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# Entrepreneurship mindset for designers: Understanding entrepreneurial capability in Industrial Design education


## Abstract

***This discussion piece explores the nexus between entrepreneurship and Industrial Design education in the context of 21st century competences. The 21st century is marked by rapid technological advancements, shifting industry landscapes, and evolving societal needs, which necessitate a re-evaluation of educational priorities. This discussion delves into the critical competences identified for the 21st century, highlighting the importance of creativity, problem-solving, collaboration, innovation, digital literacy, and entrepreneurial skills. It examines the role of STEM (Science, Technology, Engineering, and Mathematics), STEAM (Science, Technology, Engineering, Arts, and Mathematics), and HASS (Health, Arts, and Social Science) education in preparing individuals for the future workforce. Additionally, it emphasises the significance of entrepreneurship in Industrial Design education, showcasing the potential of this discipline to foster entrepreneurial capabilities among students. The discussion concludes by offering recommendations for enhancing entrepreneurial learning within industrial design education and underscores the pivotal role of this field in shaping well-rounded and competent individuals for the 21st century.***


## Introduction

**It is evident from the literature that Industrial Design education**

**plays a pivotal role in imparting a significant portion of these 21st-century competences. This underscores the substantial value and contemporary relevance of Industrial Design education in Australia, regardless of whether students ultimately pursue careers in the field. More specifically, Industrial Design education is poised to effectively cultivate key 21st-century competences such as creativity, problem-solving prowess, critical thinking, adaptability, innovation capacity, and communication skills, aligning them with the demands of the modern age. Furthermore, it is likely that STEM competences encompassing Science, Technology, Engineering, and Mathematics are adequately addressed within the curriculum, emphasising the need for a comprehensive and broad-based approach. The integration of Arts (the "A" in STEAM) may enhance the pertinence of STEM education, fostering a more holistic understanding of these disciplines.**

**Industrial Design education could also benefit from a more explicit focus on nurturing collaboration skills, promoting entrepreneurial aptitude, and expanding the incorporation of emerging technologies such as IoT (Internet of Things), VR (Virtual Reality), AR (Augmented Reality), and software development. Evidence suggests that Industrial Design education excels in delivering these competences in a practical and contextually relevant manner, further underlining its significance. Additionally, there is a growing importance attached to environmental sustainability knowledge and the ability to design for social change within the realm of Industrial Design education. However, it is noteworthy that cultural literacy, particularly in areas like design history and design theory, appears to be on the decline. In this context, libraries are emerging as informal**

**educational settings capable of providing agile support for the formal education process in Industrial Design. The literature underscores the pivotal role of Industrial Design education in shaping individuals with the competences required to thrive in the 21st century. This encompasses not only professionals in the field but also individuals equipped with the ability to adapt, innovate, and collaborate effectively in an ever-evolving world. It is imperative to recognise the enduring value of Industrial Design education as a cornerstone for the development of these crucial competences.**

## STEM, STEAM, and HASS

**Many authors highlight the importance of STEM skills and knowledge for upcoming decades (Education Council, 2015; UK Government, 2018; Australian Government, 2018; Hong Kong Government, 2016). Some authors insist that STEAM (Science, Technology, Engineering, Art and Mathematics) skills and knowledge are even more relevant (Taylor, 2016, p. 91-92; RISD, 2018; US House of Representatives, 2013), while others assert the importance of balancing STEM skills and knowledge with HASS (Health, Arts and Social Science) skills and knowledge (ISA, 2017).**

**STEM skills are valued because workers and community members will need them in order to comprehend accelerating technological development because they are believed to boost Gross Domestic Product (GDP) through the generation of innovative technologies, and because STEM-related job opportunities are currently rising at a faster rate than most other job types and this is projected to continue (ISA, 2017, p. 2; Education Council, 2015). Some areas of STEM, however, such as computer programming and human-**

**machine interactions are likely to become more intuitive, more user friendly, and less technical over the next decades so may soon become more accessible to those with less technical interests (Hajkowicz et al., 2016).**

**Durrant-Whyte (2015) claims that the STEM skillset is too abstract to be broadly beneficial to society unless it is taught in an applied, contextual, meaningful manner (p. 29). He states that STEM should be taught through "architecting, designing and analysing" rather than as a purely hard skillset. Nesta, the UK's global innovation foundation, the United States' House of Representatives, the Rhode Island School of Design, and Taylor all assert that STEM knowledge can only be rendered meaningful and contextual with the addition of A for Art, making it STEAM (Taylor, 2016, p. 91-92; RISD, 2018; US House of Representatives, 2013). In 2013, the United States House of Representatives resolved to add Art and Design into STEM programs. The following are extracts from the resolution:**

> ***"Expressing the sense that adding art and design into Federal programs that target the Science, Technology, Engineering and Mathematics (STEM) fields encourages innovation and economic growth in the United States"***
>
> ***"Whereas artists and designers are playing an integral role in the development of modern technology"***

**Beitz (2015) suggests that STEAMED may be an even more appropriate skillset to aspire to, with D standing for Design and E standing for Entrepreneurship (Beitz, 2015, p. 163). This emanates from research and policy, nominating innovation and**

**entrepreneurship as important competences for the coming decades (Kuratko, 2009; Zhao, 2012; Hajkowicz et al., 2016, p. 9). Finally, Innovation and Science Australia, in its report Australia 2030 Prosperity through Innovation (2017), goes one step further to say that Australian education must nurture the combination of STEM with both HASS and interpersonal skills. This is further affirmation of the idea of the well-rounded citizen.**

## Entrepreneurship

**Australian Government policy is supportive of entrepreneurship, especially when business endeavours centre around innovation (ISA, 2017). The 2015 National Innovation and Science Agenda Report suggests that Australia needs to create a culture accepting of risk taking and mistake making are vital ingredients of entrepreneurship (NISA, 2015). The Department of Industry Innovation and Science goes so far as to suggest insolvency laws be adjusted to assist risk-taking entrepreneurs (Australian Government, 2018). Phillips (2015) points out that entrepreneurs need to be multi-disciplinarians as industrial designers have been shown to be (WDO, 2018; NASAD, 2020, p. 125-126), and the Industrial Design competences authors associate entrepreneurship with Industrial Design very strongly (WDO, 2018; Lewis & Bonollo, 2002; NASAD, 2020; Yang et al., 2005; Erkarslan et al., 2011; Goatman & Moody, 2014; Gunes, 2012), implying that Industrial Design education is well suited to imparting desired entrepreneurial learning. The Australian Government believes that supporting collaboration between educational institutions and industry is a powerful way to drive innovation and develop impactful real-world solutions (ISA, 2017). Collaboration with industry is something Industrial Design education is well suited to because Industrial Design is a**

**profession originally created to serve and partner with industry (Zukowsky, 2017; UK Design Council, 2021).**

## Entrepreneurial learning

**Several theorists espouse the high importance of entrepreneurial learning in schools (Zhao, 2012; Mitchell institute, 2017). Industrial designers of coming decades will need to work towards environmental preservation and will need to be knowledgeable about green technologies, new green materials and principles such as regenerative design or dematerialised design. Good policy and good education will be needed to support this.**

**Industrial designers may need to be resourceful post-pandemic and in the face of other potential geopolitical disturbances because of the low resilience of design professions to adverse conditions. However, they may find that more manufacturers move back to Australia post-Pandemic and this may improve their work prospects. Industrial designers may also need to reskill often as their jobs metamorphose or they may need to move their skillsets across to related or even unrelated disciplines. Industrial Design graduates of coming decades may apply their design skills to designing social and structural systems to counterbalance extreme technological change, or in a post-work scenario, they may focus on designing cultural and recreational artefacts, or designing and making for themselves.**

**In work done by Deighton (2022), she evaluated the top competences deemed of high priority for the 21st century comparing with the top Industrial Design competences as identified in the literature. This is summarised in the two tables below:**

| Top 21st century competences | Top Industrial Design competences |
|---|---|
| Creativity | STEM |
| Problem solving | Entrepreneurial capability |
| Collaboration | Problem solving |
| Innovation | Creativity |
| Digital skills / connectivity | Interpersonal skills |
| Entrepreneurial capability | Empathy |
| Critical thinking | Communication skills |
| Adaptability / flexibility | Digital skills / connectivity |
| Communication skills | Literacy |
| STEM or STEAM | Critical thinking |
| Interpersonal skills | Environmental sustainability knowledge |
| Cultural literacy | Innovation capability |
| Environmental sustainability knowledge | Collaboration |
| Global outlook | Ethical understanding |
| Leadership | Cultural literacy |
| Literacy | Organisational skills / project management |
| Learning to learn | Learning to learn |
| - | Research skills |

***Fig 1. The top competences deemed of high priority for the 21st century comparing with the top Industrial Design competences as identified in the literature.***

**Although there are biases inherent in these lists of top competences generated from the literature, information gathered here provides a reference point and highlighted the so-called 'soft**

**skills' required for the future workforce. Importantly for Industrial Design, we see significant emphasis on entrepreneurial capability showing the important of this competence in developing an entrepreneurial mindset for designers.**

**Considering the high regard placed on entrepreneurial learning by authors focusing on 21st century competences, and recognising the unique position of Industrial Design education among disciplines — one that is not strictly a business-oriented discipline yet closely aligned with the needs of manufacturing and distribution industries — it becomes evident that Industrial Design education, across various levels, is exceptionally well-suited for imparting essential entrepreneurial knowledge to students. Entrepreneurial capability represents a pivotal attribute within the realm of Industrial Design, and the inclusion of entrepreneurial learning emerges as a natural and pertinent component of Industrial Design education, making it an ideal curriculum for fostering valuable entrepreneurial competences. In the context of these significant 21st century competences, several noteworthy aspects come to light. Firstly, there is a growing awareness of the escalating importance of imparting environmental sustainability knowledge to students pursuing Industrial Design education. Secondly, there is a proposition that greater emphasis should be placed on integrating entrepreneurial learning into the curriculum of Industrial Design education. Thirdly, there exists a need for a broad and comprehensive approach to STEM education within the realm of Industrial Design. Fourthly, Industrial Design education demonstrates the potential to equip students with crucial personal qualities, adaptability, flexibility skills, and essential life skills. Lastly, there is a discernible trend indicating a decline in cultural literacy learning within the domain of Industrial Design education.**

**Each of these elements contributes significantly to advancing our understanding of Industrial Design education in Australia.**

**It is worth noting that while some sources suggest that entrepreneurial learning need not be frequent, the inherent nature of Industrial Design learning positions is ideally for delivering relevant and contextually grounded entrepreneurial education. This approach is undeniably beneficial for students, therefore, should be actively pursued. At the university level, the entrepreneurial learning gap appears to revolve around the ability to transform design ideas into profitable ventures, which necessitates universities to cultivate strong relationships with collaborators and develop projects where students can bring simple concepts to market.**

**Turning our attention to the relevance of Industrial Design education itself, it is foreseeable that there will be heightened demand for industrial designers in Australia, driven by potential increases in manufacturing activities post-pandemic and expanding opportunities for individuals to engage in entrepreneurial design and manufacturing. However, Industrial Design education goes beyond preparing future industrial designers; it equips individuals, including entrepreneurs, manufacturers, and consumers, with insights into the products they will conceive, fabricate, distribute, use, and eventually dispose of. Consequently, Industrial Design education deserves acknowledgment from policymakers and educational leaders for its role in delivering essential 21$^{st}$ century competences and educating students about the products that shape their surroundings, irrespective of their future career paths.**

**Industrial Design education should be recognised as one of the**

**most effective platforms for instilling crucial entrepreneurial capabilities in students across various educational levels. This approach aligns perfectly with the educational framework as it provides a structured pathway for identifying and addressing real-world problems, opportunities, and needs, ultimately yielding valuable outcomes. Potential models at different educational levels include introducing concepts of entrepreneurship and mock financial transactions in primary schools, connecting secondary school students with community groups for real-world projects that do not disrupt their assessment systems, and offering tertiary students insights into actual business models they may later engage with professionally. Furthermore, community and government grants should be made accessible to support the additional time and resources sometimes required for implementing such programs. Additionally, Industrial Design education can play a prominent role in the delivery of STEAM education. STEAM, known for its engaging approach to imparting valuable STEM skills and knowledge, can also serve as a more appealing avenue to involve females in lucrative STEM fields (RISD, 2018; Taylor, 2016, p.91-92). Moreover, STEAM-related occupations may prove to be less susceptible to automation, making Industrial Design education and STEAM education valuable contributors to contemporary student development.**

## Conclusion

**Industrial design education is uniquely positioned to impart vital 21st century competences, especially entrepreneurial capabilities. As the world continues to evolve, Industrial Design education should be recognised as a crucial avenue for equipping students with the skills and knowledge necessary for success in a dynamic and interconnected 21st century landscape. By embracing**

**entrepreneurship and multidisciplinary collaboration, Industrial Design education can contribute significantly to the development of competent and adaptable individuals ready to tackle the challenges and opportunities of the modern world.**

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