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The Role of Design Education in Designers' Pursuit of Entrepreneurial Opportunities

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Abstract

This article examines the relationship between design education and entrepreneurship by exploring the ways in which design education prepares, or falls short in preparing, students for entrepreneurship. Empirically, it draws on semi-structured interviews with 23 design entrepreneurs. Theoretically, it draws on the entrepreneurial opportunity literature, which highlights the significance of the knowledge, skills and abilities (KSAs) gained in higher education. Our findings propose five ways in which design education prepares students for entrepreneurship. Design education provides students with (1) a unique (“designerly”) way of seeing, reframing and handling problems, (2) a systematic approach to new challenges, (3) KSAs related to materials and production, (4) KSAs and experience related to oral and visual communication and (5) opportunities to discover students’ individual interest areas in design.

Introduction

In the creative industries, including design, the motivation of young graduates for pursuing entrepreneurial careers has received considerable attention from scholars and educators. Distinguishing between the intrinsic and extrinsic motivations encompassed by entrepreneurial motivations, studies have underlined how creative entrepreneurs are primarily driven by the former (e.g. the desire to express and realise oneself through the creative work undertaken) rather than the latter (e.g. monetary reward) (Berube & Gauthier, 2021; Nielsen et al., 2018). Unlike their counterparts in other economic sectors, creative professionals often view their projects “as the fulfilment of a lifelong dream” that provides self-satisfaction and recognition (Kohn & Wewel, 2018, p. 309). Such views are characteristic of creative entrepreneurship.

The discouraging conditions of the job market also matter for designers’ motivations for pursuing entrepreneurial careers. Many novice designers consider entrepreneurship a more satisfying and promising career alternative for a creative professional after spending several years in in-house positions. For instance, in interdisciplinary work settings, designers may find themselves at a disadvantage within the organisational hierarchy, where they may find it challenging to compete with their counterparts in more technical fields (e.g. engineers) for access to higher positions; thus, they may prefer to switch to an entrepreneurial path (Kaygan & Demir, 2017). Others, being disappointed by the inadequate independence and autonomy offered by in-house jobs, are attracted to entrepreneurship, as it can provide them with full control and autonomy over their creative work (Kaygan et al., 2023).

In the design literature, motivation for entrepreneurship has also been discussed in relation to the designer’s gender. Lockhart (2020) suggests that for several young women industrial

designers, setting up one's own start-up is a good strategy for coping with the challenges they encounter in male-dominated industrial companies. Accordingly, becoming an entrepreneur allows women to remain outside the traditionally masculine workplace cultures of these companies in which they do not always feel welcome, and competing on equal terms with their male peers. Kaygan's (2021) research with industrial designers confirms Lockhart's (2020) argument: Women designers believe that establishing their own businesses in which they design, produce and sell products or services under their personal brands empowers them in comparison to their experiences in the industry. These studies, then, encourage us to infer that entrepreneurship potentially serves as a particularly favourable work alternative for women practising in the male-dominated and culturally masculine fields of design.

To sum up, existing literature sheds considerable light on various factors that motivate designers for entrepreneurship. However, design research on entrepreneurship has rarely grounded its questions in educational contexts. A growing body of work shows that business schools are experimentally incorporating design thinking (DT) skills and methods into their curricula and pedagogical approaches to foster creativity as an integrated and fundamental part of entrepreneurship education (EE) (e.g. Nielsen & Stovang, 2015; Penaluna & Penaluna, 2019; Zupan & Nabergoj, 2012). However, the design scholarship does not demonstrate a parallel interest in investigating the link between design education and entrepreneurial skills, qualities and attitudes. Nevertheless, understanding and reinforcing this link requires going beyond the simplistic creative designer versus business-oriented entrepreneur dualism and supporting the coherence of both the creative and business identities of young graduates who wish to pursue entrepreneurial careers (Albinsson, 2018; Koch et al., 2023; Schediwy et al., 2018). This article aims to redress this gap and expand our knowledge of the relationship between design education and entrepreneurship by exploring the ways in which design education prepares, or falls short in preparing, students for entrepreneurship. It addresses the following research question: How and to what extent does industrial design education play a role in designers' pursuit of entrepreneurial opportunities? The empirical basis is comprised of interviews with 23 design entrepreneurs. Theoretically, the article draws on the entrepreneurial opportunity literature, as explained in the next section.

Opportunity recognition

The pursuit of an entrepreneurial opportunity is a multi-stage process that among other factors entails the discovery and evaluation of opportunities, the design of exploitation mechanisms that lead to a product or service, and the assembly of human and financial resources (Shane et al., 2003). This paper is concerned with the first stage, opportunity

recognition, which refers to the formation of the belief that an opportunity exists for a person who possesses the required abilities and means to exploit it. Opportunities arise from changes, ranging from changes in the knowledge that individuals or organisations develop to changes in the market or among economic actors (Grégoire et al., 2010). Entrepreneurship scholars have long underlined prior knowledge as one of the major factors that influence individuals' opportunity recognition: Each entrepreneur identifies only those opportunities that are related to their prior knowledge, including their knowledge developed from education (Ardichvili et al., 2003; Chen et al., 2020; Filser et al., 2023; Hajizadeh & Zali, 2016; Shane, 2000). Previous work has identified a link between having a creative personality and opportunity recognition. For example, people with creative personalities are more likely to identify business opportunities and to start businesses (Shane & Nicolaou, 2015). Therefore, design education offers a particularly fruitful context for examining the relationship between prior knowledge gained through education and entrepreneurial tendencies.

Entrepreneurial motivations play a critical role in opportunity recognition, yet the pursuit of opportunities and transition through the stages of the entrepreneurial process require more than motivation. Shane et al. (2003) argue that all entrepreneurial action is the outcome of the integration of motivation and cognitive factors, including knowledge, skills and abilities (KSAs). Accordingly, it is essential for an entrepreneur to obtain (1) knowledge of the industry or relevant technology, (2) the skills required for negotiation, selling, leadership, planning, decision-making, problem-solving, communication and conflict management and (3) the abilities of intelligence and creativity (see also Boyles, 2012; Shane & Nicolaou, 2015). If an entrepreneur possesses the key KSAs, she can use her prior knowledge to develop a viable vision, and her motivation can encourage her to mobilise her prior knowledge to undertake the required actions for pursuing the identified opportunity.

Since undergraduate education programmes provide students with a certain set of KSAs, this paper focuses on the prior knowledge obtained through industrial design education as it is perceived and interpreted by design entrepreneurs themselves. However, we first wish to bring the already discovered links between design and entrepreneurship in the entrepreneurship literature to the attention of design scholarship. To this end, we present in the following section a review of recent work that highlights how contemporary EE can benefit from DT.

Entrepreneurship education (EE) and its links to design thinking (DT)

The main goal of EE is to generate successful entrepreneurs who discover opportunities that stem from competitive market imperfections, enabling them to introduce innovative products, services or business models (Tiberius et al., 2023). While this discovery process

requires practical skills and abilities, the traditional and dominant approaches to EE adhere to the writing of business plans that are based on theoretical knowledge (Coelen & Smulders, 2023). Pittaway and Edwards (2012) have noted that the “about” and “for” approaches are the most dominant forms of EE, and both of these approaches have been criticised for following a “design-then-execute logic” (e.g. executing the developed business plans) (Alabduljader et al., 2018; Canziani & Welsh, 2021). By contrast, the “through” approach to EE depends on experiential learning (Perez-Perez et al., 2021; Smith et al., 2022), which practises learning by accomplishing entrepreneurial activities rather than teaching from textbooks (Pittaway & Edwards, 2012).

In a similar vein, Lahn and Erikson (2016) categorise the existing approaches to EE under three “waves”: The first wave is based on rational planning, writing business plans, and lecturing; the second is based on simulation studies or hands-on company training; the third is based on design, with students being more active in generating new ventures. The design wave, which is synonymous with the “through” and “design-based” approaches in the literature, represents a connection between an entrepreneur’s and a designer’s mindsets (Lahn & Erikson, 2016; Pittaway & Edwards, 2012). Entrepreneurial activity, especially in the phase of discovery and evaluation of opportunities, parallels designerly ways of working, requiring similar skills to those that designers possess, such as risk-taking, leadership, motivation, innovation, customer orientation, communication, teamwork and business-planning skills (Daniel, 2016; Zappe et al., 2012). Identifying such a parallel has ignited an interest among educators and scholars in entrepreneurship in integrating DT into EE, with the aim of encouraging students to develop successful ventures after graduation (e.g. Amalia & von Korflesch, 2023; Huq & Gilbert, 2017; Lynch et al., 2021; Mansoori & Dimov, 2024; Sarooghi et al., 2019).

Neither a designer nor an entrepreneur has a clear understanding of the problem, be it a design or an entrepreneurial problem, at the beginning of their journey (Daniel, 2016). The very nature of the problem makes it impossible to analyse it fully, which has been referred to as the “wicked” or “ill-defined” nature of the design problem (Brown, 2009). The designerly method of dealing with these problems fundamentally depends on reflection-in-action and reflection-on-action, whereby the designer principally develops a solution and tests it to gather more information about the problem. In this way, designing is also a research process in which designers generate new knowledge about the problem area, which has been described as the co-evolution of the problem and the solution (Cross, 2011). In other words, designers adopt solution-oriented strategies and abductive reasoning for problem-solving (Kimbell, 2011; Lawson & Dorst, 2009) by using the solution or the prototype as a tool for probing the problem in order to explore it.

The DT mindset and tools thus provide entrepreneurs with a useful methodology for acknowledging, appreciating and dealing with the uncertainty that they face in the entrepreneurial discovery phase. While traditional EE pedagogy focuses on the “what is it?” question, the integration of designerly ways of thinking and working into EE shifts the focus to the “what might be?” question (Nielsen et al., 2017). The latter entails developing and evaluating solutions by pursuing an exploratory and iterative process that requires understanding the context, generating ideas, building prototypes and interacting with users and stakeholders to test ideas in order to come up with novel and desirable solutions (Nielsen & Stovang, 2015). Moreover, DT-based approaches strengthen systematic self-reflection among entrepreneurship students (Lahn & Erikson, 2016) and foster a learning culture with humour and informal relations, which contribute to higher student satisfaction and greater achievement of learning outcomes in EE (Huq & Gilbert, 2017).

To sum up, existing literature on EE provides considerable evidence on how business students can and do benefit from designerly ways of thinking (e.g. DT mindset, methods and process) and working (e.g. the prevalent learning models and culture in design education). However, we do not know much about design students and how design education supports them in their entrepreneurial journeys. There are few studies that confirm the existence of higher education programmes in arts and design that cover entrepreneurship-related topics, (e.g. funding, copyright and marketing) in their curricula. For instance, Yu et al.'s (2019) design education model integrates entrepreneurship courses and practical projects in the whole process of design education, building its learning objectives, curriculum and practical systems on market demand. In an earlier study, Penaluna and Penaluna (2008) suggest focusing on the parallels between design education and EE and place further emphasis on the business aspects of design projects, such as a sense of ownership, intellectual property rights, portfolio development, and participation in exhibitions, which remain rather implicit in the existing design education curriculum. This is an important gap, especially considering the emphasis that EE scholars have placed on the resemblance of the skills that entrepreneurs and designers need. This study tackles this gap, examining how the key KSAs (defined above with reference to Shane et al., 2003) that are obtained through design education support industrial designers in identifying opportunities and developing successful businesses after graduation.

Methodology

As one of the most frequently used qualitative methods in both educational and organisational research, interviews provide researchers with in-depth accounts of the common concerns, interests, desires and expectations regarding different phenomena in

educational and professional contexts (Dunwoodie et al., 2023; Powney & Watts, 2018). Given that our research question requires an understanding of design entrepreneurs' interpretations of the relationship between design education and their own pursuits of entrepreneurial opportunities, this study empirically draws on interviews as its key data source. Semi-structured interviews were conducted with 23 industrial design graduates who had established small businesses in which they designed, produced and marketed various products and services, including furniture, home accessories, lighting, ceramics, textiles, footwear, handbags, jewellery, toys, stationery, gift experiences, event organisation, and food. Two sampling strategies were adopted. First, utilising the database that the first author of this article had created in a previous research project (Kaygan et al., 2020), a list of design entrepreneurs, consisting of 18 designers, was prepared. Snowball sampling was employed as the second sampling method, as the target population was difficult to gain access to for two reasons: First, there was a small number of potential participants (compared to in-house designers). Second, sharing personal stories about their businesses required a certain level of trust from the designers (Parker et al., 2019). During the interviews, the participants were asked whether they knew other design entrepreneurs that we could contact. In total, we located 37 design entrepreneurs, of whom 23 agreed to participate in our research.

As the research project was implemented in Türkiye, the interviews were conducted in Turkish. However, most of the participants had international profiles, with 10 designers having received professional degrees abroad and six designers residing in Europe or the US, where they ran their businesses. Regardless of where they resided, most of them targeted markets beyond Türkiye, as the European and US markets were more profitable.

In the interviews, we aimed to discover how our participants started their businesses, their motivations for choosing an entrepreneurial path in design and to what extent and in what ways they saw links between their choices and design education. To ensure consistency among the interviews, we used an interview guide, consisting of three sets of questions. The first part of the interview guide focused on the participants themselves and their businesses, asking questions such as the following: "What did you do after graduation?" The second part consisted of questions to elicit stories about the business processes and actors involved, inviting the participants to talk about their preferences and the challenges that they encountered. This part also posed questions specific to education, such as the following: "Do you think that your university education in design has influenced your becoming an entrepreneur? If yes, how?" "Do you identify similarities or parallels between the design process you learned and the process you follow in your enterprise? If yes, how?" The third part included questions regarding the selected sector, the product or service category, and similar businesses established by designers. Approximately 20 hours of interview data were

obtained in total. All interviews were audio-recorded with the informed consent of the participants and transcribed verbatim. The quoted excerpts in this paper were translated into English.

After transcribing the interviews, we proceeded with a thematic analysis of the data. Our thematic analysis used a descriptive approach (Saldana, 2015), focusing on the designers' interpretations of how they related their educations to their entrepreneurial career paths. The research question led the analysis into the categorisation of the emerging themes under two main codes: (1) KSAs in design education that prepare students for entrepreneurship and (2) KSAs that are missing in design education but are required in entrepreneurship. In the second cycle of coding, the codes evolved into analytical themes, which we introduce and discuss in the next section. In the presentation of the findings, we selected quotations from the interviews to illustrate and provide evidence for the commonality of these themes. We paid attention to selecting quotations that are concise yet most representative. To make visible that the quotations in this article do not come from the same participants, we assigned a number to each participant (P1, P2, P3, etc.) and indicated the number of the participant to whom each quotation belongs.

Findings

Analysis of the interviews revealed several ways in which design education prepares students for pursuing entrepreneurial opportunities. Our findings clearly demonstrated that the design entrepreneurs relied on both the KSAs that industrial design education provided them with and the project experience gained in studio courses in which they created a concept and turned it into a concrete product or service. However, as they engaged in activities to implement and maintain the created concept as a business, they identified some gaps where their professional education fell short in terms of equipping them with the necessary motivation, knowledge and experience. We organise our findings into two parts to present and discuss these KSAs and experiences and these gaps separately.

Design education prepares for entrepreneurship: Creating a concept and turning it into a concrete product or service

Our findings lead us to propose five ways in which design education prepares students for entrepreneurship. It provides students with (1) a unique ("designerly") way of seeing, reframing and handling problems, (2) a systematic approach to new challenges, (3) KSAs related to materials and production, (4) KSAs and experience related to oral and visual communication and (5) opportunities to discover their individual interest areas in design.

A unique (“designerly”) way of seeing, reframing and solving problems

According to the participants, design education leads students to develop a certain way of thinking, which they believed is unique to designers. Demonstrating parallels with the existing definitions of a “designerly way of thinking” in the literature (for an extensive review, see Johansson-Sköldberg et al., 2013), the participants highlighted certain aspects of such a way of thinking with regard to entrepreneurship. The first involves being critical of the problem at hand and attempting to question, widen and reframe it, rather than accepting the accuracy of the initial problem. Many participants explained how, thanks to this mindset, being sceptical about the initial problem results in a broader problem definition, which leads to a better explored and larger solution space. The quotation below illustrates this:

The ability to design is something completely different. Because when we start a design [process], we do not define the product [beforehand]. We don't say we will design a bag or a wallet, but we look at it from a different perspective. First, we identify problems and try to solve them. This is the point where we differentiate [ourselves from non-designers]. (P18)

Given that entrepreneurship requires designers to undertake various activities related not only to design but also to production, marketing and business management, the participants underlined the advantage of being able to approach every aspect of their businesses with this mindset. One participant explained this advantage as follows:

I have always thought that being a designer is a great advantage [in entrepreneurship]. [Professors] had always told us to take two steps back and look [at the big picture]. Having such a discipline is quite influential. Because no matter what we do, it's not only the product. Whether it's making the website, presenting the product or preparing it for the fashion show, we take a step or two back and reflect on what we're doing: Will this work go the right way? Will people see what I see? It [education] made me think and act in this way. (P13)

Internalising the motto of “take a step back and look at the big picture” helps design students view the problem from diverse perspectives and thus consider alternative solutions, as opposed to rushing in and narrowing the choice to a single solution. Indeed, the participants placed considerable emphasis on “the ability to translate every challenge into a design problem,” which enabled them to deal with most of the business issues that they encountered in everyday life more smoothly.

A systematic approach to new challenges

Another aspect of design education highlighted in the interviews was the design process. The participants commonly stated that design education above all teaches the design process, which provides students with the KSAs of how to design by following a systematic approach. Adopting this approach, designers proceed from a conceptual problem to a physical product step by step, establishing cause-and-effect relationships through analytical ...designers to see, reframe and respond to problems with an open, positive and solution-focused mindset. This way of thinking is guided by design methodology, which provides designers with a structure and tools as they move forward from the problem to the solution. One participant described the typical design process that she practised in studio courses as follows:

We have learned [how to design systematically], so it has now become a learned behaviour. How you start, how you progress, how you finish [...]. For example, you can't start the project by making a model. You don't just sit in front of the computer and prepare a CAD [Computer Aided Design] model. First, you should do research, think about it, sketch ideas, then make a simple mock-up, something like this from play dough or Styrofoam. You don't start from the end because you have a [systematic] technique like that. (P12)

The participants drew parallels between the process of creating a new product and the process of developing a business, as entrepreneurship also corresponds to introducing something novel to the market. They identified dealing with uncertainty as the key challenge in both processes, arguing that in entrepreneurship, introducing new products and services, identifying and entering new markets and developing new business models require the willingness to embrace uncertainty and discovery. Working with a step-by-step process, which allows for making mistakes early on and encourages several iterations until the desired outcome is achieved, designers learn to be comfortable with uncertainty from the early years of their professional education. Thus, when they enter the entrepreneurial world, they feel self-confident in managing the high levels of uncertainty that they encounter in various tasks and roles. This is illustrated by the following quotation:

In design education, we learn to deal with uncertainty because we don't know what the outcome will be when doing a project. If the output is obvious from the beginning, you're probably doing something that's not very original. You constantly try to improve something by struggling with that uncertainty. In fact, the world of entrepreneurship is very similar to this, and it is one of the most challenging issues for people. That's why, as a designer, you can act more agilely in that uncertainty, or

it doesn't worry you that much because you are accustomed to such an environment.
(P4)

Thus, in comparison to non-designers, recognising uncertainty as a fundamental element in the process of creating something new and being equipped with the necessary KSAs to work with uncertainty in a systematic manner towards a creative and innovative product, service or business model are significant advantages for design entrepreneurs.

KSAs related to materials and production

Industrial design programmes typically include theoretical and practical courses that focus on materials and production methods. Unlike founders of technology-based start-ups, and as is common in creative entrepreneurship (Lassen et al., 2018), our participants started their businesses without large investments, often relying on their own savings. For this reason, the designers chose to focus on product categories that could be produced with simple tools and machines either by themselves or in small workshops so that they could plan and oversee the manufacturing processes of the products that they designed. Therefore, the knowledge and skills obtained in such courses were of paramount importance to the participants' opportunity recognition.

The participants who had studied at universities that offer extensive production facilities, in which students are trained to use tools and machines to build prototypes of their designs, also underlined the significance of these hands-on skills. They suggested that these skills provided them with self-confidence and autonomy during the development of the products of their own brands:

This actually comes from the education we get at school. We always produced our designs ourselves. There was carpentry there. We were designing from scratch and making the product. For this reason, we had a command of the whole process. When this is the case, one thinks why don't we run our own business. That is why we decided to start our own business when graduating from school. (P7)

Moreover, 10 participants placed emphasis on their passion for handcrafting their designs themselves, which provided them with the freedom of preparing their products on their own or with little help, using materials such as marble, ceramics, leather and paper. Being able to make products by hand was commonly described as a source of pleasure and satisfaction, as well as an invaluable ability that provided the designers with opportunities to design unique details that distinguished their products from their competitors in the market. Others subcontracted manufacturers or craftspeople with small-scale production facilities or utilised new-generation technologies, such as 3D printing. This latter group of participants indicated

that they benefitted from their knowledge of materials and production methods in their communication and collaboration with subcontractors. The quotation below illustrates this finding:

We know how furniture is produced – its manufacturing and materials. Having knowledge of material and technique, thanks to university education, makes it much easier for us to deal with manufacturers. We don't let [the craftspeople] decide how to produce our designs by looking at our drawings. Instead, we instruct them that they should do it in a particular way. [Education] grants us this power. Thanks to our education, we can speak their language as well. (P6)

KSAs and experience related to oral and visual communication

Communication skills are essential in design practice. Oral and visual presentations are of great importance for designers seeking to convey their ideas to their colleagues, managers, clients and other parties. Design education focuses on these skills through both specialised courses in the curriculum (with the objective of improving students' communication skills) and studio courses (in which student work is presented through oral presentations supported by visual materials, such as posters, boards and videos). Thus, design education seeks to ensure that students have strong competences in this regard when they graduate. Our analysis showed that the knowledge and skills in communication gained during professional education were invaluable for the designers in their entrepreneurial careers:

[At school] we constantly present projects; we learn to express ourselves – both visually and verbally. When you start your own business, you are constantly showing and explaining yourself. Of course, this, I mean coming from [design] education, is of great benefit. (P21)

The designer drew a parallel between entrepreneurship and design education, indicating that expressing oneself is essential in both. She believed that communication knowledge and skills are required to make her business visible and competitive and to reach as many people as possible. She considered the education she received to be very useful in this respect, as it allowed her to gain such knowledge and skills through project presentations. Visual communication skills were underlined separately, as the following quotation illustrates:

[In this business] I need a lot of visual presentations, both when designing the products and when presenting them to potential customers. This could be how I will exhibit these products at a trade fair I attend, printing a catalogue promoting the products or designing my own business card. Or, as I said before, product photography [...]. Photos of those products are very important. One of the things that

increases the appeal of [the products] is how successfully I can photograph them. These are the qualities that make me stand out from many people trying to do this job. So, I feel like [design education] puts me ahead 1–0. At least I don't need anyone in this regard. (P3)

Their professional training equipped the designers not only with the necessary KSAs and experience but also with a strategic understanding of how to develop a brand identity that is expressed through the ways in which products are displayed, photographed and mediated. The self-sufficiency and autonomy in undertaking visual communication tasks and the marketing activities closely connected to them seemed to increase the designers' motivation for entrepreneurship. As they developed the brand and its products and services, they concurrently created a vision for its communication.

Opportunities to discover students' individual interest areas in design

Our findings showed that design education also supported the participants' opportunity recognition in a way that was not directly linked to the KSAs addressed in the curriculum: It did this by creating opportunities to discover their individual interest areas in design through diverse project work throughout their undergraduate education. Such diversity, which occurs in the project topics, the materials and production methods, the organisations and industrial sectors collaborated with and the scope of the projects (e.g. whether they focus on digital or physical solutions, whether they are product and/or service design projects and whether they tackle technical or user-centred design problems), enables students to explore their own interests. Several designers participating in our research indicated that their entrepreneurial ideas were based on their interests at design school. For instance, one participant narrated her entrepreneurial trajectory as follows:

I was like that at school, too. Designing small products, fold the material, finish them, touch them immediately and hold them in your hands. I loved that. Instead of traditional industrial design – parts, models or moulds [...]. I liked designing products that were simple, basic and whose results I could see immediately, rather than products that required large parts and long processes. (P3)

The quoted designer founded a business producing thematic gift boxes that contain multiple small items related to a selected theme. Above, she explained how her interest in designing products that can be created quickly and seeing the results immediately came from design school. Although industrial design education is primarily concerned with mass-produced products, it includes courses and exercises that focus on two- and three-dimensional composition and hands-on prototyping to improve students' manual skills. The above quotation shows the relationship that the designer saw between the pleasure she received

from designing products utilising simple and fast prototyping methods and her pleasure in discovering entrepreneurial opportunities based on such methods.

To illustrate further, another designer who started an accessory design business stated that the business had its roots in a bag design project conducted at university. Likewise, another participant explained that she had discovered her interest in glass production in an elective course that she had taken and that after her graduation this interest had evolved into a glassware business. Therefore, the diversity that students encounter in design education plays an important role in their recognition and encouragement of entrepreneurial pursuits, as it enables them to discover their special interests, get to know various sectors and learn about and even experiment with various materials and production techniques.

Design education falls short in preparing students for entrepreneurship:

Implementing and maintaining the created concept as a business

As presented above, our data showed overall that design education enables designers to identify a business idea and equips them with the mindset, self-confidence and KSAs that are necessary to turn that idea into a concrete product or service. However, when it comes to pricing and selling their products and services, finding marketing and sales channels, running their enterprises and growing them into profit-oriented businesses, designers consider themselves unprepared, lacking knowledge and experience. The tasks related to implementing and maintaining the business were defined as a challenge, especially for novice entrepreneurs. Although industrial design programmes typically offer courses on marketing and management, the participants indicated that such courses are taught on a theoretical basis and are disconnected from studio courses.

Moreover, design education teaches students to be user-centred, focusing on the user's needs, expectations and experiences in the framing and solution of design problems. Therefore, designers graduate with in-depth knowledge of the "user" (i.e. user-centred research and design methods), yet they do not have much familiarity with the notion of the "consumer." For this reason, as our participants discussed, design entrepreneurs have difficulties in identifying whom to sell to, how to sell their products and through which channels. One designer explained this situation as follows:

We don't know how to sell [the product] and whom to sell it to because we have no education on that subject. The school is weakest in this regard. In other words, when I enter the market to sell my products, [I don't know] how much this product is, how the product gets to the market, how we communicate with consumers, companies, retailers and what distributorship is. If we had already known these things, we would

have started 1–0 ahead. But unfortunately, we didn't know. I don't know if there are any design schools that blend this in design education right now. (P1)

Due to the lack of prior knowledge, designers find it challenging to undertake marketing activities. Nevertheless, as they cannot afford outsourcing marketing and sales services either, they investigate and learn what they need to promote their products and develop sales channels. This may involve influencers on social media, shopping websites, trade fairs, exhibitions and press bulletins. It can be suggested that they develop experience and the KSAs that they lack through trial and error from the very beginnings of their businesses.

Furthermore, industrial design curricula do not typically offer courses on entrepreneurship, business development and management. Although a few participants indicated that they had gone through accelerated training processes in entrepreneurship support programmes, the interviews showed that one of the issues was that the designers found themselves inadequately prepared for their entrepreneurial careers. They had the most difficulty with continuing to develop an enterprise and ensuring the successful management of the entrepreneurial process. Although the process starts with a strong design idea, the designers did not feel competent in ensuring the continuity of the business. One of the designers explained that she was not trained in business-related issues, describing how she experienced business activities:

I have no idea about business development. I don't have the knowledge to say, "Oh, this is not going to work, so let's go that way instead of this way." My education or my skills [...] I didn't receive anything like that. That's why I consider myself inadequate in business planning. Which direction would be more profitable for a business? Which sides should not be entered at all? And which direction should I keep up with? [...]. Also, financial management and an income-expense budget [...] . I really had a stomach ache while writing a three-year business plan – it was very difficult for me. You have to calculate and show that you will earn that money from somewhere. You have to say, "I sell approximately this much in wholesale, this much in retail; I set this price for products, sell this much abroad; I give this much to the shops". So, [planning this] was painful for me. (P5)

Since entrepreneurship was viewed as a dynamic process that entails risk-taking, continuous learning and flexibility, handling challenges should be seen as commonplace in this process. However, the marketing and business-related challenges for which designers believe that they are not well equipped can break their motivation for entrepreneurial pursuits. This study showed that several of the KSAs that the designers brought from their educations strongly supported their opportunity recognition of and entry into entrepreneurship. By

contrast, the lack of key marketing- and business-related KSAs, which reflected their exclusion from practice-based studio projects, created obstacles for the design entrepreneurs on this career path.

Concluding discussion

The review of the literature on opportunity recognition provided us with three key KSAs that enable entrepreneurial action (Boyles, 2012; Shane et al., 2003; Shane & Nicolaou, 2015). These include (1) knowledge of the industry or relevant technology, (2) the skills required for negotiation, selling, leadership, planning, decision-making, problem-solving, communication and conflict management, and (3) the abilities of intelligence and creativity. Based on our exploration of these KSAs in the context of design education, we assert that design education overall plays an important supportive role in design students' pursuit of entrepreneurial opportunities after graduation. It equips them with the mindset, self-confidence and KSAs to identify a business opportunity and then take the necessary steps to realise this opportunity. Design entrepreneurs benefit not only from the design KSAs that overlap with several of the key KSAs listed above but also from the project and sector experience that their professional education offers. Nonetheless, our study confirmed that design graduates face significant challenges in entrepreneurship, as they lack vital KSAs in marketing and business management. Notably, while all our participants had attended courses on marketing and design management during their undergraduate education, they barely recognised the KSAs targeted in these courses as useful in entrepreneurship. This is hardly surprising, as in design programmes, studio courses constitute the foundation of the pedagogical approach and methods as well as the learning culture (Hatunoğlu & Kaygan, 2024). Our analysis revealed five sets of KSAs obtained from design education that prepare designers for entrepreneurship: a unique way of seeing, reframing and handling problems; applying a systematic approach to new challenges; KSAs related to materials and production; KSAs and experience related to oral and visual communication; knowledge of one's individual interest areas in design. All of these are grounded in studio courses in which students learn by practising (i.e. creating tangible outputs, such as sketches, mock-ups and prototypes, through project work).

By contrast, traditional marketing and management courses in design programmes utilise lectures, textbook-based content and written assignments that rarely provide students with opportunities to acknowledge the relevance of these courses to the core design practice during their studies (Penaluna & Penaluna, 2008), although students may recognise the significance of these courses after they become entrepreneurs. If our findings from almost two decades later confirm Penaluna and Penaluna's (2008) conclusions about the missing

link between studio courses and business-related courses, we should interpret this as an enduring gap in design curricula, which awaits the attention of educators and policymakers.

Our proposed solution for fostering design students' engagement with the KSAs targeted by marketing and business courses lies in revising the curriculum as well as the pedagogical methods in a way that acknowledges the interconnections between the KSAs targeted in studio courses and those in marketing and business courses. Incorporating practice-based and experiential learning considerations into the latter would not only support the engagement of design students in such business-related activities but also provide familiarity with the actual challenges and formal processes that characterise entrepreneurship beyond theoretical knowledge of marketing and business development. This can be achieved, for example, by studying real-life cases from industry, inviting design entrepreneurs who have already started businesses that are undergoing challenging processes to be lecturers and encouraging students to apply theoretical knowledge to their own design projects. Scholars have highlighted how obtaining prior knowledge alone does not necessarily lead to the identification of entrepreneurial opportunities if it is not combined with an entrepreneurial orientation (Filser et al., 2023). Therefore, such strategies are important in helping students see themselves as entrepreneurs and gain the motivation to explore new business opportunities.

Besides strengthening students' acquisition of marketing and business-related KSAs in design programmes, the second suggestion that flows from our findings is to develop interdisciplinary collaborations between design and business programmes. As we indicated in our literature review, EE scholars have already identified parallels between the skills and mindsets of DT and entrepreneurship (e.g. Daniel, 2016; Huq & Gilbert, 2017; Lynch et al., 2021; Mansoori & Dimov, 2024; Sarooghi et al., 2019). This article confirms these parallels from the perspective of design education, as design entrepreneurs recognise both designerly ways of thinking and working and a systematic approach to problem-solving, two key aspects of DT, as privileges bestowed to them by their professional training. Having an open, positive and solution-focused mindset, being comfortable with and managing uncertainty and being able to see a problem from various perspectives are skills and abilities that they possess as professional designers and employ as entrepreneurs.

Such a correspondence between the EE literature and our design-education-focused findings encourages us to propose that both fields can significantly benefit from jointly developed interdisciplinary courses addressing both design and business students. For instance, a "design entrepreneurship studio" based on interdisciplinary teamwork could combine the "through" approach to EE with a broader understanding and application of DT, which would also include KSAs relating to visual and oral communication, and thus fulfil the needs of both

disciplines. Such a studio course could also incorporate marketing and business-related issues in the implementation of the design project (e.g. by developing a business model or preparing a funding application), which would constitute a rehearsal for the future actions of design entrepreneurs.

Moreover, working in interdisciplinary teams through project work facilitates students' learning from each other, which results in in-depth understanding of the mindset and vocabulary of the other discipline. In the design education literature, we encounter a growing body of work on interdisciplinary collaboration between engineering and design students, which attests how interdisciplinary courses make a significant contribution to the professional development of design students by combining the strengths of both disciplines (e.g. Blanco et al., 2017; Kaygan, 2023). We suggest that the already discovered parallels between entrepreneurship and design could likewise be interwoven through interdisciplinary project-based teaching, preparing design students for the non-creative aspects of entrepreneurship through an experiential, and thus familiar, pedagogical approach.

One motivation behind this study was to bridge the gap between design education and entrepreneurship, which has so far remained an underexplored relationship in the design field. An exception is Fernandes's (2019) research on fashion design education in Portugal, which concludes that the lack of a link between industry and existing higher education programmes results in the inadequate preparation of young graduates for the job market, particularly in terms of facing challenges related to the production, marketing and development of small businesses. By examining industrial design education, our study represented a different field of design in which KSAs related to materials and production are well integrated into the curriculum and are indicated as important components of the education on which designers rely in their entrepreneurial pursuits. Future research on other fields of design, particularly digital fields, would generate further comparable outcomes, providing us with a broader understanding of design entrepreneurship and the KSAs required for it.

As a final note, the sample of this study consisted of designers who initiated their businesses in Türkiye. However, this does not mean that our context should be understood as limited to that of design entrepreneurs in Türkiye, as most of our participants had international profiles. Further research examining design entrepreneurship in different geographical contexts may draw different conclusions, which could be discussed in relation to our suggestions.

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