my teammates and receiving their critiques. I will try my best to be a better collaborator by listening to others opinions and being humble."*

Similarly, P50's reflected on growth in storytelling and communication:

> *"I was able to gain more experience and training in storytelling and communications skills through preparing presentations…It helped me think of how I'm going to elaborate detailed information through visuals and speaking."*

Many students also reflected on their growth in technical skills which included design (n = 24; 32%), software acquisition (n = 22; 29%), and research skills (n = 8; 11%). Technical skill growth was (obviously) related directly to the specific course assignments. For example, in the second context, where students conducted user research, learned new software, and designed an artifact, it was common for students to mention all three common areas of technical skill growth; P12 submitted:

> *"I believe that over the course of the semester, I have picked up several skills from all these areas of study – including research skills, from our user interviews, card sorting and tree testing activities, technical skills from our bout with Optimal Workshop and prototyping skills from our design process on Figma. I have even picked up finer design skills – something I believed I already had a good skill set in, from my teammates and classmates through the process of constructive criticism and iterative designing."*

Assessing the Helpfulness of the Intervention

Recall, in the third institutional setting (n = 45) we asked how the article was helpful (or not). Most students (n = 12; 27%) focused on how the article provided a framework by which to inventory and assess their strengths and weaknesses at the end of the term. In an example, P49 wrote:

> *"I think the most helpful aspect about these self-reflections/the article we read in the beginning was that it forced us (well, it at least forced me) to think about how and where we stand as designers at least compared to how and where we think we should be at. In my opinion, the first step to improving is understanding your limitations in the first place so that you can place focus on improving those weak parts."*

Students (n=11; 24%) also reported that the article and assignment were helpful in assessing their progress and growth; P67 wrote:

> *"I feel this is helpful in being able to do a progress check-in. It's very easy to get caught up in feeling like there is still a lot to learn, but this is a great reminder of all the growth I have had in just one quarter."*

Finally, there were four responses (9%) that mentioned how the article gave them more context for the UX field, which helped them better understand where they saw themselves in that context. In an example in which the student encouraged us to continue the assignment, P73 wrote:

> *"I think both reflections were helpful. It's hard for me to stop and recap my experiences during my education. Being a student is really a constant journey that slams you with task after task, so it's nice to stop and think about the fruits of my labor. The article was also helpful because it had good insights into the job market and made me think more*

about the soon to be future where I'll really need to sell myself for a job. Overall, a great exercise that we don't get to do in any other classes, so I suggest keeping it for other students."

Follow up visualizations

In addition to the reflection questions, students in the first two academic contexts (n = 29) were also asked to create a new visualization of their skills as part of the follow-up assignment. Of the students who created a second visualization, all but three students chose the same style as their initial submission. When examining these follow-up visuals, we identified two themes: enhancing their skills and recalibrating their understanding of their current skills.

Enhancing skills

For the majority of students, the follow-up visuals show a mild-to-moderate enhancement of their UX-related skills. For some students, the final visuals showed an increase in the number of skills they possessed. For example, participant P5 used the exact same "t-shape" visual from their initial submission but added four new skills: leadership, self-starter, persistence, and "deal with complexity."

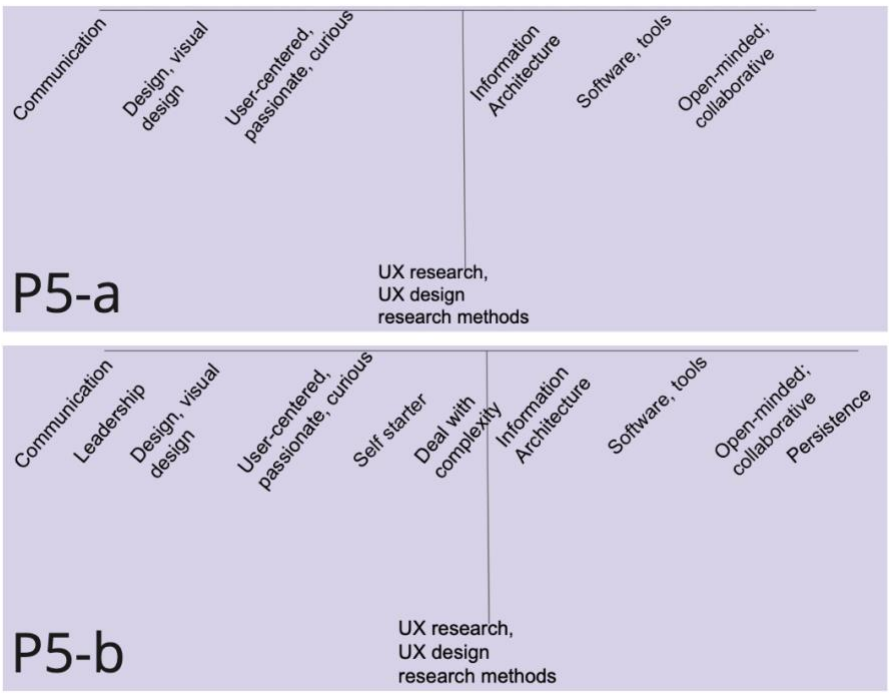


Figure 13. Initial (a) and follow-up (b) visuals from participant P5 showing an increase in the number of skills they possessed

For other students, the final visuals showed growth in their existing skills rather than the addition of wholly new skills. For example, P19 (Figure 14) used a series of different-sized bubbles on their "enhanced t-shape" visual to demonstrate growth and improvement.

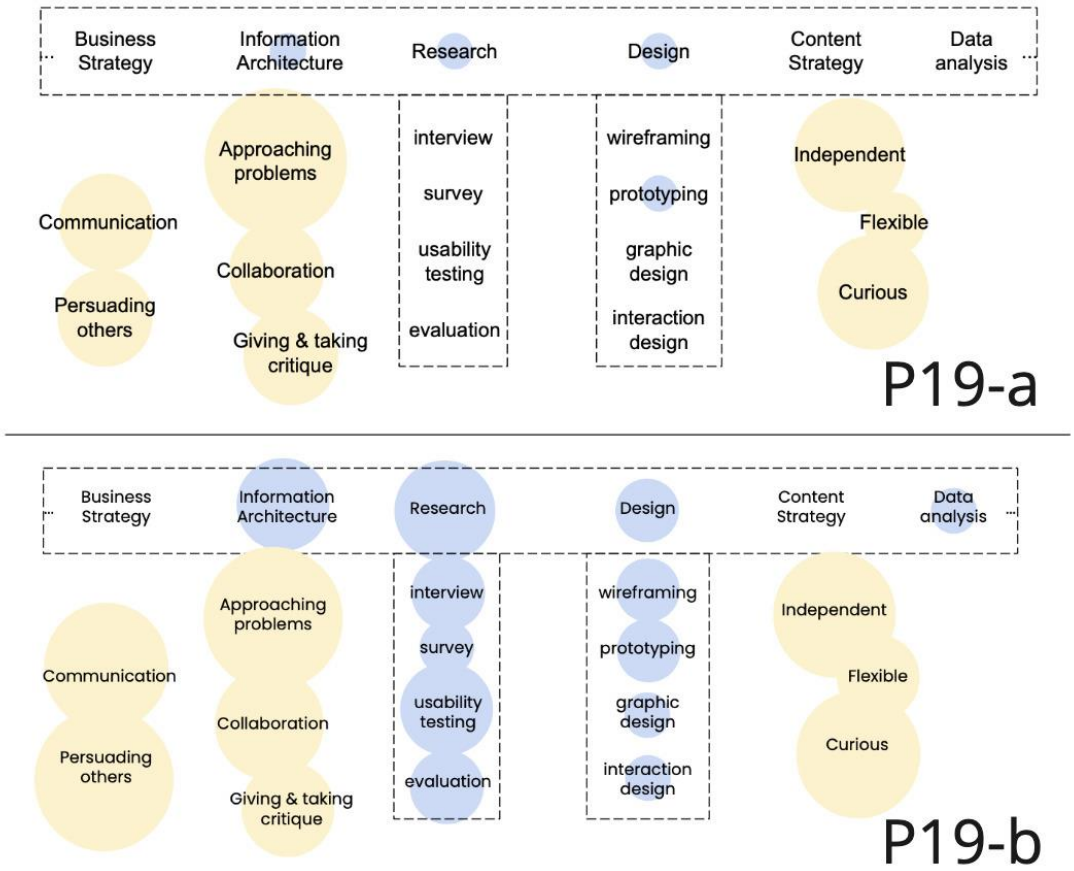
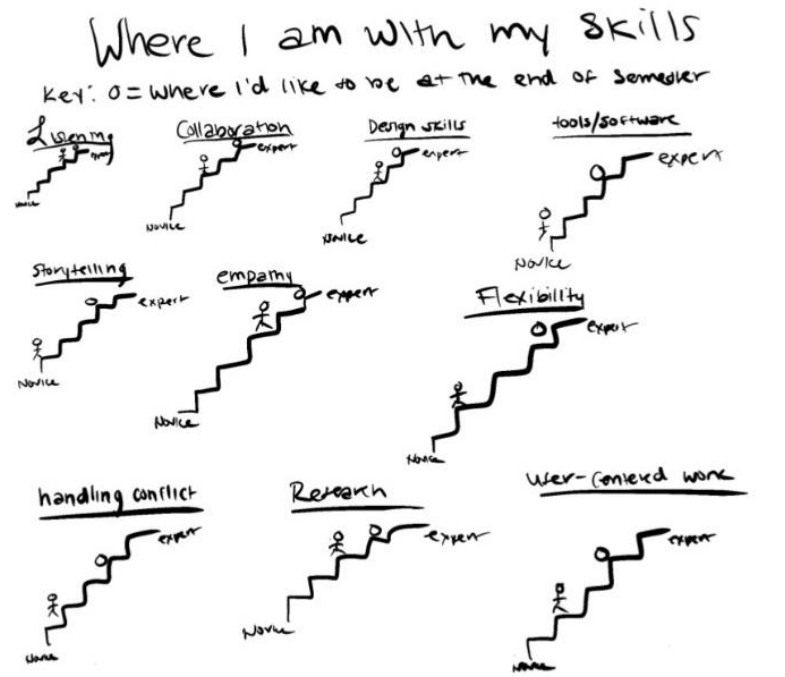


Figure 14. Initial (a) and follow-up (b) visuals from participant P19 showing how they improved several skills

Recalibrating their skills

For some students, the final visuals seemed to encourage a recalibration and appreciation for the effort required to develop new skills. For example, participant P15 used the "steps" metaphor to indicate their current and desired skill levels on both the initial and follow-up visual. However, on the follow-up, they depicted themselves on a lower step on several skills (listening, collaboration, empathy, and flexibility) compared to the initial visual.



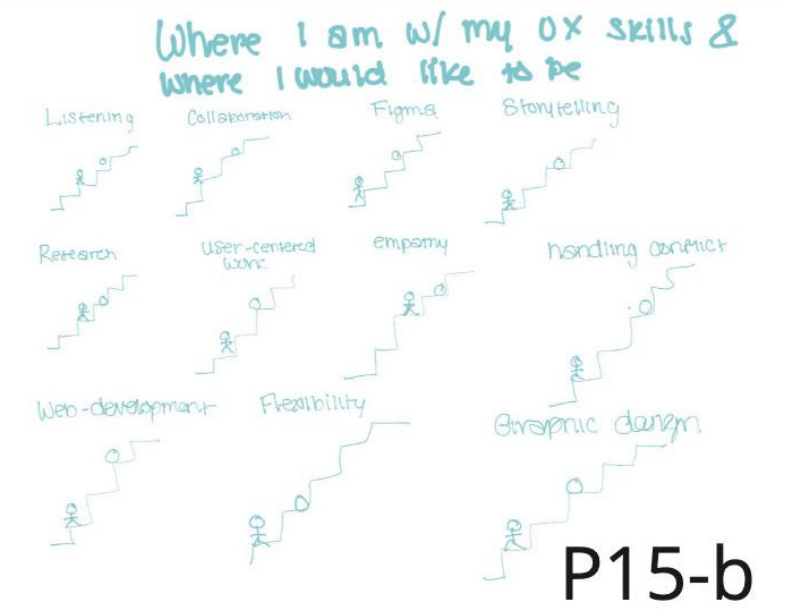


Figure 15. Initial (a) and follow-up (b) visuals from participant P15 showing a recalibration of their self-assessed skills

This example shows that growth was not simply progressive in terms of students seeing their skills increase. Instead, some students' appreciation for what a skill might entail and their perceived strengths in a particular area changed over time. The following student, in their final reflection, spoke to how their perception of their skills changed over time and how they recalibrated that perception.

> *"At the start of the semester, I graded my skills at a very high level but over time I realized that I'm falling short in some areas of the skill set. As the semester went on I tried to push myself to bridge the gap. Sometimes the result came in quickly but other time it took more time then expected." (P26)*

This evidence points to how the intervention is a helpful tool for self-reflection and can complicate students' understanding of the skills themselves and their growth in relation to those skills.

Implications and Implementation

In this section, we discuss the implications of the findings presented through our analysis and provide recommendations for others interested in implementing the intervention in their own classes.

A helpful intervention

Based on the data shared in the previous section, we have concluded that the reflection intervention was helpful for students enrolled in UX courses for several reasons.

First, the intervention scaffolded a double-loop learning (Argyis 2003) opportunity for students to make assumptions about their understanding of what the skill sets were and how they assessed their existing knowledge. Students then reflected on these skill sets that they were asked to engage in throughout the term, to see how their initial understanding changed and evolved. They were asked to demonstrate these skills while also reflecting on how they were learning and how they were executing these skills, a form of reflection-in-action (Schön 1983).

Second, the intervention helped break down and demystify the skills that UX professionals need to be successful in the workplace. Students were able to learn about these skills, not just through their classes but through reading an article based on evidence from practitioners who identified these skills as critical.

Third, the intervention not only helped students appreciate the breadth of skills in UX but provided them with a way to scaffold their own existing and emerging skill sets, so they could strategically know what to strengthen or work on based on their individual goals. We concluded that this activity was a helpful example of an advance organizer. Additionally, our findings suggested that the KWL (Know, Want, Learned) format (Ogle, 1986) was a beneficial way to help students become aware of their existing skills and it also provided a way to set goals and assess what they had learned.

Fourth, we see that this intervention helped to disrupt the false notion that technical skills are the priority in UX. Students expressed a sense of relief that the skills were not solely technical. It helped broaden the idea of what it takes to be successful in UX.

Finally, given the different types of programs that we piloted this intervention in, both undergraduate and graduate, and in design, computing, and technical writing, we concluded that this intervention can be implemented in other UX-related fields at different levels.

A skill-building exercise itself

In addition to being a helpful tool to help inventory skill sets and set goals, there is evidence that the intervention itself is an activity that helps to strengthen UX skills. First, the act of doing an inventory of one's skills can be seen as a type of research exercise where students are searching inwardly through reflection to identify, catalog, and assess their own skills. Second, creating the visualization is a type of design exercise in which students have to consider how to create a visual design that represents both their existing strengths and where they wish to improve. Given very little description of how to do so, we see students demonstrate a variety of different ways to represent their own skill sets and where they might need to grow. This range of options demonstrates some creativity on their part to think through a design exercise with little direction, which is not unlike the experience they will find themselves in when they are on the job.

Considerations for implementation

Given the flexibility of the intervention, we believe it is a suitable exercise and activity for a variety of classes where students are learning about UX. While the data presented here are from the first implementation of the exercise, we have continued to implement and refine it in subsequent classes. Given our experience implementing the activity for over three years, in three different courses, in three institutions, we have identified additional considerations for implementation.

Pre and post

It is helpful to have the implementation act as both a pre-assessment of student skills and also post-assessment. Students can be asked to repeat the visualization they created at the start of the course and reproduce, iterate, or create a completely different visualization of their skills. Alternatively, instead of reproducing a visual, students could be asked to respond to a series of prompts that asks them to describe how their skills have changed.

Peer sharing and review

When we ask students to share these visualizations with each other, they also get to appreciate how there is no one way to design based on a prompt and there are many possible conceptualizations of their skill sets. To do so, we recommend making sure that students first submit their assignment and then share them with students, either in small groups or through an online peer review process. Providing a peer review or sharing process can make the exercise social and collaborative. If implementing group work in a course, this activity may also be a helpful way to identify teams with a mix of skill sets.

Examples and instructions

The original research article that the students read (Rose, et al., 2020) had industry professionals use the term "T-shape" (Brown, 2005) to describe the breadth and depth of skills. Therefore in the initial instructions, we told students "to use the metaphor of the T-shaped skills or find another way to show the relationships between what you know and what you hope to learn." As a result, the T-shape was the most common visualization that occurs in student submissions. However, when students chose a different visualization, the results were richer and more creative. Therefore, in future implementations of the exercise we have either omitted the instructions to use a T-shape as the metaphor or have explicitly instructed students to not use the T-shape. In addition, we sometimes show examples of previous students either

before or after students have submitted their assignments. Providing examples can be helpful to show the different ways to approach the visualization but it can also prompt students to replicate those existing examples. In either case, in our instructions, we encourage students to be creative and attempt to design something that is unique to them.

Course integration

We continue to think about how individual student assessments can be integrated into the courses. For example, one skill that we saw repeatedly that students felt like they wanted to learn more about was storytelling and information architecture. This was both seen in the pre- and post. Given this interest, we are considering how to elevate or draw attention to these specific components in the class as they occur. For example, within assignments, it would be helpful to specifically point out which skills a student might be able to demonstrate within the specific assignment. Alternatively, the KWL chart could be used as a self-assessment tool for each assignment where the student can connect the skills they are learning to their original goals.

Program integration

In each of the examples from our work, we have integrated the skill assessment into a single course. However, the assessment could also be integrated into a program where we ask students to take part in the intervention at the beginning or end of a specific gateway course and again at the end of a program. Having multiple iterations can assess how students' perceptions of their skills are shifting over time. It can also be used to assess where a program might need to strengthen or make improvements.

Limitations and future work

While we believe that the intervention we designed is successful, we also acknowledge the limitations of this work. Our assessment of this intervention was exploratory and not intended as a controlled experiment. A strength of the intervention is that we were able to implement it in three unique classrooms in three programs in three settings with a range of students. The audiences were all slightly different and included undergraduate students and graduate students. However, our enthusiasm for this intervention may be impacted by the fact that we both designed and evaluated the intervention and therefore were invested in its success, which may have introduced bias into the evaluation. We believe this initial data indicates it is successful, but encourage and invite other instructors to implement and evaluate it in other classroom settings.

Part of understanding the impact of this intervention was to see if students saw value in it. Students mentioned both in class and on course evaluations that they saw value in this exercise. Additionally, we have continued to successfully use this intervention in our classes and students see value. We have also shared this intervention with colleagues who have also implemented it in their classrooms. To examine its impact more fully, it would be helpful to do additional research and design a controlled experiment to evaluate its effectiveness in a variety of settings.

In conclusion, having students attempt to engage in double loop learning (Argyris 20003) and reflection-in-action (Schön 1983) and assess their skills through a Know, Want, Learned (KWL) advance organizer was a successful intervention that helped students cultivate awareness of

industry expectations, the importance of human skills, and to assess their own self-awareness and personal growth. We believe that due to its successful implementation in three different programs with different student populations, it is an effective pedagogical tool to support student learning and inform course design for students studying UX.

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29.1

The Influence of Teachers' Perception of Creativity and Makerspaces on Their Practice in Norwegian Compulsory Schools

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Abstract

The use of makerspaces in Norwegian compulsory education is growing. However, using maker-centred learning to support creativity has yet to be examined extensively in the Norwegian context. Consequently, the aim of this research is to explore Norwegian makerspace teachers' conceptions of the use of maker-centred learning to augment creative capabilities and digital competences. The study focuses on teachers' understandings of creativity and makerspaces along with various aspects of maker-centred learning and how they support creativity. The data was collected via six semi-structured interviews with teachers working in school-based makerspaces. In the interviews, the teachers conceptualised creativity related to makerspaces and reflected on various pedagogical aspects of managing creative makerspace activities. The research indicates that teachers have similar understandings of makerspaces but different interpretations of creativity. As a result, the makerspaces are designed differently, and the teachers use a variety of teaching methods. The findings also indicate that the teacher must be able to change their role from being an instructor to a facilitator and observer while also managing the utilised technology. Digital technology, collaboration, and constraints were also found to be factors that supported students' creativity.

Keywords

Creativity, Norwegian compulsory education, makerspaces, maker-centred learning, invention pedagogy

Introduction

In recent years, several Norwegian schools have established makerspaces. In the context of education, makerspaces are physical spaces within schools that feature activities based on creativity and where students are given opportunities to craft innovative artefacts using both manual tools and digital technology (Clapp et al. 2016). Such makerspaces have emerged as the educational potential of the maker movement has been acknowledged (Blikstein, 2013). According to Halverson and Sheridan, the maker movement refers to "the growing number of people who are engaged in the creative production of artefacts in their daily lives and who find physical and digital forums to share their processes and products with others" (Halverson & Sheridan, 2014, p. 496). Makerspaces at schools are also referred to in the literature as technological and design-based education.

Much of earlier maker research has focused on STEAM (science, technology, engineering, art, and mathematics) learning in makerspaces at museums and public libraries as well as in non-formal learning environments such as after-school programs, summer camps, or community centres (Brahms & Werner, 2013; Halverson et. al., 2017; Sheridan et al., 2014). The recent

growth of school-based makerspaces has also fuelled research interest to analyse the potential of makerspaces and maker education in compulsory education (Kajamaa & Kumpulainen, 2019; 2020; Riikonen et al., 2020; Wohlwend et al., 2017). Many of the aspects that are highly valued in makerspaces – such as hands-on activities, maker mindset, and a community of practice – are also regarded as important factors in formal education. Furthermore, there is strong belief that makerspaces and maker activities can transform education by fostering 21st-century skills, democratising digital fabrication tools, and combining interdisciplinary connections to STEM (Blikstein, 2013; Martin, 2015; Riikonen et al., 2020). The term *21st-century skills* refer to knowledge and personal qualities that are necessary to succeed in unpredictable times. Unpredictability follows rapid change, necessitating, among other things, flexibility, creativity, problem-solving, collaboration and critical thinking (Piirto, 2011).

Some educators consider 21st-century skills ill-defined and heavily utilized by institutions and policymakers to promote their educational programs to legislators and businesses, hoping to participate in the global economy. Moreover, there is need to integrate the ideas of Education for Sustainable Development (ESD) and Global Citizenship Education (GCED), which could shed light on the wider context of adopting values, attitudes and skills that would benefit humanity not only in the twenty-first century but also in the future (Cleminson, 2021). However, tensions are evident between school-based makerspaces that emphasise standards-based curriculum and informal out-of-school makerspaces that prioritise open-ended material exploration and individual-initiated projects. Furthermore, contradictions exist about the teacher's role as an instructor or facilitator (Godhe, et al., 2019).

One of the central aims of including makerspaces in formal education has been to support students' creativity and innovativeness through interdisciplinary and collaborative learning and, thus, to help fulfil the intentions of the national curriculum. The current Norwegian national curriculum for compulsory education was implemented in 2020. The core curriculum, which describes the values and principles for primary and secondary education, stresses the importance of supporting creativity and innovation (Kunnskapsdepartementet, 2017). Nevertheless, these values are not always visible in the learning goal descriptions for each school subject (Dale et al., 2011). Consequently, it can be unclear how teachers are expected to support the development of creative skills in students and foster an innovative learning environment. A growing number of schools in Norway have established technology-rich educational makerspaces equipped with digital fabrication tools and materials for creative production. Nevertheless, makerspaces at schools are not a new phenomenon in many Scandinavian schools. In Nordic countries, craft, design, and technology education have been considered part of compulsory education for a century (Olafsson & Thorsteinsson, 2011). In the Nordic countries, these subjects have been taught in specific classrooms designed to foster similar activities but with a clear focus on learning skills and making quality artefacts (Seitamaa-Hakkarainen & Hakkarainen, 2017). Educational makerspaces add to this setting due to their cross-curricular activities and STEAM focus.

Teachers' understanding of creativity affects how they support student creativity (Bereczki & Kárpáti, 2018; Olafsson, 2022). Generally, teachers have a positive attitude towards creativity and want to support their students' creative development (Olafsson, 2022). However, the teacher's perception of creativity can affect the development of students' creativity skills

(Davies et al., 2013). Therefore, it is important to understand how teachers perceive creativity and makerspaces and how their perception influences their practice.

This article discusses aspects of creativity and makerspaces by first examining literature related to creativity in the context of educational makerspaces. Then, the research setting, and data collection are presented, and the results of the data analysis are reported. Finally, the authors discuss the findings and draw conclusions.

The research reported in this article is part of a research project that focuses on maker education in Norway (www.usn.no/maker). The aim of this project is to investigate how makerspaces are used and what type of pedagogical practices and values are present. Furthermore, it seeks to offer opportunities for researcher–teacher partnerships to examine how teachers can best facilitate and scaffold students' innovation processes by implementing new pedagogical practices in schools.

Creativity in maker-centered learning

Makerspaces are creative and uniquely adaptable learning environments equipped with tools and materials that provide structures for inclusive, creative, and innovative collaboration among pupils to allow for multi-disciplinary problem solving and open the doors to the world of technology (Hakkarainen & Seitamaa-Hakkarainen, 2023; Loertscher et al., 2013). Makerspaces can facilitate participation in real-life projects that helps students develop important problem-solving skills, critical thinking, and teamwork. The tools applied by students in makerspaces are often hybrid in nature, utilising both digital manufacturing technology (Hawken et al., 2013) as well as traditional technology such as hand tools and tangible craft materials.

Maker-centred learning is based on active student- and project- or problem-based learning, thus boosting students' agency and their awareness of how they can modify the world around them through engaging in creative activities. The pedagogical background of maker-centred learning leans on the work of constructionism theorists (Blikstein, 2013). The pedagogical frame often met in makerspaces develops the constructionist mentality through collaborative, flexible, student-driven, and multi-disciplinary practices and provides the space and time necessary to cultivate miscellaneous knowledge, skills, and ways of thinking. Computer-aided design and manufacturing have given rise to maker-centred learning in which the aim is to foster creativity supported by digital technologies and artefact-focused making (Clapp et al., 2016). Studies have also indicated that the makerspace culture motivates students to innovate, which augments their self-perception and creativity. Positive self-perception substantiates a student's feeling of belonging to a makerspace community (Carbonell et al., 2019).

Maker-centred learning through collaboration facilitates ways of obtaining understanding that differ qualitatively from more traditional classroom situations (Korhonen et al. 2022). When students share knowledge and reflect in collaborative settings, they gain a deeper understanding of their undertakings and how they can participate in developing the world around them (e.g. Sawyer, 2019). Maker-centred learning is concerned not only with making but also with fostering the maker's capacities to observe closely, explore complexity, find opportunities, and influence future conditions (Clapp et al., 2016). This type of learning also provides opportunities to create personalised projects and products that are meant to connect to students' own lived experiences and that demonstrate authenticity.

Research has demonstrated that learning in makerspaces enhances the design-thinking, problem-solving, and cognitive skills of students and supports creativity (Timotheou & Ioannou, 2021; Taheri et al., 2020; Hatzigianni et al., 2021). Moreover, it also supports group creativity via co-creation in maker-based work (Lille & Romero, 2017). Interactive and well-planned pedagogy is critical for enhancing creativity in makerspace settings (Giannakos et al., 2017; Bower et al., 2020; Trahan et al., 2019). According to Clapp et al. (2016), the main role of teachers in maker-centred classrooms is to act as facilitators. Moreover, their roles vary from offering direct instruction and advice to modelling behaviours and mentoring (Smarason et al., 2021). Students must be the driving force in the creative process in a maker-centred educational setting to support innovation. Odey et al. (2015) stated that teachers should focus on students by assigning tasks that inspire teamwork and risk-taking. The conventional teacher-centred role can be altered using different models (Heinze, 2008; Bonk & Cunningham, 1998), and the emphasis can be placed on open communication and similar roles between students and teachers in makerspaces (Jonsdottir & Macdonald, 2011)

Creativity

The word *creativity* is used in different contexts and different meanings are ascribed to it. However, there has been a broad consensus among creativity researchers that creativity is something new and task appropriate (Helfand, et al., 2017; Runco & Jaeger, 2012). Nevertheless, the criteria for what counts as creative are also defined by the context of the creative act. As an example, what accounts as creative for a young student in an educational setting is not necessarily a creative contribution to a professional domain.

This standard definition of creativity refers to a creative product. However, creativity is manifested in a process as well (Green et al., 2023). Traditionally, instruction in the arts in compulsory education in Norway has been focused on producing artefacts (Randers-Pehrson, 2016). In contrast, teaching and learning in makerspaces focus on the creative processes of problem solving that lead to new innovations and design (Korhonen, 2022), often in the form of prototypes. The process of conceptualising ideas in the mind, also known as idea generation, is essential to most problem-solving situations. Since idea generation is the foundation of both invention and design, it is justifiably acknowledged to be an important stage in the invention process (Van de Ven et al., 2000).

Creativity is a central element of learning (Beghetto & Kaufman, 2007; Sawyer, 2012) and internalising new knowledge. Instructionism involves knowledge that is transferred by the teacher to the student, who is then expected to memorise the content. According to Sawyer, this approach results in shallow knowledge, and Sawyer further adds that it is not possible to be creative with shallow knowledge. By contrast, creative knowledge is gained through creative activities. When the student learns though creative knowledge, they understand what they learn (Sawyer, 2012).

Amabile (2013) described four dominant components that must be present for creativity to occur: domain-relevant skills, creativity-relevant skills, task motivations, and a supportive social environment. *Domain-relevant skills* concern the professional knowledge and experience that are applicable to being creative in a field. To be creative in a specific field of knowledge, one requires in-depth knowledge of that field. However, the ability to work with multiple solutions to a problem also requires some competence in other fields. *Creativity-relevant skills* concern

general skills and personal qualities such as endurance, the ability to think differently, flexibility, and openness to new ideas. *Task motivation* applies to the individual's attitudinal approach, such as commitment and passion, and high internal task motivation results in more creativity. The *social environment* concerns the working environment and surroundings, which can be supportive or obstructive to developing creative ideas (Amabile, 2013). In the context of education, the school's leaders, school traditions, and teacher–student communication can affect students' motivation and creative outcomes. Furthermore, none of the above elements can be separated from the social and cultural context of the individual. Consequently, the context of the maker activities influences the development of students' creativity.

Robinson and Aronica (2015) stated that many scholars believe that creativity can transform and reimagine education. Makerspaces, in the context of innovation, aim to provide a setting that stimulates students to think creatively, experiment with novel concepts, and push the limits of innovation. A makerspace enables students to construct prototypes and experiment, thereby transforming ideas into workable solutions through access to tools and resources. Makerspaces also offer settings in which students may improve their creations, learn from their failures, and enhance their comprehension of a variety of subjects (Smarason et al., 2021).

Among other skills, creativity has been depicted as a vital 21st-century skill (Piirto, 2011) along with competency in digital technology (Van Lar et al., 2017). Although 21st-century expertise is much broader than digital skills, it can be argued that digital mastery is essential to be creative in many domains. These skills converge in makerspaces. Digital technology can boost creativity in education by providing new resources, platforms, and settings for creative learning. This is not to say that all digital technology will facilitate student creativity, but digital components can scaffold creative learning (Glăveanu et al., 2019).

In addition, numerous studies have demonstrated that task limitations – including product configurations, design specifications, a narrowly defined issue scope, or external objectives – may stimulate creativity (Rietzschel et al., 2014; Medeiros et al., 2014). Moreover, creative thinking may be stimulated by a variety of resource constraints, such as those pertaining to time, money, knowledge, or resources.

Educators in the European Union believe that technology may foster creativity and learning and that it can be applied in any school subjects (Cachia & Ferrari, 2010). Teachers have a positive attitude towards creativity and are the key to stimulating students' creativity in makerspaces. However, teachers' perceptions of creativity are dissimilar, which influences their teaching practices and evaluations (Olafsson, 2020). Although teachers exhibit a positive attitude towards creativity, they can find it challenging to convert their ideas into effective practices (Bereczki and Kárpáti, 2018). Teachers require an appropriate understanding of the role that creativity plays in knowledge creation and must learn how to meet related challenges in the classroom (Olafson, 2022).

Method

The aim of this research was based on case study methodology to examine how teachers' conceptions of creativity and makerspaces affect their work in Norwegian compulsory education. The case was carried out in a Norwegian makerspace and the methodology used to respond to real-life situations and changing perceptions. Data was collected via qualitative

interviewing that is a key method in the human and social sciences. It was based on illuminative paradigm from the interviews including transcription, coding and determining core themes (Cohen et al., 2007). The analysis was based on Miles et al. (2014) method. The research questions are as following:

1. How do teachers define creativity and makerspaces in Norwegian compulsory education?
2. How does teachers' understanding of creativity and makerspaces affect their work?

Six interviews were conducted in 2022 with nine in-service schoolteachers working with makerspaces at their schools. An internet-based communication platform was used for the interviews due to the geographical spread of the schools. The interviews were conducted by the first author and other collaborators in the maker research project. The schools were selected because they already contained established school-based makerspaces, and the teachers were instructing upper secondary level students, ages 14–16. Five interviews were conducted with solo participants, and the remaining interview had four participants. The interviews were open-ended and were based on a semi-structured framework that allowed for follow-up questions, which enabled the researcher to delve more deeply into issues of interest that emerged during the interviews (Cohen et al., 2007). The themes of the semi-structured interview guide were (a) the use of the makerspace, (b) creativity, (c) planning and executing classroom activities, and (d) assessment. Each interview was 40–60 minutes long. The interviews were transcribed verbatim, analysed, and coded in the NVivo computer program, and the transcripts were read multiple times to identify structures and themes within them. The analysis was based on Miles and Huberman's (2014) method for analysing qualitative data. The coding process consisted of two phases and used analytical memos to help define the structures (Miles et al., 2014). In the first phase, both deductive and inductive approaches were used for coding. Twelve codes were pre-defined, and six codes emerged during further analysis, eighteen in total. The predefined codes came from the literature and were connected to themes and questions in the semi-structured interview guide. Ten of these codes were used to describe the data in three categories, that were in line with the themes from the interview guide. Table 1. shows the categories and codes. The ten codes were selected because they were best suited to answer the research questions.

Table 1. Categories and codes

Categories	Codes
Definitions of creativity and makerspaces	– Creativity definition – Makerspace definition
The use of makerspaces to foster creativity	– Creative processes – Motivation – Constraints in student projects – Open-ended projects
The teacher's approach in makerspaces	– Teachers' role – Student project design – Classroom atmosphere – Teacher feedback

Findings

In this section, the results are presented in the three categories that emerged from the data:

- Definitions of creativity and makerspaces,
- The use of makerspaces to foster creativity, and
- The teacher's approach in makerspaces.

Definitions of creativity and makerspaces

The teachers were asked during the interviews to define the terms *creativity* and *makerspace*, and their responses defined creativity with various terms, such as thinking outside the box, having many ideas, trying new things, and finding solutions. Descriptions such as creative and innovative were used interchangeably. One of the teachers described creativity as making choices: "*Creativity is making choices and giving grounds for why. … It is making choices based on knowledge of materials. ... That is a big part of creativity*".

Three teachers emphasised that creativity builds on other ideas and that the students' task is to find a new approach and combine different possibilities. Facilitating the possibility to combine knowledge from various school subjects was considered important for students' creative expressions: *"[What they make] doesn't have to be completely new, but it must be their own. They must make something themselves; something that is new to them or new to us. To be creative is for them to combine different things into something of their own".*

The teachers were asked whether creativity was innate. All of them stated that it was innate to a certain point, but they emphasised that creativity could be developed in the context of education:

> *I think it's a bit of both. With some, it's just like they only have visual means in their DNA. They understand what balance is, what contrast is, "this is something I can do"; it's aesthetically pleasing when they make things. While others must have more explanations as to "why should I place things in the golden ratio", "why should I put a poster together the way it should", "how should I manage to get the attention of the viewer?" They must have a more knowledge-based explanation. But I definitely think you can learn it [creativity]. I know you can learn it, … but some people just have it. They are lucky.*

Some teachers described creativity as involving personal traits such as daring to act and being independent. Furthermore, resilience was described as important: *"[The students] may come up with bad ideas, but that is part of creativity… they should try and see how it goes".*

Most of the teachers stated that technological tools of the makerspace were important for students' creativity:

> *[A makerspace is] a place where students can come and work exploratorily and use their creativity. You have tools that make it easier to work with problem solving and the new learning goals … that the new teaching plan demands. [A makerspace] is a place to work on collaboration, exploration, and creativity in a different way.*

Two teachers stated that, at the beginning, they used non-creative projects to teach their students how to use the various machines. This, then, allowed later use of machines to enable creativity when the students began to work on more open creative projects in the makerspace. Consequently, one teacher highlighted that creativity was emphasised more with older students.

When defining a *makerspace*, all of the teachers except one explicitly referred to it as a place in which students utilise their creativity by making things. One teacher emphasised the importance of making without mentioning creativity: *"[Makerspace] is a room with technical equipment where [students] can make things … first on the computer and then on a 3D printer, for instance".* Other concepts were mentioned, such as a makerspace being a place for exploring, building, and collaboration. All of the teachers considered makerspaces to be connected with technology, such as 3D printers, smart cutters, Legos, and laser cutters. However, one of the teachers remarked that makerspaces did not necessarily have to involve technology:

> *[A makerspace] doesn't have to have anything to do with technology. Sometimes, it has something to do with technology because we are working with programming. But if you could use arts and crafts to express yourself, then I think you could have the same thing there. It's about expressing opinions or knowledge through a product, after all; it applies to both arts and crafts and the creative makerspace.*

The most important aspect, therefore, is to create an environment in which creativity and innovation could occur. A makerspace was further described as a place in which students can experience mastery in ways that differ from the traditional classroom: *"[In the makerspace], there is perhaps a slightly lower threshold for getting started with the creation process. You have digital aids so that you can implement your creativity in different ways. … It is a good place to explore and be curious".*

The use of makerspaces to foster creativity

The teachers used different approaches to teaching and supporting creativity in the makerspaces. Some worked with ready-made kits, such as Lego robot and micro-bit kits, while others emphasised open-ended creative processes. The teachers considered the use of ready-made kits to be both creative and contingent on problem solving. According to one teacher, some students were not accustomed to building things by themselves without the use of pre-defined projects; therefore, they found doing so challenging. However, according to other teachers, one of the goals of the makerspace activities was to teach students to work with open-ended creative processes. For instance, one teacher interpreted this to mean teaching students to be open to new ideas, take risks, persevere, be independent, be comfortable with making mistakes, and tolerate uncertainty in the creative process. Another teacher said, "*The most important reason for me [to utilise makerspaces] is that the students get a chance to explore within a context that they know, to some extent, from before and are not afraid to work with*".

Some of the teachers said they often began by teaching the students a variety of techniques before unleashing them to work creatively. However, most teachers were aware of not spending too much time on teaching and technologies, such as programming, before students could begin working with their own creative three-dimensional products. One of the teachers

chose not to provide students with information at the outset; rather, the instruction took place during the process of students working on their projects. He stated that it was preferable to provide information after the students had begun, because then they could connect the new knowledge directly to their products and processes.

A few respondents mentioned that the relevance of the projects was important to enhance student creativity. The digital tools used in makerspaces were considered to be pertinent for students' learning and their future working lives. In addition to relevance, the teachers also mentioned increased motivation. Sometimes students who were not motivated to work in other classes exhibited greater enthusiasm when working in a makerspace. One teacher stated the following:

> *I planned to work on the weather station project for three to four weeks last year… but I extended the period to eight weeks. I made that choice because the students were highly motivated to make a good product. I had one student who had problems with theory, i.e., reading, writing, math, and natural science. But after his first day in the makerspace, he still thought it was difficult, but now he is smiling in these classes. … Finally, he could show what he was capable of.*

That same teacher also reported that the student's motivation to engage in theoretical subjects had increased after their working session in the makerspace. Other teachers reported that some students were inspired to work in the makerspaces, while others were not. However, most of the teachers stated that students did exhibit greater motivation overall in the makerspace compared to most other curriculum-related activities. However, one teacher who also taught arts and crafts stated that the students did not exhibit higher motivation levels in makerspaces than they did in arts and crafts classrooms.

According to two teachers, constraints are also important for students' creativity. Without constraints, the students felt it was difficult to begin a project or produce ideas. As one teacher observed, "*The criteria are the same for all students, but what they end up with is largely different. For me, that is the difference between the makerspace and other subjects*". Another teacher who emphasised open creative processes reported that students worked only at a model level, and the model became the final product.

The teacher's approach in makerspaces

The research identified the significance of the makerspace teacher occupying multiple roles to support students' creativity. The teachers identified their role in planning the activities, preparing the classroom, and taking care of the technology. Furthermore, for creativity to thrive, all of the teachers said they were aware of their role as facilitators and observers. The teachers also underlined the importance of being able to shift into a conventional instructor role when students needed basic training in the use of technology and, moreover, when they needed to enhance the students' collaboration to support knowledge transmission between the teacher and the students.

Two teachers highlighted the fact that acting as a facilitator included asking questions rather than giving answers. One of them said, "*I give them time, and they can come to me if they need help or questions, and I can also ask questions that make them think about their own work. Or I can point them in directions that might make sense".*

The teachers said they were also aware of not executing the students' tasks for them and guiding them further in the creative process by discussing and sometimes limiting their options. "*[Sometimes] I'm there to limit them. If I see that they are thinking they are going to build something that is completely impossible, then I help them to limit their options so they don't feel that their idea is bad but that they get a small variation or almost what they thought".* Furthermore, the teachers focused on allowing students to reflect on various challenges, with these reflections occurring individually or within groups.

One of the teachers mentioned that it could be somewhat chaotic in the classroom when students worked independently or when he changed his role to that of facilitator: "*A challenge there is that it can get a bit chaotic, especially at the start when there are many people who don't know where to start".* Working in this way could also be tiring, but the teachers said the students became more independent over time.

Discussing the findings

Defining creativity and makerspace

All of the teachers similarly defined the term *makerspace* as a place where students utilise their creativity and make things. A makerspace was further described as a place in which students can experience mastery in a different way than in a theoretical study in a typical classroom. The teachers offered many useful conceptions of creativity and emphasised creativity as being something new and different that could be learned. However, although the teachers' conceptions of creativity were simple, they differed. For example, some teachers used the terms *creativity* and *innovation* synonymously, some emphasised technological knowledge in a makerspace as a base for creativity, and others talked about the importance of combining knowledge from different school subjects. This could indicate that these teachers had different understandings of creativity, which could affect their teaching approaches and, consequently, students' creative development (Davies et al., 2013). These results are consistent with Olafsson (2020) findings that teachers' understandings of creativity are different in many ways and, consequently, they use different teaching methods to train students. Furthermore, teachers may be capable of creativity, but their knowledge level and work environments may discourage it (Bereczki & Kárpáti, 2018). Using conceptual models such as Amabile's (2013) componential theory, therefore, would help teachers conceptualise and support student creativity. For example, of Amabile's four components, the teachers mentioned *domain-relevant skills* and *creativity-relevant skills* more often than *task motivation* and the *social environment.* Nonetheless, according to Amabile, all of the components should be emphasised to support creativity (Amabile, 2013).

The teachers said they believe that the ability to be a creative maker is developed through the students' work in the makerspace. However, the teachers' understandings of creativity may have affected their design of the makerspaces and, as a result, their teaching. Several researchers have recognised makerspaces as inclusive places that support hands-on learning through the use of highly technical tools and low-structure materials (Hakkarainen & Seitamaa-Hakkarainen, 2023; Loertscher et al., 2013). These places can foster creativity, interpersonal communication, teamwork, problem solving, critical thinking, and professional skills in groups of makers (Peppler et al., 2016). Therefore, the makerspace design should also set the stage for constructive teamwork and a positive social environment. However, the teachers interviewed placed little emphasis on the social environment despite the fact that research has found

student interaction to be critical for enhancing creativity in makerspace settings (Giannakos et al., 2017; Bower et al., 2020). Furthermore, a positive makerspace culture also motivates students to innovate and enhances their self-perception and creativity (Carbonell et al., 2019). This does not mean that the teachers who were interviewed do not have good practices to support students' creativity, but there is room for improvement regarding their conceptual understanding. A better understanding of creativity could improve the design of makerspaces and related teaching practices.

Makerspaces to foster creativity

Some of the teachers in this research based their work on ready-made kits, while others focused more on open-ended creative processes. Maker-centred learning is based on social constructivism and is aimed at fostering makers' capacities for observing closely, exploring complexity, finding new opportunities, and creating future conditions (Clapp et.al., 2016). If the teaching is based merely on ready-made kits, the activities are related mostly to learning new technology and problem solving in the context of finding pre-defined solutions. Furthermore, the teaching methods often become more instructional. The processes of problem solving and idea generation lie at the core of both invention and design (Van de Ven et.al., 2000). However, a creative process is much more than problem solving and must progress beyond ready-made kits with pre-defined solutions. Furthermore, preparing students for participation in the 21st century requires open-ended creative processes with many possible solutions. Many academics, according to Robinson and Aronica (2015), consider that creativity has the power to change and reimagine education. They have observed that the traditional methods of "factory model classrooms" and assessment-driven learning have prevented young students from being creative and, instead, have focused on high-stakes tests. The use of digital technology in makerspaces can scaffold creative learning and plays a vital part in preparing students for the future (Van Lar et al., 2017; Glăveanu et al., 2019). Furthermore, it helps students create new knowledge by participating in inventive practices and "making" (Halverson & Sheridan, 2014). A few of the interview respondents highlighted the importance of fostering student creativity using digital technology, and working with manual and digital technologies was believed to increase students' motivation levels. Moreover, digital tools utilised in makerspaces were considered helpful for students' learning and their future working lives. However, supporting knowledge creation and creativity requires teachers go beyond the use of ready-made kits and enable students to participate in open-ended creative processes.

One of the goals of makerspaces, according to some of the teachers, is to educate children in how to participate in flexible creative processes. These teachers placed less focus on ready-made kits and more on open-ended design tasks or problem-solving assignments. For instance, these open-ended creative processes aimed to teach students to be flexible, take risks, persist, be independent, feel free to make mistakes, and embrace uncertainty in the creative process. Some teachers said they believed the students' results were not very creative, that their pupils had only worked to make prototypes as the outcome of the activity. Nevertheless, teaching methods that focus on problem solving, design, and innovation can be used in makerspaces or in learning units that combine several subjects. Such teaching pushes students to find new ways to solve problems in which they learn through the process of creative knowledge construction (Sawyer, 2012). Furthermore, students' knowledge acquired through an open-ended design task will contribute to their development and enable creativity.

However, the teachers also noted that time became a concern. Too much time was spent on learning to use the technology, such as programming, before students could begin their own three-dimensional creations, leaving insufficient time for the completion of other tasks. Nevertheless, several teachers realised that students might learn by creating objects and solving problems; therefore, these processes enable future creativity. The Norwegian core curriculum emphasises creativity and innovation (Kunnskapsdepartementet, 2017), but the curricula for various school subjects (UDIR, 2019) do not seem to provide sufficient room for working with creative processes (Dale et al., 2011). According to Halverson and Sheridan (2014), students generate new knowledge via creative thinking and making. Therefore, spending more time in the makerspace could give students opportunities to utilise their knowledge and skills to learn different core subjects through engagement in creative processes.

The teacher's approach in makerspaces

Most of the teachers stated that their approach in a makerspace differed from their traditional classroom approach. They felt the necessity of assuming multiple roles and of being observers and facilitators rather than instructors. Clapp et al. (2016) stated that a teacher's main role in a maker-centred classroom is to be a facilitator. However, some of the teachers argued that they must also give students basic training in the use of technology and, thus, they alternate between the roles of instructor and facilitator. This is in line with the findings of Smarason et al. (2021), that the teacher's role varies from direct instruction and offering advice to modelling behaviours and coaching or mentoring. Nevertheless, Heinze (2008) argued that the conventional teacher-centred role in which knowledge is "transmitted" from the teacher to the learner should be augmented by alternative models, and the focus should be on supporting and guiding students in a classroom where the roles of teachers and students are similar, and the communication is open (Jonsdottir & MacDonald, 2011). Therefore, learning basic skills could be done through creative processes in which teachers facilitate rather than instruct (Sawyer, 2012).

Makerspace activities can be recognised as learner-centred, and any activities can be described as constructivist and socio-cultural (Blikstein, 2013; Bonk & Cunningham, 1998). Teachers in a makerspace would benefit from creating circumstances that scaffold the students' creativity and provide a source of information that facilitates their activities (Vygotsky, 1978). In this research, the teachers envisioned their role as someone who asks questions rather than provides answers, who does not carry out the assignments given to the students, and who guides the pupils further into the creative process through discussion. These teachers' approach, therefore, supported the students' knowledge construction. Furthermore, two of the teachers said they were aware of the role of constraints in fostering students' development and creative thinking, adding that they thought it was difficult to begin a project or produce ideas when there were no restrictions. Research on creative ideation (Medeiros et al., 2014; Rietzschel et al., 2014), product development, design innovation, and engineering design have all documented the facilitative effect of constraints for enhancing student creativity.

One teacher stated that disorder was a possibility in the classroom when students worked independently and when the teachers switched back and forth from being instructors to facilitators. The students, moreover, sometimes became tired because they were not used to working independently. It is likely that the novelty of being inside a makerspace in a different teaching and learning context meant that the students needed time to adapt to this new

educational context with which they were unfamiliar and to establish their new study behaviours. Transforming education to stimulate students to be creative (Robinson and Aronica, 2015) will require investments of time from both students and educators, and makerspaces can be an important part of that transition. Furthermore, student-led collaborative environments should be the driving force in a maker-centred educational setting (Korhonen et al. 2022).

Conclusion

The teachers' understandings of the term *makerspace* as a place where students use their creativity to make things were similar. However, their understandings of creativity differed, and these variations could affect their concepts and their uses of makerspaces (Bereczki & Kárpáti, 2018; Olafsson, 2022). Some teachers focused on ready-made kits to encourage problem solving and used conventional teaching methods to establish technical knowledge and skills rather than fostering open-ended creative processes. Consequently, students worked less with their own ideas. Assessment-driven learning and old-fashioned art education appear to be the driving forces of education and may prevent young students from developing their imaginations (Robinson & Aronica, 2015). According to some of the interviewed teachers, their students had to spend too much time learning how to use new technology, which prevented them from gaining new knowledge by creating objects and solving problems (Halverson & Sheridan, 2014).

Nonetheless, according to some of the teachers, the use of digital technology enabled and stimulated the students' creativity and learning (Cachia & Ferrari, 2010). Regarding their work with innovations, the teachers also saw this use of technology as a means of helping students build 21st-century capabilities (Van Lar et al., 2017; Glăveanu et al., 2019). However, none of them mentioned the importance of incorporated ideas of Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) into the makerspace pedagogy to assist students in acquiring values, attitudes, and abilities that will benefit humanity not only in the twenty-first century but also in the future (Cleminson, 2021).

Some teachers also noticed that the students' motivation levels increased during their time in the makerspaces, and they attributed this enhanced motivation to teamwork, design work, and the use of both manual and digital tools (Bower et al., 2020; Giannakos and Jacherri, 2018). The teachers offered many useful ideas about creativity. However, they would benefit from using conceptual models such as Amabile's (2013) componential model, which would allow them to consider additional aspects of creativity when organising their classroom and planning their lessons.

Most of the teachers observed that their work supporting creativity in a makerspace differed from that in conventional classrooms. Rather than being traditional teachers, they believed they needed to play a variety of roles, such as observers and facilitators (Clapp et al., 2016). Additionally, they felt the need to alternate between being an instructor and a facilitator according to the requirements of each individual student (Smarason et al., 2021). In addition, they said teachers must provide information that supports the students' activities and allows the makerspace to enable their creativity (Vygotsky, 1978). The results of this study also indicate that teachers struggle to strike a balance between teaching students to use the makerspace equipment and supporting their creativity when doing so. Integrating makerspace activities in a student learning environment from a young age would give students the time

necessary to learn how to use the makerspace's digital and non-digital equipment and, thus, enhance their later ability to work with open-ended creative processes.

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Design and Technology Education: An International Journal

29.1

Formation of Industrial Design Culture from Educational to Professional Life

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Abstract

Although the professional culture of designers has been emphasized as a peripheral issue in various fields of study in design, such as design culture and design management, it has rarely been the central topic of research. However, studies from other professional fields have demonstrated the significance of studying professional culture, especially its formation in higher educational contexts, as it has direct implications on professional status and career prospects of these professions' members. This paper aims to redress this gap by exploring how the professional culture acquired in industrial design education shapes industrial designers' work experiences in manufacturing companies? It focuses on the context of Turkey and empirically draws on interviews with industrial designers who have work experience in large-scale manufacturing companies. Interviews reveal insights into industrial designers' perceptions of the profession, experiences in undergraduate education, adaptations to professional life, and professional experiences in manufacturing companies where they collaborate with other professions, where cultural disconnect becomes visible. The qualitative data analysis highlighted the significance of being a community and having flexibility in space and time in industrial design's professional culture in the examined context. The findings underline collaboration and teaching of soft skills such as communication and teamwork as implications for industrial design education.

Keywords

Industrial Design Education, Design Culture, Professional Culture, Designer-Engineer Relations, Collaboration in Design, Manufacturing Companies

Introduction

Industrial design is a relatively young profession compared to architecture and engineering. Its scope continuously changes according to innovation and technology developments (Tovey, 1997). Over the years, the industrial design profession has been the subject of many studies, and its context has been defined many times according to its position during the studies (Tovey, 1997; Micheli et al., 2012). According to Er et al. (2003), after World War II, when industrial design first spread globally, its context was limited to industrialization and modernity. In the 1950s and 1960s, mass production and consumer goods were added to industrial design. During the 1970s and 1980s, technological developments and the emergence of human-machine interface (HMI) (Kang & Seong, 2001) and human-computer interaction (HCI) (Fallman, 2003) created new industrial design needs, and the required skills of industrial designers changed accordingly (Wang, 2022). Today, the World Design Organization (WDO) provides a shared and detailed description of the industrial design profession as designing and further developing consumer goods, systems, and services that enhance human lives and sustainability

(WDO, n.d.). In this definition, essential skills like problem-solving, creativity, and business relationships are also emphasized.

WDO's definition highlights six vital aspects of contemporary industrial design practice. These are (1) human-centred, (2) production-based, (3) creative and abstract, (4) have critical thinking," (5) "have a broad scope," and (6) "built with experiences." These aspects are interrelated (see Figure 1). Since the beginning of the profession, designers' human-centred outputs must be (mass) producible, commercial, and adaptable to the market. Thus, this situation entails creativity and originality. Designers also need to push the boundaries of disciplinary approaches and ideas, be open to incorporating other discipline's concepts into design (Dykes, 2009), and broaden their skills, and be able to work with other disciplines (Kimball, 2013). Lastly, since the profession is creativity-based and deals with human needs and experiences, it is firmly embedded in everyday life and experiences.

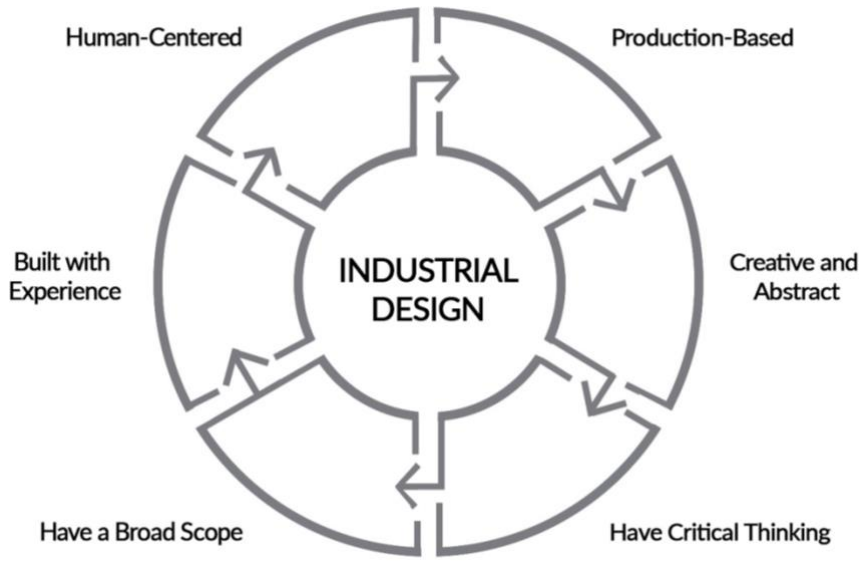

Figure 1. Aspects of the industrial design profession

Equipped with all these knowledge, skills, and competencies, industrial designers take part in design, new product development (NPD), and research and development (R&D) processes in manufacturing companies (Hertenstein et al., 2005). Designers, however, usually constitute a minority in manufacturing companies since manufacturing companies are often dominated by engineers (Kim & Lee, 2014; Marinas et al., 2021). As a result, the organizational culture of manufacturing companies tends to be aligned with the professional culture of engineering, and being a relatively smaller group compared to their non-designer colleagues makes designers less influential in decision-making processes (Molotch, 2003). This is especially a consequence when the top management is also dominated by engineers (Kaygan, 2014). Different and even conflicting professional cultures lead to different work experiences for engineers and designers in manufacturing companies. Beyond this, previous research has shown that to what extent one's professional culture is aligned with the organizational culture has implications for their status in the company, and thus, as companies become more accustomed to the design culture, the professional status of designers would improve in manufacturing companies (Kim & Lee, 2014).

Although the professional culture of designers has been emphasized as a peripheral issue in various fields of study in design, such as design culture (Julier, 2014) and design management (Hertenstein et al., 2005; Kaygan, 2014), it has rarely been the central topic of research. However, studies from other professional fields, such as architecture (Abdullah et al., 2011) and engineering (Dryburgh, 1999), have demonstrated the significance of studying professional culture, especially its formation in higher educational contexts, as it has direct implications on professional status and career prospects of these professions' members. This paper aims to redress this gap by exploring the following research question: *How does the professional culture acquired in industrial design education shape industrial designers' work experiences in manufacturing companies?*

The context of this research is Turkey, where the beginning of the 21st century has become a turning point for the industrial design profession due to the increased awareness of the value of design and innovation in the industry, the growing demand in small and medium-sized enterprises (SMEs), and initiation of national design policies as well as financial support programs by the state institutions (Hasdoğan, 2009). A recent study that traces the change in the employment of industrial designers between 1984 and 2018 in Turkey shows a sharp increase in the number of industrial designers, most of whom work in in-house positions, including manufacturing companies (Kaygan et al., 2020). In a close-up study, Hasdoğan (2011) examines the sectoral preferences of industrial designers in Turkey and finds that 28% of industrial designers in Turkey primarily work in furniture and interior design companies, and 24% choose to work in industries focusing on electrical household appliances. Both industries offer work environments where industrial designers work primarily with engineers (Kim & Lee, 2014). Thus, Turkey provides a rich context that explores the above-formulated question. The empirical basis of the study comes from semi-structured interviews with industrial designers who study industrial design and work in manufacturing companies in Turkey.

Industrial Design Education, Design Studio, and Its Culture

The conflicts between the Arts and Crafts Movement and the Industrial Revolution significantly shaped the industrial design profession and its education (Giard, 1990; Emilson, 2014). The movement's focus on the artistic and humanistic qualities of everyday objects, combined with the mass production emphasized by the Industrial Revolution, influenced the development of industrial design as a profession. These debates, revolving around quality versus quantity, heavily influenced the perception of industrial design. Furthermore, discussions on industrial design education merged traditional art, craft, and apprenticeship approaches (Friedman, 2000; Kolko, 2005; Başar & Ülkebaş, 2011) with emerging manufacturing techniques, knowledge, and theories in academic settings (Giard, 1990). Mainly rooted in the Bauhaus movement of the early 20th century, industrial design education emphasizes the synthesis of art, craft, and technology to create functional and aesthetically pleasing products (Papanek, 1972). This holistic approach to design education laid the groundwork for integrating design thinking, human factors, and engineering principles into the curriculum. The Bauhaus Design School within the German education system provided formal industrial design education through the university system, blending art with research to establish contemporary industrial design education (Betts, 2007; Noel, 2020). Today, many globally acclaimed industrial design educational institutions have emerged, influenced significantly by the teachings and philosophies of the Bauhaus school.

Industrial design education strongly emphasizes interdisciplinary collaboration, learning by doing (Dewey, 1980), and problem-solving (WDO, n.d.). Therefore, the design studio system within industrial design education emerged as a response to the need for hands-on, experiential learning that mirrors real-world design practice through collaborative projects (Cross, 2006). Rooted in the Bauhaus tradition, which emphasizes practical, project-based learning, the design studio system places students in a collaborative environment where they engage in iterative design processes, critique sessions, and project-based assignments (Emilson, 2014). Notably, the Ulm School of Design (HfG Ulm) in Germany, founded in 1953, played a significant role in formalizing the design studio system within industrial design education. Under the guidance of influential designers such as Max Bill and Hans Gugelot, HfG Ulm pioneered a pedagogical approach that prioritized studio-based learning, interdisciplinary collaboration, and the synthesis of theory and practice (Noel, 2020). The studio culture in design education fosters teamwork, creativity, and iterative design processes, mirroring the collaborative nature of professional design practice.

Industrial design education is deeply entrenched in cultural values that shape the profession's ethos (Green & Bonollo, 2003), notably through fostering interdisciplinary collaboration and problem-solving within design studios (Yenilmez & Bağlı, 2020). This emphasis on collaboration reflects the recognition of the multifaceted nature of contemporary design challenges, necessitating the integration of expertise from various disciplines. Interdisciplinary collaboration cultivates a culture of teamwork, innovation, and holistic problem-solving within the industrial design profession and education (Kolko, 2005). Through collaborative projects and interactions with peers from diverse backgrounds, students learn to appreciate different perspectives, leverage complementary skills, and co-create solutions that address complex societal needs (Emmitt & Ruikar, 2013). This studio-based approach instils technical proficiency and fosters cultural values such as curiosity, experimentation, and adaptability. By presenting students with a dynamic and supportive learning environment, design studios play a pivotal role in shaping the cultural values of industrial design education, preparing graduates to thrive in the ever-evolving landscape of design practice.

Therefore, industrial design education serves as the crucible where the professional culture of industrial designers is formed and nurtured. By imparting interdisciplinary knowledge, fostering collaboration, and instilling cultural values such as user-centricity and experimentation, design education shapes the ethos and identity of designers. By adapting to industry dynamics and emerging trends, design education ensures graduates have the skills and competencies to advance in a rapidly evolving design landscape. As the field of industrial design continues to evolve, design education will play a central role in shaping the profession's future and empowering designers to drive innovation, sustainability, and positive social change.

Cultural Forms of Professions and Organizations

Culture is a term used in various social sciences, such as sociology, anthropology, and education. While different fields have their perspectives and understanding of culture, they commonly refer to the definition of culture by Hofstede et al. (1990), which states culture's seven distinctive features, including (1) a holistic view, (2) close relations with traditions and customs, (3) rigid and relatively challenging to change nature, (4) human-scale, (5) subjective nature, (6) hidden meanings, and (7) personalized forms that define itself. In a more recent

definition, Alvesson and Svenningsson (2016) suggest that culture can be defined as guiding knowledge and practices, meanings, values, and norms shared among group members.

Shaped by its disciplinary knowledge and specialized skills, an authority that stems from expertise, formalized curricula, learning environments, and code of ethics, every profession develops its culture (Slusser et al., 2018). Through the shared priorities, values, norms, objectives, and expectations, a profession provides its members with recognized standpoints and "regularized ways of assigning meaning and responding to things" (Bloor & Dawson, 1994; Gubrium & Holstein, 2009, p.162). Interpersonal relations and the shared educational background of the same group of professionals lead to the emergence of their professional culture (Dryburgh, 1999; Johnson et al., 2009). Members of a profession are well-defined because they go through the same formal higher education and generally have common interests, limitations, and challenges in their professional lives.

Organizational culture also comprises shared interests, values, meanings, norms, definitions, and knowledge that direct certain groups of people's actions and behaviours (Schein, 2010; Costanza et al., 2016). While organizational culture could be considered how things are done or managed within a well-defined organization (Sun, 2008), professional culture is located beneath organizational culture as a subculture (Hofstede, 1998). Specifically, organizational culture contains various professional cultures. Different professional cultures within an organization bring along diverse cultural aspects. These aspects shape the organization's culture and, in turn, shape the experiences of the members of these different professions. Another difference between professional and organizational cultures appears in the learning process. While people first encounter and adapt to their professional culture in undergraduate education (Johnson et al., 2009), they learn and become a part of their organizational culture starting from working at the organization (Palos & Veres Stancovici, 2016). While the former is unique to the profession and includes a one-off learning process, the following changes from one organization to another. In every organization, people go through a new learning process.

The research examines the aspects of industrial designers' professional culture. Beyer's 1984 dated "List of Definitions of Frequently Studied Cultural Forms" (as quoted in Beyer & Trice, 1987, p.655) states the primary cultural forms in organizations as follows: *rite, ritual, myth, saga, legend, story, folklore, symbol, language, gesture, physical setting, and artifact.* This list provides the analytical framework for exploring these aspects. While reviewing recent studies, it was identified that there had been a tendency to rethink and combine these cultural forms under more general categories in the last two decades. For instance, while some research studies discuss rites and rituals within the organizational culture (Sueldo & Streimikiene, 2016), some research studies discuss physical setting and artefacts together with space (Kallio et al., 2015). Gabriel (2004) also links myth, legend, and story while discussing organizations. Considering the extant literature, we organized the list into five main categories; "(1) stories, (2) language, (3) social relations, (4) physical space and artifacts, and (5) dress and appearance norms", accordingly (see Figure 2).

Figure 2. Cultural forms in professions and organizations

Stories are based on myths, and actual events combine truth and fiction (Beyer & Trice, 1987). A story is an acclaimed form of culture, demonstrating many insights into the shared norms, meanings, and values in professions and organizations (Gabriel, 2000). As Brown and Duguid (2001) highlighted, stories are vital in knowledge sharing, organizational learning, and sense-making within professional communities. In organizations, stories are performed in three paths. First, stories pass on culture among generations (Czarniawska, 2004); second, they introduce and depict a distinct culture to the outside world (Abdullah et al., 2011). Third, organizations' cultural change can be revealed via stories (Hansen et al., 1994).

Language constitutes another form of expressing culture in organizations, where members of a profession promote knowledge creation and sharing (Lauring & Selmer, 2011). Language provides information on, first, the shared vocabulary and jargon within a professional group. For instance, while people from various disciplines, such as accounting, marketing, and engineering, adopt the term *oral presentation*, designers from creative industries adopt the terms *juries* or *critiques* to refer to oral presentations (Dannels, 2005). In that context, while critiques refer to the students' weekly oral presentations regarding their design project, the term juries refers to the students' final oral presentations at the semester's end. Second, language reveals how a term may have multiple meanings to different groups of people. In that context, design and engineering students understand production concepts differently, such as models, mock-ups, and prototypes. This difference comes from the fact that, in engineering education, the aim of using physical models is to test whether the design works or not, while in design education, physical models are not always the end products; instead, they are features of the creative process (Kaygan & Demir, 2017).

Culture also becomes visible in social relations within professions and organizations. While looking at the context of design studios, Dannels (2005) states that because design studios are the environments where students spend most of their time talking, collaborating, socializing, eating, or sleeping when they want to, studios are considered flexible environments. These informal relations and inner dynamics of design studios are integral elements where culture becomes visible.

Physical space and artifacts create another cultural form in organizations together. According to Beyer and Trice (1987), physical settings surrounding people and artifacts, human-made objects, offer grounds for culturally rich activities. An organization's physical setting includes many influential artifacts in establishing meaning. Design studios, where designers study/work and socialize, appear as a physical setting that has been examined (Abdullah et al., 2011). In design studios, design work's abstract and creative nature has encouraged designers to socialize and utilize collaborative design methods, such as co-creation and idea generation, with fellow designers and academics. Abdullah et al.'s (2011) research suggests that architecture

students are determined to study in the design studios while focusing on the design development and production stages because of the design studio's large space and open plan layout, which helps quick and effective information transfer and sustains collaboration. In these spaces, design sketches (Vyas & Nijholt, 2012) and architectural models are considered artifacts that define the space and give a sense of belonging to the members of the space.

Dress and appearance norms act as the final cultural form in the context. They are the most visible aspect of professional culture and are closely related to organizational hierarchy and power relations (Rafaeli & Pratt, 1993). While uniforms give a sense of belonging to their users, their primary purpose is to show status, rank, and qualifications with the badges' help. Professional groups may have different and contrasting dress and appearance norms in the same organization. Kaygan's (2013) research shows that while engineers and marketing people are expected to wear formal clothes in manufacturing companies, designers have more flexibility in wearing casual clothes due to their association with creativity. However, their casual style depicts designers as less suitable for managerial positions with these companies, which directly points to a lower status. Thus, dress and appearance norms strongly affect people's competence and suitability for specific roles and positions.

The description of these five ways through which culture is constructed, sustained, and becomes visible provides the analytical framework for understanding how industrial designers learn and internalize the professional culture of industrial design in their education. Additionally, it presents how this culture affects their work experiences in manufacturing companies, where designers constitute a smaller percentage of employers compared to engineers.

Research Design

As this study is concerned with the relationship between the professional culture of industrial designers that they internalized through undergraduate education and their professional experiences in manufacturing organizations, we adopted a methodological approach that fosters understanding their individual experiences. Since individuals' feelings and interpretations of past experiences are neither observable nor reproducible (Merriam & Tisdell, 2015), interviewing was selected as the method for data collection that enables people to share their experiences in their own words and by making sense of them (Matthews & Ross, 2010).

In the sampling, two selection criteria were applied. First, participants were expected to be industrial designers who graduated from universities between two and six years ago so that participants would have some work experiences to reflect on. However, their memories regarding undergraduate education would also be relatively fresh. Secondly, they were expected to have at least a year of professional experience in large-scale manufacturing companies since they offer multidisciplinary work settings where industrial designers work with colleagues from different professional cultures.

In-depth, semi-structured interviews were conducted with 15 industrial designers consisting of eight women and seven men (see Table 1). They are industrial design graduates from six universities in Turkey and have work experience in six cities.

Table 1. Overview of the interview participants

GENDER	INDUSTRY	WORK EXPERIENCE
Woman	Consumer Electronics	1,5 years
Woman	Defense	1 year
Woman	Automotive	3,5 years
Man	Defense	2,5 years
Man	Automotive	4 years
Man	Urban Equipment	3 years
Man	Consumer Electronics	3 years
Woman	Automotive Equipment	4 years
Man	Building Materials	2 years
Woman	Furniture	1,5 years
Woman	Glassware	3,5 years
Man	Furniture	6,5 years
Man	Automotive Equipment	2 years
Woman	Yacht Design	1,5 years
Woman	Furniture	3 years

Interviews lasted 70 minutes on average. An interview guide containing 29 questions on the industrial design profession, its education, and professional life experiences was used (See Appendix A). The questions explore industrial designers' perceptions of their profession, their purposes in choosing industrial design, their early encounters with the profession in education, and their interactions with their colleagues. All interviews were audio-recorded with the informed consent of participants and fully transcribed. Transcriptions were analysed using the computer coding software ATLAS.ti analysis software.

To analyse interview data, we used template analysis, a qualitative data analysis method that uses templates for thematically organizing and analysing the data (King, 2012). The researcher creates a list of priori codes (initial template) corresponding to the themes that emerge at the end of the literature review. The initial template is revised as the researcher reads and interprets the transcripts. The template analysis method is frequently used in cases working on previously selected themes with existing sets in qualitative research (King, 2012). In this research, the five aspects of professional culture identified through the literature review, 1) stories, 2) language, 3) social relations, 4) physical space and artifacts, and 5) dress and appearance norms", were taken as the themes of the initial template. As the coding was carried out, inductive themes also emerged and expanded the template. These include 6) being a community, 7) flexible work nature, and 8) working long hours. Accordingly, the template was revised, and the findings were organized as presented in the following section.

In addition to identifying the themes in the coding, we also distinguished between three components of the research question: (1) industrial design profession, (2) industrial design education, and (3) industrial designers' work experiences. Such a distinction was essential since we aim to investigate the influence of undergraduate education on the professional experiences of industrial designers in their work lives. The codes under the industrial design profession theme are mainly related to the basic skills and knowledge of professional practice. Examples of codes under this theme include creativity, abstract, working types, motivations,

and ideals. The codes under this theme relate to how the participants define the profession and the main reasons behind their desire to orient toward this field. The codes under industrial design education mainly focused on the participants' experiences in their educational life. Within this theme's scope, the participants' knowledge, and experiences regarding the educational approaches in other schools were analysed. Some of the codes under this theme are design studios, learning from each other, multitasking, collaboration, and curriculum. In addition, the positive and negative points that the participants experienced in their education were included under this theme. The industrial designers' work experience theme contains codes related to the participants' past and current work experiences. This theme includes codes such as departments, workflow, teamwork, and collaboration with engineers and blue-collar workers. As in the education theme, the participants' positive and negative work-life experiences are also included under the work experience theme.

Findings

In accordance with the themes and codes, findings are presented under two main sections: (1) learning and adapting to the professional culture in industrial design education and (2) work experiences of industrial designers in manufacturing companies.

Learning and Adapting to the Professional Culture in Industrial Design Education

Interview data suggests that participants identified the prominent features of industrial designers' professional culture in three headings: being a part of a community, having flexibility in working time and space, and having the ability to work for long hours based on their encounter with the profession in undergraduate education. Participants stated that they spent most of their time in their design studios during their undergraduate education, where a sense of community was established. In the studios, where they spend time out of course hours, they study, socialize, and learn from each other. They indicated that, since in Turkey, design departments have smaller numbers of students than the departments of engineering or management, industrial design students know each other better and become closer, thus learning to act as members of a community. Industrial designers learn to be flexible while working in time and space, which results in working for long hours. Participants stated that industrial design students spend long hours in their design studios in their undergraduate education due to design practice's abstract and creative nature. Moreover, since they considered that design practice requires many iterations until satisfied with the outcome, they identified themselves as perfectionists who must work for long hours, day and night. The account below provides information about the subject.

> *"It [industrial design education] teaches us to think in detail and look at things from different angles. Indeed, you are thoroughly examining the consequences of things. It makes you a perfectionist; you must be a perfectionist. You need to look over a job, you do not need to be quick, and you need to search for something different."*

The long and continuous design process cycle puts industrial designers in constant questioning and self-criticizing. Design education's subjective, abstract, and creative nature is pivotal in creating perfectionist industrial designers. The interviews show a strong connection between perfectionism and industrial designers' work satisfaction. The statement below strengthens perfectionism in industrial design education while showing the link between perfectionism and work satisfaction.

> *"They [senior students] came and said goodbye to sleep. I was very determined; no, I will go to sleep. Then I realized that it was not like that. Because of the satisfaction… If I could already do something okay, our profession would not exist if there is such a thing as reaching the best. Then the best of everything will be designed, and everything will be done."*

The lack of absolute truths in the abstract design process creates a constant need for work that affects industrial design students' satisfaction levels. Because this statement acts as a working principle in the industrial designers' realities, it first appears in academic life. Then, it becomes a part of the profession and links perfectionism with work satisfaction.

Above, the five cultural forms of professions, including "stories, language, social relations, physical space and artefacts, and dress and appearance norms"), are defined. "Being a community, flexibility in time and space, and long working hours" provide examples of these five cultural forms. Most participants indicated that since industrial designers mainly studied within their community in education, they did not learn much about the different cultures of other disciplines. In their design studios, they spend days and nights among themselves. They do not just study or exchange ideas but also share stories, values, and assumptions, which led to the designers' community's formation. While all the participants commented on this topic, one stated that:

> *"An engineer friend in the studio said, Are you always here? We are going. I said, no, we have got a course to attend. Then he answered, Is it here, too? Yes, it is here because this is the studio. All our classes are in the studio. We were sleeping here, and we were eating all our food here. That is why the studio was like our home. We would not take many courses from other departments."*

The common language also substantially impacts the formation of their professional culture. Industrial designers stated that they have terms and sayings for their departments and projects. These terms are either formed due to professors' famous sayings, senior students, or misspelled words among themselves. When asked about the common language and jargon in undergraduate education, industrial designers provide many examples, such as the one below.

> *"We heard a lot of; This would fall; from our professors. It was about overturning the model we made or when the project was unsuccessful."*

Today, new sayings among students are also slowly forming their place in the common language. The statement below shows how students form their language within their community.

> *"Close fit is used only among students and as a connection detail that teachers never understand. We heard this in the senior classes' juries. It is the plastic detail that fits tightly together, but there is no such expression."*

Regarding physical space and artifacts, industrial designers emphasized the studio and its surroundings. Design studios have rules based on mutual respect instead of strict ground rules and have a social structure based on a multifunctional home concept that creates a fundamental part of industrial designers' professional culture. Industrial designers consider

their design studios as their homes. In that sense, studios' physical surroundings and elements strengthen professional culture visibility.

> *"Studios were open 24/7, and we could use them anytime. They were beautiful because of the high ceiling. Our stools were terrible, but we still loved them. Studying was enjoyable because our studios were the places that belonged to us at school. We had a connection, could go in and out, and could study comfortably."*

Studios, where designers study within their community, create flexibility and a sense of belonging among industrial designers. Additionally, industrial design education requires a lot of free space and many surfaces to work on. Design studios and their entire content fulfil these requirements and become essential parts of industrial design. The statement below emphasizes the importance of the idea of design studios as homes by stating:

> *"The design studio is critical because you start a project, you draw it in 2D/3D. Then, you are modelling and prototyping, which are not things that you can do at home. You usually need large areas because there are many team projects."*

Lastly, dress and appearance norms were mentioned concerning flexibility, but only as little as the other cultural forms. Most statements cover the flexibility achieved by social relations, language, and physical settings. However, participants stated that students prefer to be dressed flexibly within their communities due to the intense and long study periods. The following account states an industrial designer's point of view towards dressing in industrial design education.

> *"I remember juries… I went out with my tracksuit covered with paint because I had no time to dress appropriately. I do not remember ever hearing such negative comments [from academics]."*

This flexibility is in their undergraduate education, and in time, people from other departments started to get used to their flexibility in their working environment and dress and appearance norms. Besides people from other departments, academics in their department also do not have any comments about dress and appearance norms. Cultural forms become visible in the undergraduate education of industrial design. They create essential elements of industrial designers' professional culture in their educational life; "being a community, having flexibility in time and space, and working long hours". These aspects are fundamentally interconnected and provide crucial information for the emergence of the professional culture of industrial design in educational life.

Work Experiences of Industrial Designers in Manufacturing Companies

The research explored industrial designers' professional lives to understand how their work experiences in manufacturing companies are influenced by the relationship between their professional and organizational cultures. Manufacturing companies are usually where scientists and engineers have dominant and pivotal roles in advancements (Marinas et al., 2021). Therefore, manufacturing companies' organizational culture tends to contain many aspects of engineering culture. Due to the differences between professional design and engineering cultures, industrial designers need to fit comfortably into the organizations' culture.

Three out of five cultural forms, social relations, language, physical space, and artifacts regarding professional culture on work experiences came forth. Regarding social relations, participants expressed that being a community and having a comfortable and flexible working environment have pivotal roles in their work experiences. Unlike their educational life, where designers work among themselves, participants emphasized their interaction with engineers, who have different mind-sets with different values and priorities. Most participants agree that collaborating with engineers involves different approaches and disagreements. The following account provides an example on the topic by stating:

> *"When we work with engineers, minor differences occur. For a designer, the function is vital; it cannot be separated from the form. For example, while an engineer is working, support must be given to the product for self-standing. If you do not constrain or guide them, engineers cannot do things. Alternatively, if you do not give alternative solutions, the engineer calculates and thinks this is the best solution; let us do this. Why do we choose other options? Then, the engineer offers you a single solution."*

The statement demonstrates that industrial designers prefer to be around and are pleased to work among their peers within their community as they have lived through similar experiences. Additionally, differences in the work dynamics between industrial designers and engineers are the points in which disagreements arise. Industrial designers feel obliged to adopt the professional culture of engineers to fit in the organizational culture or choose to work in designer-dominated work settings such as design firms.

> *"Back there [in the software company], the dominant culture was software engineering. They did not know my profession. Some people said that they had heard of an industrial designer for the first time. I knew I was not involved in that culture and could never be involved."*

Communication appeared as the second issue through which the professional culture becomes visible in work settings. Participants stated that their common language and jargon in education and work life show crucial differences. In their undergraduate education, industrial designers are accustomed to a flexible working environment where they work within their community. That leads to more casual communication and socialization between industrial designers. Because they share similar experiences and perspectives that form a common culture, they seek this feature from their educational experiences in their work lives. Almost all the participants compared their work environment with design studios and stated that there is a very unfamiliar formal working environment. The following account proves that by stating:

> *“The work environment is very formal. I find people more boring at work. It is not like school. So, because it [work environment] is not designer-led, you are not in the same mind-set as others in work.”*

Industrial designers feel strained in a formal work setting where they cannot work with their colleagues in their community. Just like socialization, they find communicating with their colleagues more casual. Since they are accustomed to sharing similar experiences and perspectives that form a common culture in undergraduate education, they seek this feature in their work lives. However, in professional life, their common language changes when working with people from other professions. Companies’ business sectors also differentiate everyday

language by providing special terms and sayings. The account below provides an example on the subject by stating:

> *"For example, while working in [design-oriented company], there was no such thing as, will they understand if I will use that term? Of course, they will understand. We all use the same common language. However, as I said in [manufacturing company], people do not even have to know the point of my job."*

Industrial designers who have professional experience in engineering-oriented manufacturing companies and design-oriented companies state that the different address forms and jargon styles are different. Dominant engineering culture in the manufacturing industry makes changes in communication and common language. In that sense, the account above shows that specialized terminologies, according to their work industries, make changes in their professional jargon.

Physical space and artifacts were used as a fundamental cultural form while defining their work experiences and their relations with professional culture. Community and flexibility aspects of the professional culture have pivotal roles in physical space and artefacts. Industrial designers consider their design studios as their homes in undergraduate education. They compare their design studios and their office spaces in the companies they work for in their work life. In manufacturing companies, industrial designers primarily work in open office layouts. Industrial designers who have experience working both in an open-office layout with people from other professions and in an office entire of designers prefer working within their community because of the traditional professional culture and flexible unwritten rules they share, as the account below shows by stating:

> *"My work environment in [design-oriented company] was more comfortable because the office belonged entirely to us [industrial designers]. In the [manufacturing company], there were cubicles… The cubicle is a rather unfortunate design and a structure that negatively affects the employee's performance."*

According to the interviews, most industrial designers suffer from small workstations in manufacturing companies' offices. Companies are not aware of the requirements of their profession. Since industrial designers work in open offices with other professions, their workstations are primarily suitable for general purposes. While affecting industrial designers' motivation, all these problems also create contrasts between the professional culture they gained in their educational life and their professional experiences. A participant's statement below gives the overall idea of participants on the given subject.

> *"We have a table that looks like it is from the accounting department; it is more like an officer's table. We can make drawings on it at most. It is an environment that should be kept clean and quieter.*

The flexibility aspect of the professional culture also becomes visible when industrial designers' perception of dress and appearance norms is explored. Most participants agreed that these norms stay the same between academic and professional life. One participant compares their dress and appearance norms between academic and professional life as follows:

> *"Usually, you must wear a shirt and a tie [in a manufacturing company], but we do not. There is not much criticism. You need to take care of your beard. Other than that, I have not heard anything regarding dress codes. I wear almost the same things that I wore at university."*

In professional settings, dress and appearance norms are the features that change the least among all the cultural forms. Manufacturing companies that are familiar with the design process and contain design departments that lead to industrial designers' flexible dress codes. While there are formal rules concerning appearance, industrial designers mostly dress almost identically to their academic years. In the interviews, industrial designers revealed their process of becoming industrial designers. With many examples, they demonstrated that their professional culture's foundations were laid from the beginning of their undergraduate education. According to the interviews, three main features create professional culture: 1) being a community, 2) flexibility in space and time, and 3) working for long hours (see Figure 3).

Figure 3. Aspects of professional culture in industrial design education

All these aspects interconnect regularly and link with five cultural forms in professions and organizations: stories, language, social relations, physical space and artifacts, and dress and appearance norms (see Figure 4).

Figure 4. The relationship between cultural forms in educational life and professional life

Stories, language, and social relations are often mentioned in industrial designers' educational and professional lives. Their roles and importance started from the beginning of their education and continued in professional life. In terms of physical space and artifacts, the flexibility aspect of the profession becomes visible. However, its relationship with flexibility and long working hours is still substantial, with examples from design studios. Lastly, dress and appearance norms present insights into the flexibility feature of industrial designers' professional culture.

However, it is the least visible one where professional culture becomes visible among all five cultural forms.

Conclusion

The research, whose problem area, aim, and research questions are based on the literature review, mainly concentrated on the connection between the professional culture of industrial design formed in education and its equivalent within the professional culture in manufacturing companies. The formation of the industrial design professional culture investigated within the scope of the research questions is constructed through a community-based collaborative and flexible setting in design studios. Additionally, the industry collaborations within industrial design education provided students with information about their future profession's context, process, and practice. This information has shaped the professional perceptions of the students in their educational life in an industry-specific way and started to create specializations in their professional culture. Interdisciplinary teamwork and collaborations within the scope of the organizational structures of manufacturing companies and the job descriptions of designers have also diversified the professional culture acquired in education by providing an interdisciplinary approach.

The cultural forms in organizations investigated in the literature review were re-evaluated through the professional culture of industrial designers and their experiences in manufacturing companies. While they all present professional culture in different sorts, stories, and language, the five cultural forms from the literature introduce more subjective perspectives. However, social relations, physical space and artifacts, and dress and appearance norms provided more visible examples of professional culture in organizations. Within the research scope, one main finding is that education and the professional life of industrial designers are interconnected. This finding's effect illustrates two main conclusions, concentrating on the importance of being a community and the importance of having flexibility in space and time.

Importance of Being a Community

Being a community is essential to industrial designers' professional culture. This sense of community is built during their educational life, and they want to sustain it during their professional lives. In professional culture, fostering a strong sense of community is vital. The community nurtures creativity and collaboration, essential traits in the dynamic field of industrial design. Industrial design is a relatively contemporary profession with a lower student number than some other disciplines they work with, such as engineering. This situation creates a robust social bond among students and the emergence of a community. Students spend most of their time experiencing their abstract design education for long hours and learning together by socially interacting within design studios. Lack of a clear path to do their assignments leads them to adopt the trial-and-error system. That enhances social interaction and sustains a well-established community in industrial design education. This social interaction cultivates a strong sense of belonging and identity within the design community, instilling students with purpose and passion as they connect with past designers and feel inspired to contribute to the field's evolution.

In their work, industrial designers wish to work within their community as in their undergraduate education. However, in manufacturing companies, they primarily work collaboratively with more people from other disciplines. This interaction does not match their

initial sense of community and togetherness during their education. Their professional culture differs from other disciplines, such as engineering (Johnson et al., 2009) and the manufacturing companies' organizational culture. These cultural differences cause work adaptation issues for industrial designers. Some industrial designers adapt to this new culture through multidisciplinary collaboration and teamwork and further develop their professional culture. On the other hand, others choose to work in design-led companies or design offices with their colleagues. In conclusion, it was revealed that industrial designers are settled into working with peers in a setting like their educational lives. Acting as a community feature of their professional culture emerges in undergraduate education, and its essence further develops to be a prominent aspect of their professional lives.

As the research question explores, in the context of professional culture, the notion of community is crucial and takes on a multi-dimensional role within industrial design education. It serves as a platform for knowledge, meaning, and value creation and transfer, where ideas are shared, critiqued, and refined in design studios. It provides a support system for students, faculty, and professionals, fostering an environment where individuals feel empowered to take creative risks and push the boundaries of design innovation. Therefore, being a community goes beyond the design studios; it encompasses a network of students, educators, professional individuals, and industry partners where co-creation and collaborative projects thrive.

Importance of Having Flexibility in Time and Space

Industrial design represents an interdisciplinary field wherein designers engage with and collaborate alongside other disciplines like engineering. It is a dynamic profession requiring constant adaptation, as design solutions must harmonize with swiftly evolving technologies, user demands, and societal shifts. In such an environment, rigid frameworks and inflexible approaches can impede creativity. Flexibility in both time and space facilitates the natural flow of ideas, enabling designers to explore, experiment, and refine without limitations. This flexibility empowers individuals to surpass traditional classroom confines, embracing diverse learning contexts that nurture creativity and innovation.

Like being a community, having flexibility in the work environment is also a crucial feature of the industrial designers' professional culture. It is also established in their formal educational lives. As the findings show, industrial designers study for long hours together as a community, primarily within their design studios, which they consider home. Industrial designers socialize, eat, and sleep in design studios besides studying. This physical setting creates a sense of belonging. They need to be in the studios for specific assignments, which shapes their dress and appearance more comfortably. People from other departments started to see the flexible nature of industrial design education, and they became accustomed to this professional culture in undergraduate education. Flexibility in time and space clears obstacles of rigid rules and regulations of time and space; therefore, industrial design education offers a dynamic learning experience and enriches real-world practices.

The findings revealed that industrial designers look for flexibility in their work environment. Unfortunately, manufacturing companies might be unable to provide flexible work settings like design studios. This contrast in the physical setting also leads to a problem of professional adaptation in industrial designers. The level of flexibility changes according to the organizational culture of the companies. Companies that maintain a strong design culture

understand the significance of flexibility in the professional culture of industrial designers. These companies provide work environments that are flexible enough to accommodate the needs of designers. This situation also affects industrial designers' dress and appearance norms in their work-life compared to their education process. While industrial designers in the design departments might be able to dress more freely, departments like management, engineering, or accounting dress more formally.

Therefore, as this study seeks to answer, flexibility in time and space is a critical aspect that shapes the professional culture of the industrial design profession within work life. It fosters a culture of adaptability and resilience within the industrial design profession. Industrial designers who embrace flexibility are better equipped to thrive in this dynamic landscape, leveraging emerging opportunities and easily overcoming unforeseen challenges. Ultimately, flexibility in time and space nurtures a sense of autonomy and empowerment among designers, allowing them to chart their process and practice on their terms.

Implications for Industrial Design Education

This research has addressed the differences between the professional cultures of industrial designers and the organizational cultures of the manufacturing companies they work for. Based on the findings and conclusions of the research, cultural disconnection between industrial designers and manufacturing companies results in miscommunication and misunderstanding, work quality and efficiency issues, and career limitations for industrial designers. Such issues arising indirectly from cultural disconnection can be mitigated by emphasizing the development of soft skills that (1) promote interdisciplinary collaboration and teamwork and (2) emphasize communication skills in industrial design education.

Moreover, creating opportunities for industrial design students to collaborate with manufacturing companies during undergraduate education can more precisely prepare students for professional life. Through engagement in real-world projects alongside industry stakeholders, students acquire first-hand experience addressing the complexities of realizing designs and establishing connections with potential employers. Besides technical expertise, industrial design education should equip students with communication, negotiation, and teamwork skills. These abilities are crucial for nurturing productive collaboration between designers and engineers in manufacturing companies and adeptly navigating cultural disparities in professional environments (Kaygan, 2023).

Limitations and Further Research Directions

Since this research explores industrial designers and manufacturing companies in Turkey, the data focused on designers trained and working in Turkey. Although design education and industry in Turkey share similar trajectories with other developing economies, such as Latin American countries, where industrial design has gone through a similar development as Turkey, and Asian countries where government policies have provided support for the integration of industrial design to industry (Er, 1997), we acknowledge that culture is context dependent. We hope that further research on the professional culture of design that focuses on other national contexts, of both similar at different economic developments, provides us with comparable research outcomes.

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Appendix A

Interview questions

Questions about profession

- How would you describe an industrial designer?
- How would you separate industrial designers from other (creative or not) profession groups?
- Why did you want to be an industrial designer? What were your thoughts about this profession before you started university?
- Have you changed these thoughts since you started university (throughout your education life)? In what direction and how much? Are you pleased to be doing your job right now?

Questions about education

- What do you remember about your undergraduate years? (Positive or negative sides)
- From whom and how did you learn to be a designer in this process? How did the people around you define the designer?
- Were there any terms, phrases, or address forms you often encountered during your undergraduate years?
- What were the most influential stories you heard about your department or profession from students in upper classes or academics?
- Were there any general opinions about how the designer should look in your undergraduate years?
- What about the design studio during your undergraduate years (written / unwritten rules, spatial perception, usage style, rituals)?
- What about your communication with academics and assistants during your undergraduate years? Was there someone you influenced? Why and how?
- Is there anything you can tell that, unlike students from other departments or universities, we did this in the undergraduate years, or did we go there?
- Have you worked with people from other departments during the undergraduate years? If so, what characteristics did you see that were different from yours?
- What do you think about the professional culture that your university impresses on you?
- What do you think about the industrial design departments in other universities? Do you see yourself differently?

Questions about work-life

- What did you do after graduation? (Where did you look for a job? Did you look for a career?)
- What can you say about the organizational culture of organizations or companies you have worked in so far?
- Do you work more individually, or does group work play a more pivotal role in your working environment?
    - Who is on the team? From which universities/departments are these people?
    - Are there any differences between your perspectives and those of others? If so, how? How do they affect your work experience?
- I have just asked you about the professional culture you learned in your undergraduate education. For example, how the designer looks, how he/she speaks, how he/she socializes, and so on. If you consider these in the context of extensive culture of the organization/company that you are working in,
    - What are the terms or address forms that you often use in your working environment, and how do you compare them to those you used in your undergraduate education?
    - What kind of language do you use in your working environment? Familiar or foreign to you?
    - How do you dress at work? Is it different from the undergraduate years? Why and how?
    - What kind of working environment do you have? (Does it resemble the studio environment in the university?)
    - How are your relationships with your colleagues? Is there a social environment? Are there any known social activities primarily organized for your department or organization/company?
    - How is your relationship with your manager? How often do you come together with them on projects? What do you think about the current organizational structure? (hierarchical relations)
- Have you changed your thoughts and opinions about your profession since you started your work life?

Design and Technology Education: An International Journal

29.1

Anonymous Modern Design Education in Western China: A Case Study

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Abstract

Along with the rapid development of Chinese modern design since the 1980s, modern design education has grown in China. Many studies have already been conducted to examine the key aspects of this historical phenomenon, e.g., heroic figures and well-known institutes. This article, however, investigates the anonymous activities of modern design education in Western China that have long been ignored because of their mundane function. Methods such as document analysis, questionnaire, interview, and subjective understanding are used to achieve the goal of this article. Through research on the School of Fine Arts in a University of Science and Engineering in Western China, as a typical case, this article reveals that although the school lags behind many other design schools, modern design education at the school has experienced sustained growth since its rise in the twenty-first century. The school has made achievements in a difficult situation but suffers from a series of disadvantages and problems. Additionally, modern design education at the school is facing new challenges resulting from changes related to raised standards and intense competition. In conclusion, the value of relatively unknown educational organisations of modern design is becoming clearer, since they are closely connected to the everyday life of ordinary people in Western China and take on a great deal of responsibility in serving the general populace and the vulnerable groups in society. This article, therefore, tries to call attention to anonymous modern design education whose aspects are disclosed through a case study.

Keywords

Anonymity, modern design, education, Western China, case study

Introduction

Although there is no universal definition, modern design can be briefly defined as a creative activity that provides solutions to problems in various fields through planning and preparation, e.g., architecture, interior decoration, fashion, visual communication, and product (as well as service) in modern times, in which technology and aesthetics play a part. Meanwhile, modern design education aims to enable the educatees to learn design thinking and methods and acquire design skills through systematic training in an institution in order to meet the needs of design in the abovementioned fields. Chinese modern design has developed rapidly since its emergence in the 1980s (Hang and Cao, 2009; Li, 2008; Tao, 2013; Wang, 1989; Xu, 2015). Accordingly, modern design education has been growing in China for almost 30 years. Many studies focusing on key aspects in design history have been conducted to investigate this historical phenomenon through empirical research and theoretical reflection (e.g., Fielding and Chung, 1998; Fung and Lo Choi, 2002; Wong, 2005; Wu, 2011; Xiang, 2015; Yang, 2009; Yuan, 2014; Zhang, 2008; 2020). In practice, however, Chinese modern design education consists not only of “the celebrated”, namely the pioneers (e.g., Guanzhong Liu, Dingbang Yin, and Fuchang Zhang), historic events (e.g., the establishment of China Industrial Design Association and

Guangzhou Conference), and well-known educational organisations (e.g., Guangzhou Academy of Fine Arts, Nanjing University of the Arts, Zhejiang Academy of Fine Arts, and Sichuan Fine Arts Institute, most of which are in Eastern China), but also of "the ordinary" education activities, which probably reflect more meaningful aspects and details. That is, not only the celebrated but also the ordinary parts should be taken into consideration when attempts are made to outline the main facts of Chinese modern design education. Hence, the concept of "anonymity" is introduced in this article to further investigate Chinese modern design education. As a term, "anonymous history" is rooted in studies of modern design history (Dilnot, 1984; Raizman, 2010; Sparke, 2019; Woodham, 1997) and expanded upon by Siegfried Giedion and Adrian Forty, who have both dismissed the "heroic approach" (Conway, 1987) and advocated for the importance of impersonal factors from a sociological perspective (Giedion, 1948; Forty, 1992). Arguing against the heroic approach of Nikolaus Pevsner who is a classical historian of modern design and wrote the earliest work on modern design history in the 1930s, Giedion advanced the anonymous history in the 1940s, shifting the focus from the "historic force of heroes" to a much broader view of the impact of "impersonal industrial technology". Similarly, Forty strongly suggested that the attention of the historical research of modern design should be diverted from the classic work of design or the life of celebrated designers and should be drawn to the social context of design activities and the materialisation of social relations through design activities. Taking the same view, this study of anonymous modern design education will correspondingly pay closer attention to the anonymous practice, which is usually passed over in favour of the glorious heroes and events of modern design education, and endeavour to define anonymous practice from a sociological perspective. To call attention to this kind of educational practice (namely, the practice involved in unknown organisations within the less-developed areas), this research conducts a case study and develops a profile of anonymous Chinese modern design education, from which the various related contributions (which is concerned with achievements in a backward situation), difficult positions (which is concerned with problems arising in the sphere of institutional reform, management system, and staff recruitment), and prospects (which is concerned with opportunities and challenges in the future), as well as the social significance, will emerge.

Methodology

Questions and Approaches

Through a case study, the research aims to answer the following questions: (1) What is the present situation of anonymous modern design educational practice in an institution in Western China? (2) What key features has such a practice produced in terms of achievements, disadvantages, and problems? (3) what are the prospects for the improvement of Western Chinese modern design education in the future? Responses to these questions will be instructive for ascertaining the meaningful aspects of anonymous modern design education in Western China and calling attention to this kind of educational practice.

The School of Fine Arts in a University of Science and Engineering in Western China, is an art and design education institution. The department of design has been practising the teaching of modern design for about 20 years and is chosen as the object of study because of its relatively unknown position in Western China. The approaches used here include document analysis, questionnaires, and interviews. Generally, based on primary or secondary sources, document analysis is an effective means applied to providing evidence or supporting statements in historical research (Tosh, 2002). It is employed in the archival research of this study to compile

basic information (e.g., alumni information and curriculum) on the practice of modern design education in the school. Questionnaires and interviews, approaches frequently implemented in sociological surveys to generate statistics or measure public opinion (Burke, 2015; Giddens, 2001), are used to obtain information on the historical background of the school or the opinions of students, teachers, and managerial staff, which are connected to comments on the performance or prospect of modern design education in the school. In addition, subjective understanding, an approach derived from "understanding sociology" (Weber argues that "subjective understanding", instead of "outside observation", is the specific characteristic of sociological knowledge. See, Weber, 1978; 2017), is employed to interpret the relevant facts and ascertain their meaning. Specifically, the method of subjective understanding is applied to determine the implications of the information or the remarks empirically collected from the participants through questionnaires and interviews, the meaning of which cannot be determined directly from the empirical evidence. This method is also used to make comments or subjective judgements about the significance of this kind of educational practice. Since the author had worked for the school as a faculty member for more than 10 years, this method is employed to examine the way the school is managed, which the author was familiar with through his everyday work.

Participants

Participants in the research included students, teachers, and managerial staff from the School of Fine Arts at the above mentioned University. For the questionnaire, based on a random selection of the list of students offered by the chairs of the teaching and research sections (environmental design, fashion design, and visual communication design), numbers of students from the department of design (including undergraduate and postgraduate students) were chosen as the respondents to anonymously answer the questions. The group interviews were conducted with five teachers from the department of design, who have extensive teaching experience with modern design, and none of them is currently holding a managerial position at the school. The deputy dean of the school and three chairs from the teaching and research sections (environmental design, fashion design, and visual communication design) of the department of design were interviewed by the author personally.

Data Collection

All documents from which the information has been collected in the research are official files from the archives of the above mentioned University or of the School of Fine Arts. There are no data regarding the School of Fine Arts from outside publications. The documents include the official records of alumni information filed in the archives of the above mentioned University, the student curricular schedules filed in the School of Fine Arts, and the list of students offered by the chairs of the teaching and research sections. The questionnaire included two prompts: (1) Has the curriculum of the department of design increased the students' ability to solve design problems? (2) Please explain your reply. The questionnaires were sent out to the selected students by e-mail via the chairs of the teaching and research sections (environmental design, fashion design, and visual communication design). In the group interviews, each interviewee discussed the problems caused by the inefficient managerial activities (the names of interviewees are withheld from this article). The individual interview with deputy dean covered what factors hinder the practice of modern design education in the school and what strategies could be developed to improve modern design education at the school. For the individual interviews with the chairs from the teaching and research sections, the historical

background of the practice of modern design education in each teaching and research section were discussed. In brief, the collected data help in revealing the achievements, disadvantages, and problems of modern design education at the school.

The time line of research process was as follows. First, the author visited the archives of the above mentioned University on 8 June 2020 and consulted the official records of alumni information stored in the computer. Second, the questionnaire was administered between 2 July 2020 and 19 July 2020. Third, an individual interview was conducted with the deputy dean of the school in his office room on 10 July 2020, and it lasted 30 minutes. The students' curricular schedules at the School of Fine Arts were examined by the author on the same day. Another three individual interviews were conducted with the chairs of the teaching and research sections (environmental design, fashion design, and visual communication design) by telephone the next day, and the interviews lasted 15 minutes each. Then, two separate group interviews were conducted online. The first one was conducted with three teachers on 15 July 2020 and lasted 35 minutes. The second one was conducted with the other two teachers on 4 November 2020 and lasted 27 minutes.

Data Analysis

Quantitative and qualitive analysis are employed in the process of data analysis. Quantitative analysis is used to analyse the quantitative information collected from the documents, questionnaires, and interviews. First, 10 official records of alumni information over the period from 2010 to 2019 were examined (see Figure 1). It is found that the lowest number of students graduated from bachelor's programmes related to modern design is in 2010 (195 graduates) and the highest number is in 2012 (365 graduates) during the period. The average annual number is 281 graduates. Second, the information collected from the questionnaires were analysed (see Figure 2). A random sample of 30 students were chosen as the respondents, which approximately account for 10 percent of the annual number of graduates from bachelor's programmes and master's degree programmes. There are 26 students who responded to the questionnaire, and the response rate is 87 percent. Among them, 14 respondents are female and 12 respondents are male (54 percent and 46 percent respectively). Third, 17 copies of the student curricular schedules were also analysed regarding the change of the courses set in the past 17 years. In addition, 5 teachers participated group interviews, and 3 teachers are female and 2 teachers are male. Their teaching experience are 16, 10, 6, 11, and 12 years respectively, and the average teaching experience is 11 years.

Qualitive analysis is used to understand and interpret the information obtained from the interviews. First, the content of the group interviews was summarised. It indicates that the problems caused by the inefficient managerial activities are mainly concerned with the regulations of the tutorial system, the examination system, the arrangements of the teaching tasks, and the performance of the decision makers (along with their managerial team). Then, the content of the individual interview with the deputy dean of the school was generalised. It reveals that the geographical location and the recruitment of new members are the factors hinder the practice of modern design education in the school, and localisation and internationalisation strategies should be developed to improve modern design education at the school.

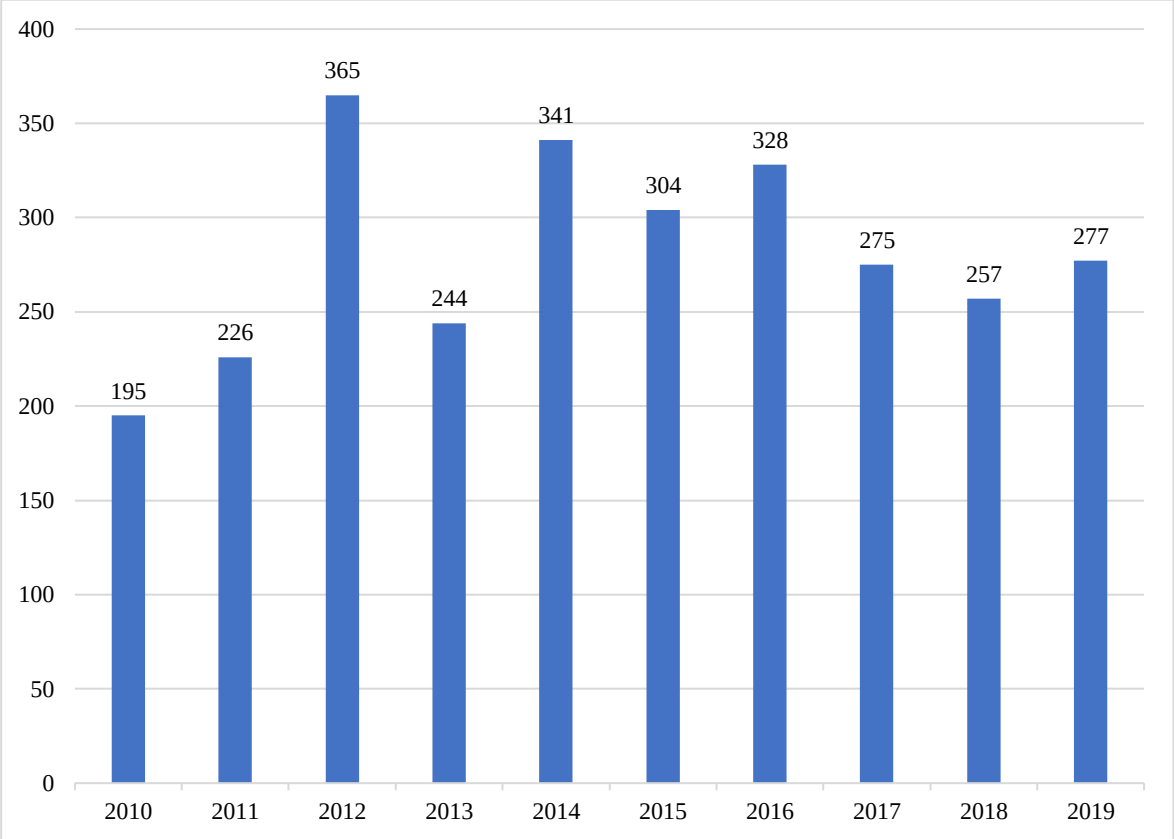

Figure 1. The annual number of graduates over the period from 2010 to 2019

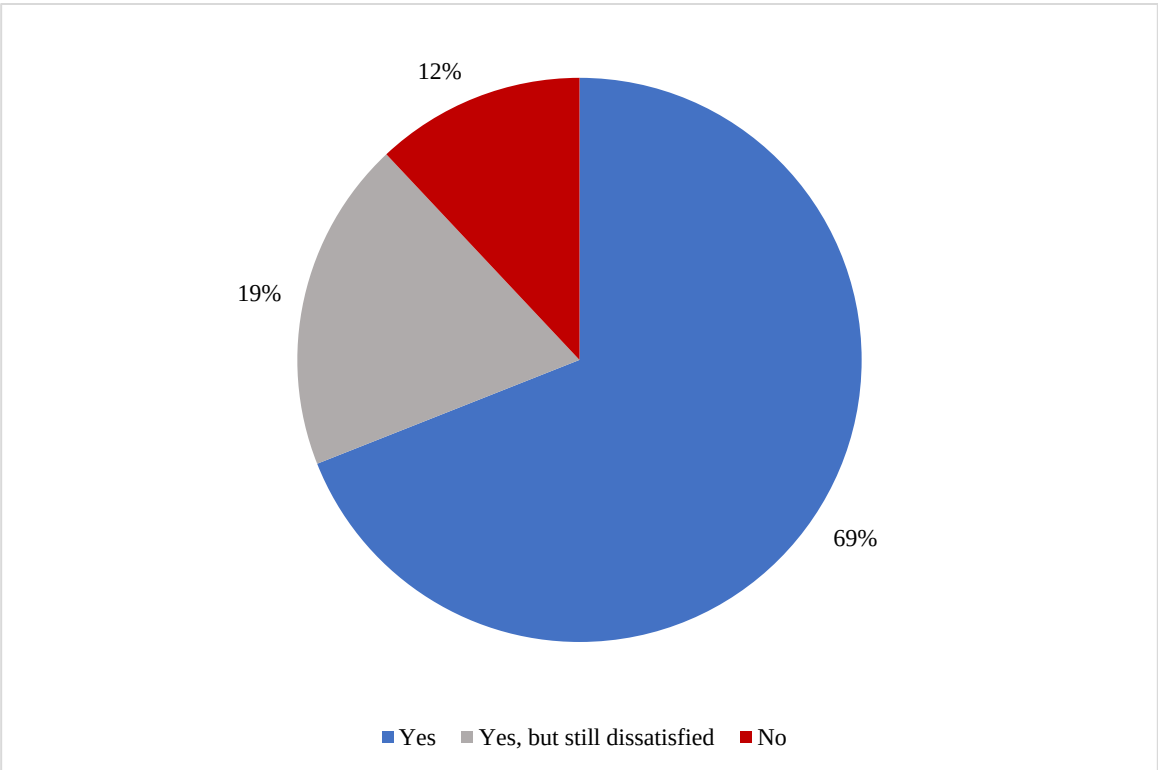

Figure 2. The students' opinions on the curriculum of the department of design

Findings and Discussion

Historical Background

The gap between Eastern and Western China in terms of economic growth and modernisation was reflected in the differing progress of modern design education in these two areas. Since the idea of modern design was introduced and adopted in Eastern China in the 1980s, e.g., Guangdong province (Wang, 1989), Chinese modern design education was first provided in the coastal areas. Therefore, the development of modern design education in this school can immediately be seen to be "lagging behind" when compared with that in universities and academies in Eastern China. The rise of modern design education of Eastern China was in the mid-1990s (Yuan, 2014), yet modern design education activities in this school (in Western China) did not begin until the early twenty-first century because the demand for modern design education only became strong enough to reach Western China during that period.

The School of Fine Arts at the above mentioned University, once known as the Department of Fine Arts in a Teachers College in Western China, was founded in 1986. This Teachers college and another three colleges were integrated into a brand-new university in 2003. In the beginning, fine arts education had played a leading role, and the teaching of modern design was marginalised in the school. In that early period (around the 1990s), the school provided only a three-year diploma of "modern design-like" education programme under the speciality of "arts and crafts". Nevertheless, with the surge in demand for modern design education across China since the beginning of the twenty-first century, educational reform aiming to promote the teaching of modern design was adopted to confront the new challenge, as many other fine arts schools had already done. In 2004, the school began to offer a bachelor's degree, and a modern design education programme, classified under the speciality of "fine art", was launched. Meanwhile, a teaching and research section of design was established. It was not until 2008 that modern design education was divided into three programmes, namely, "environmental design", "visual communication design", and "fashion design". The teaching and research sections were divided accordingly. Finally, environmental design, visual communication design, and fashion design were approved as the independent specialities and began offering bachelor's degrees in 2015: different programmes have been set up, e.g., "interior design" and "landscape design" fall under environmental design, "visual design" and "new media design" fall under visual communication design. Since 2015, the school has offered two master's degree programmes, namely, environmental design and visual communication design, under the speciality of "art and design". Currently, there are more than 1,000 undergraduate students, about 120 postgraduate students, and 76 faculty members at the school (the statistics were collected in 2019). Approximately two-thirds of the students are trying to obtain a degree in modern design.

Achievements in A Difficult Situation

Although the situation indicates the "backwardness" of the region at the macro level, the progress seen in modern design education is compelling and has remained stable in this school since the beginning of the twenty-first century. The number of students graduated from school over the period from 2010 to 2019 testifies to this. As the chart shows (Figure 1), the annual number of graduates from bachelor's programmes related to modern design, e.g., environmental design, visual communication design, or fashion design, has seen a moderate increase despite the fluctuations within this period.

Furthermore, the students' curricular schedules, which are compiled by each teaching and research section every year, prove this progress as well. The compulsory theoretical courses set in 2005, 2008, 2015, and 2018, for instance, make a marked difference. A comparison of the schedules presented in the table (Table 1), shows that there were no theoretical courses directly related to the issue of modern design in 2005; the course "modern design history" was introduced in 2008 to improve the understanding of modern design by offering a historical perspective. In 2015, "Chinese art history" and "foreign art history" were removed from the curriculum because the independent specialities of modern design were approved, and the introductory course "an introduction to art", which provides a brief overview of the history and principles of art, was introduced as a substitute for the removed courses. These changes strongly demonstrates that modern design history, supplanted art history, playing a major role in the theoretical system of modern design education in the school. Since 2018, the course "modern design methods" has been part of the curricular offerings, with the aim of encouraging students to carry out their design tasks through the scientific processes and using reliable methods. To some extent this change illustrates that the teachers and the decision-makers behind them have seen the logic in promoting modern design education at the school. Progressive changes have also been found in other professional courses. "Infographics design" and "user interface design", for instance, were introduced as elective courses in the visual communication design programme in 2012 and were set as compulsory courses in the students' curricular schedules in the visual communication design speciality in 2015. This indicates that the school is struggling to keep up with technological changes in today's information society. The course "ergonomics" is another important example. The course, which is irrelevant to traditional art education curricula, was introduced in the environmental design programme as an elective course in 2008 and then became a compulsory course in the environmental design speciality in 2015. Again, the topic of this was determined to be one of the core subjects of the compulsory courses in 2018. These changes suggest that the school attaches increasing importance to the factors of humanised design in the reform process.

Table 1. The compulsory theoretical courses set in 2005, 2008, 2015, and 2018

2005	2008	2015	2018
Chinese art history	Chinese art history	modern design history	modern design history
foreign art history	foreign art history	an introduction to art	an introduction to art
an introduction to art	modern design history		modern design methods

Additionally, the school has developed a localisation strategy aiming involving traditional cultural heritage through which the characteristics of local culture and crafts, e.g., "*Za Ran*" (tie-dye) and "*Cai Deng*" (illuminations of Spring Festival), have been integrated into the curriculum. Both "*Za Ran*" and "*Cai Deng*" are traditional crafts that are the representative of local Zigong culture. *Za Ran*, also described as "*Shu Xie*", has earned a reputation for its tie-dyed textiles, which are made using a solution made from natural material, e.g., indigo, that produces a unique dyed effect. *Cai Deng* is well known for the characteristic lantern decorations in the parks and on the street during the Spring Festival. This kind of illuminations at the Lantern Festival has allegedly been popular in what is modern-day Zigong since the Tang or Song Dynasty. Over time, the tradition developed into a lantern show that has proven to be

the best showpiece for the city, not only communicating local culture but also promoting the creative economy of the city with the assistance of renewal techniques and materials. In one of the individual interviews, the deputy dean, who manages academic research, argued that the localisation strategy will help preserve the traditional cultures, customs and lifestyles, reach a compromise between localisation and modernisation in design, and sustain the growth of modern design education at the school as resource that will continue to be available.

On the other hand, the school has also followed internationalisation trends. Teachers are encouraged to study or undertake research abroad to obtain international education experience. There are several teachers who completed their degrees or conducted research in Europe, North America, Japan, and South Korea thus far. Moreover, since 2019, the department of design has started an international programme under the visual communication design speciality in cooperation with a university in America. In the first term, 102 students entered the school and experienced the programme; they study at their home university for the first three years and then have an opportunity to study in the United States for the fourth year if they passed a language test.

Disadvantages and Problems

Nevertheless, the achievements are shadowed by some disadvantages or problems. First, as a school that grew out of a fine arts institute, its modern design education system obviously bears the characteristics of the traditional art education model. The remnants of the traditional model then became the key components of so-called art-type modern design education at the school (contrasted with “engineering-type” modern design education, which originated from Bauhaus and the Ulm School of Design) (Wang, 2015), and pedagogical limitations of the system are sometimes encountered. Specifically, this kind of system, which exists not only in this school but also in many other schools with the similar transition backgrounds, is always oriented around visual expression instead of problem solving and depends on artistic (e.g., intuition, inspiration, or the unconscious) instead of scientific (e.g., logic or reason) training methods, disregarding modern design’s ability to inform decisions and find solutions (The aforementioned theoretical course “modern design methods” is considered a remedy to this problem). According to the question about whether the curriculum of the department of design has increased the students’ ability to solve the design problems, 12 percent of respondents replied “No”. Additionally, some respondents still expressed their dissatisfaction with the curriculum even though they replied “Yes” (Figure 2). The survey results suggest that the curriculum and the teaching methods at the school fail to sufficiently overcome the difficulties arising from the transition from a traditional to a new curriculum.

The old-fashioned management system at the university is another limitation. The managerial activities at the school have been deeply influenced by the patriarchal concept that defines management as “control” instead of “service”, which impedes the effort to embrace “teacher-centred” management and hence affects the development of teaching and research in the school. The advancement of academic research, for instance, has been severely dependent on the strategy of academic research being led by administrative preferences instead of personal preferences. That is, the decision-makers of the school are inclined to exert an administrative force (even pressure) on teachers to drive them to pay more attention to their academic contributions. Meanwhile, the academic interests of the teachers have been ignored to some extent, particularly those interests that cannot be realised as an instant contribution expected

from the upper levels of administration. Consequently, this situation gives rise to the strange circumstance in which only those academic activities whose results are in accordance with the goals of the administration can be properly promoted. Otherwise, research that merely represents personal academic interests are likely stifled, if not completely prevented. Nevertheless, in regard to the value of academic research, the approval of the administration can hardly be equated to the value of the research itself, although the encouragement coming from the former sometimes promotes the rise of the latter. This phenomenon reveals a meaningful mechanism that has worked in the educational organisations whose development lags behind. In other words, due to backwardness the university heavily relies on the effect of administrative power to reduce stagnation and catch up with more advanced schools. Meanwhile, individuality has been undervalued. Moreover, based on the group interviews with several teachers, a number of problems caused by the managerial factors related to the teaching of modern design have emerged. The interviews with the teachers revealed the following information.

> ***Interviewee A (male, the teaching and research section of visual communication design, 16 years' teaching experience):*** *I strongly disagree with the regulations of the tutorial system. It does not mean that I deny the system itself, but the regulations are full of confusion and conflicting information. The students are required to choose the different tutors for different tasks, e.g., course selection, contest, and postgraduate entrance examination, yet these tasks cannot be divided so clearly. It is also unreasonable in terms of the timing and the method of tutor selection. From my point of view, this decision has been made blindly. It is the consequence of insufficient communication between the decision-makers in the chair positions and the teachers who are on the front lines.*
>
> ***Interviewee B (female, the teaching and research section of visual communication design, 10 years' teaching experience):*** *I think the examination system failed to adapt to the nature of some courses in which the performance of students can only be assessed properly by the exercises outside the classroom. However, the rigid and dogmatic system has the students sit for the examination in the classroom. It is quite ridiculous that the teachers who offer the course and know the course best have no right to choose the means of testing by themselves. On the other hand, those who have the right to choose the means of testing are not involved in teaching.*
>
> ***Interviewee C (female, the teaching and research section of visual communication design, 6 years' teaching experience):*** *There is a serious conflict between the standards of examination and the syllabus of those courses which must be lectured by different teachers simultaneously. It produces the side effect that the content of examination does not always match the content of lecture sometimes and also results in the uneven quality of the teaching. Indeed, it is caused by the loosed preparation of lectures in groups. But I am not sure whether the management has learned such information, as this trouble has been around for a long time. Nobody has taken any managerial action to change it.*
>
> ***Interviewee D (male, the teaching and research section of environmental design, 11 years' teaching experience)****: In my opinion, the way the teaching is managed is very*

problematic. In terms of the teaching arrangements, the tasks have arbitrarily been divided among the teachers in each teaching and research section, disregarding the strong points of each teacher. The teachers have been burdened by these tough arrangements. Sometimes the teachers have failed to convey the full content of lectures because they did not have enough time to prepare and digest the content of the course with which they were not already familiar. Hence, I think some lectures are becoming a matter of routine, with the result that the students who have attended the courses and learned the limited knowledge will not be able to confidently meet the challenge of design tasks in the future.

Interviewee E (female, the teaching and research section of fashion design, 12 years' teaching experience): *I think that the decision makers (with their managerial team) who are leading an organisation that offers design education should be well cultured and should have a long-term vision. They should also be well informed through communication with qualified scholars in the field of design research. Furthermore, they should show full consideration for teachers who are on the front lines, and the relationship between them should be equal rather than hierarchical. However, as regards the issue discussed here, the managerial performance of the school is quite poor. As a result, the teachers do not feel good about the requirements, although they superficially agree with them. There are some inconsistencies. I just think this problem interferes with the initiative of the teachers.*

The interviews gave a snapshot of the negative effects of management on educational practice. As these interviews disclosed, the teachers do show some disagreement with the method of management, although they concealed their dissatisfaction in their mind and seldom expressed it publicly. On the other hand, the decision-makers and managerial staff become accustomed to this management style and thus take it for granted that the organisation is running smoothly in this way. These hidden conflicts, however, are likely to increase inefficiency in management.

The recruitment of new members who are competent in teaching modern design is troubling the school as well. Objectively, the university's location is a considerable disadvantage for the school, which is eager to attract qualified teachers. Compared with Chengdu or Chongqing, which are both centres in Southwestern China, the city of this university has a rather marginal location. This factor has the school run into difficulty with recruiting excellent young teachers, for whom cities such as Chengdu or Chongqing are more alluring. At the same time, the requirements for achieving strategic targets are challenging the teachers who have been working for the school. The above mentioned dean indirectly suggested that these demands are beyond the capabilities of some teachers at the school and is hoping this situation will be remedied by recruiting new members.

In addition, the school's overall development is encumbered by its outdated educational infrastructures and facilities. The designers of the buildings, which were constructed in the campus around the 1980s, could hardly take modern design education functions into account. As described in the brief history of the school, this reality is a result of the delayed development of modern design education in Western China, and the designers then could not foresee the rise of modern design education at this school in the twenty-first century. Consequently, many students, as well as a number of young teachers who are less tolerant of the poor teaching

conditions, have complained in private that the school buildings are so antiquated and not equal to fulfilling their task. Similarly, the underdeveloped facilities present other difficulties. For example, the lack of laboratories and equipment for some postgraduate courses is a serious impediment to the completion and quality of academic research.

Prospects

The problem discussed at the end of the last section will be addressed first. Another campus for the school was completed in 2021. The new buildings and facilities, designed with a full consideration of the functions of modern design education, began to serve all the students and teachers of the department of design. This time, those planning the new campus wisely asked for advice about the functional details of the buildings and facilities in advance. They collected the information by meeting with the faculty members, who voiced their requests. Along with the progressive improvements in educational infrastructures, a high-speed railway entered service in the same year. This railway links the university's city with Chengdu and Chongqing, integrating the city into the "one-hour economic circle" in Southwestern China, centred around Chengdu and Chongqing. The economic exchange and the cultural communication among the cities will be significantly increased. It is believed that this improvement will benefit the school in terms of human resource.

Continuous social modernisation, which leads to certain demands for modern design, will assure design education a place in modern China. Beyond any doubt, this school and its department of design will make steady progress in improved circumstances, although they are currently in a backward position, and their adopted policies, such as localisation and internationalisation, have been making steady progress. Nevertheless, the strong demands for modern design in China also raise the standards of Chinese modern design education. The higher standards are challenging the school to improve its modern design educational practice. The reform of the management system is becoming the most difficult challenge because it affects all aspects of educational practice. The old-fashioned management method should give way to the modernised methods in which "teacher-centred" is not just a slogan and the boundary between executive power and academic freedom is clearly defined. Otherwise, the school will suffer from inefficient modern design education that may not be perceived by the decision-makers but will weaken the school's every effort to modernise. In any case, the tasks involved in modernising the school's management system cannot be whitewashed by the modern or post-modern styled buildings and interior decorations on the new campus.

Conclusions

As a case study of anonymous modern design education in Western China, this research presents some aspects of current educational practice in terms of the achievements, disadvantages, and prospects at a specific school; these subjects have rarely appeared in traditional studies whose focus is normally on celebrated pioneers, historic events, or well-known educational organisations. This research investigates the School of Fine Arts at the above mentioned University and found that although this school lags behind its eastern peers, the modern design education at the school has been experiencing a sustained growth since its rise in the twenty-first century. The school has made great efforts to improve the educational practice of modern design and encourage teachers and students to involve themselves in relevant academic research. These attempts have resulted in achievements such as a stable annual number of graduates, the improvement of the curriculum, and incorporation of

localisation or internationalisation strategies aimed at future development (as illustrated above under the subtitle “Achievements in a difficult situation”), as well as in the disadvantages and problems charactering the school’s transition, training methods, old-fashioned management system, recruitment of faculty members, and outdated educational infrastructures and facilities (as illustrated above under the subtitle “Disadvantages and problems”). Some limitations, e.g., the replacement of infrastructures and facilities, are becoming moot, while the other challenges, e.g., the reform of the management system, should be seriously concerned if the school wishes to improve under the changing conditions related to rising standards and intensified competition in the field of Chinese modern design education (as illustrated above under the subtitle “Prospects”). The investigation draws the following conclusions. First, anonymous design education practice is an integral part of Chinese modern design education. Although attracting little attention, the practice has been in progress. Second, anonymous design education practice makes achievements in a backward situation that means a series of disadvantages and problems, meanwhile facing new challenges.

Incidentally, according to John Ruskin and William Morris, modern design is obliged to serve the public, as well as to assist “the insulted and injured” portrayed by Fyodor Dostoevsky. Unknown designers, instead of stars, are most likely to provide the design services for the populace in Western China. Although the star designers are leading the way, they are still a minority in this area. The significant demands of the public for modern design, e.g., the interior decoration of a little restaurant or the signage at a local market, have been and will be satisfied by unknown designers. As, in large part, they have been the product of anonymous modern design education, schools and academies that undertake the unknown teaching of modern design are becoming increasingly valued. These institutes, therefore, will take on more economic and moral responsibility. This is the very reason why attention should be turned to them. Their rise and development suggest the need for higher-quality design activities, which have become more connected to the everyday-life of ordinary people in Western China.

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