How Design Thinking can make STEM education thrive in the AI era

Maria Vieira

In a time where ChatGPT enables students of secondary and tertiary levels to create assignments with just a single click, a pertinent question arises: how do we cultivate critical skills and authenticate their work? Design Thinking offers solutions to these challenges. This article explores the impact of Design Thinking in addressing the issues posed by AI and global digitalisation in STEM education, drawing inspiration from the 'Co-Creating Community Connections' exhibition in Adelaide, South Australia.

In an age increasingly dominated by Artificial Intelligence (AI), we find ourselves grappling with new questions about the nature of education. Students of secondary and tertiary levels are now confronted with dilemmas: Is using ChatGPT for academic purposes considered cheating? What is the simplest route to achieve a passing grade? If a peer successfully uses AI for their assignment, is it acceptable for others to follow suit?

Amidst these challenges, we, as educators, recognise our pivotal role in cultivating strong critical and creative thinkers who will be capable of successfully addressing these dilemmas. These individuals must be adept at utilising new technologies to succeed beyond the classroom. A significant hurdle is that AI can obscure the genuine critical thinking in students' work. How do we effectively evaluate these skills when AI can create a seemingly convincing illusion of critical or creative thought? This is where Design Thinking comes into play.

In the past decade, the global educational community has shown significant interest in incorporating Design Thinking into classroom teaching. Yet, a comprehensive analysis of how this approach might shape the future of education, particularly in the context of rapid advancements in AI and digitalisation, remains largely unexplored. A recent visit to the "Co-Creating Community Connections" exhibition at the Kerry Packer Civic Gallery in Adelaide, South Australia, highlighted how Design Thinking could effectively address key challenges posed by technologies like ChatGPT.

Curated by Match Studio, an innovative learning space at the University of South Australia, the exhibition features a selection of projects developed in the studio in recent months. Since 2010, Match Studio has championed interdisciplinary projects where teams comprising students, academics, researchers, industry professionals, and community members collaborate to devise creative solutions for real-world problems using Design Thinking and other innovative methodologies.

Although not its primary focus, I found that the exhibition provided an ideal backdrop to highlight the significance of Design Thinking in addressing the challenges posed by AI and digitalisation in education. Amid continuous debates about generative AI, particularly following the emergence of ChatGPT, there has been a necessary re-evaluation of how we design, deliver, and assess educational methods and student performance in various settings. Although originally developed for tertiary education, this example highlights Design Thinking's potential applicability in K-12 education, especially within STEM disciplines. The reflections shared in this article aim to guide educators in all settings to understand Design Thinking beyond a simple buzzword and emphasize the urgent need for its effective implementation in K-12 classrooms.

Developing critical skills

In the past, technology evolved slowly, allowing time for adaptation. Now, AI is changing the world at an exponential and unpredictable pace. The digitisation of the world presents a multitude of intricate problems, and education plays a fundamental role in preparing future generations for these challenges (Shah, 2023). Therefore, stimulating inherently human skills that AI cannot replicate – such as creativity, critical thinking, and collaboration – is imperative (Cropley, 2020). At the same time, it is forecasted that the automation of work brought about by AI will alleviate teachers' workload, allowing them more time to focus on developing these capabilities. As educators, we are all eager for this time to come. But how do we know what strategies should be put in place to appropriately develop those capabilities in the classroom?

Design Thinking offers an answer to this problem, as it integrates a human-centric approach and a curiosity-driven framework easily adaptable to problem-based learning strategies in STEM disciplines across any K-12 classroom. Typically, the Design Thinking process includes five stages: empathy, definition, ideation, prototyping, and testing (Kelley & Kelley, 2013) – illustrated in Figure 1, which teachers can use to help students navigate complex problem-solving processes. However, my objective in integrating Design Thinking into my teaching practice goes beyond merely instructing students to memorize a framework. I focus on instilling in them a Design Thinking mindset. This encompasses the ability to take risks, manage uncertainty, learn from failure, and work collaboratively – all intrinsically human capabilities that AI cannot replicate.

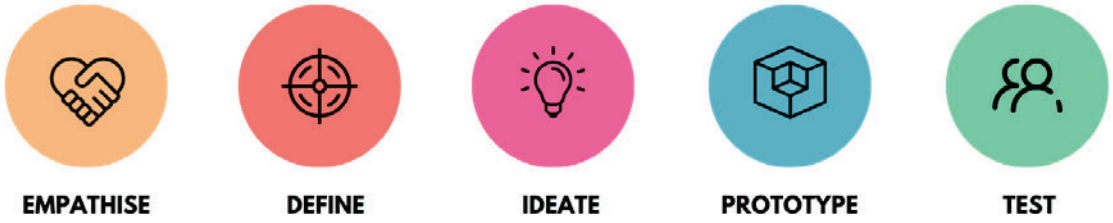

Figure 1 The Design Thinking process includes five stages, which teachers can use to help students navigate complex problem-solving processes.

The exhibition 'Co-Creating Community Connections' demonstrates the power of human-centric complex problem-solving through Design Thinking and showcases the development of capabilities critical in the era of AI. The challenge posed to students focused on developing innovative solutions to collaboratively support the mental well-being and resilience of South Australian communities. Although different groups developed varied solutions to the same problem, a primary aspect that caught my attention during the visit to the exhibition was the observation that many of the student-proposed solutions were grounded in offline experiences.

With such easy access to digitalised tools, it is common for students to assume that all problems experienced by people can be solved through the development of a new app. However, given that the central theme of the challenge posed by Match Studio was connectivity, many groups opted for incorporating offline, real-world interactions between community members, where the primary audience they chose to help consisted of elderly individuals or young children. Examples of such projects are CURIO, a scrapbooking initiative designed to encourage students at a public school to engage in more active and creative pursuits, and Doug, a teddy bear created to assist children coping with experiential avoidance – which is illustrated in Image 1. Those examples underscore how Design Thinking, with its emphasis on empathy, is capable of fostering innovation and developing critical capabilities in students with a human-centric lens—that is, prioritising people and their needs.

This approach can be adapted for K-12 classrooms, where students simultaneously address issues that are both STEM-related and human-centric. The process starts with teachers defining a problem to be solved, drawing inspiration from global challenges such as climate change, or collaborating with industry to identify more practical issues. It is also the role of teachers to determine the duration of the Design Thinking process, which could span a single class, a week, or an entire term, depending on their schedule. Although this might seem like a significant effort, it actually reduces the teacher's workload by shifting their role from lecturer to facilitator. This change allows students to lead their own learning, actively engaging in and directing their educational journey.

Although each problem in the Design Thinking process should be unique, students can intuitively navigate each phase with teacher guidance. In the empathy phase, they are invited to research the audience affected by the problem through interviews, videos, and digital resources, focusing on their feelings. The definition phase involves critical thinking to identify the problem's root cause and formulate research questions. During ideation, students will employ divergent and convergent thinking to generate solutions. In the prototype and test phases, they build and assess a model, analysing it for future improvements. This iterative process involves constant collaboration, teaching students that real-world solutions are always evolving and can be refined. In this context, Design Thinking provides a flexible framework that fosters the development of a mindset open to ambiguity and experimentation. This not only enhances students' understanding of STEM but also develops their STEM-thinking skills.

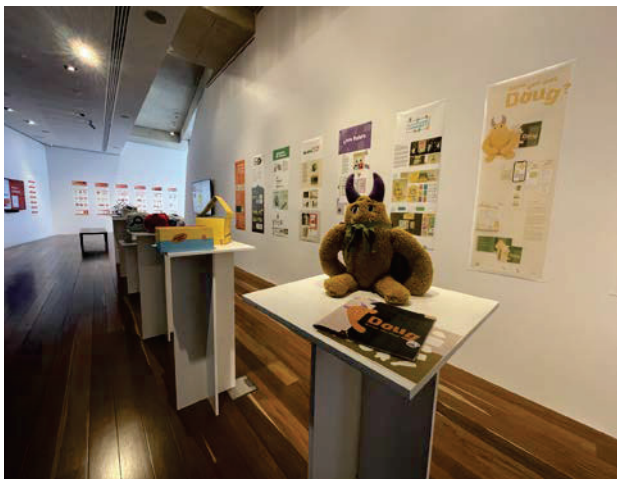

Figure 2 Addressing creativity and complex problem-solving through human-centric lens: Prototypes displayed at the "Co-Creating Community Connections" at the Kerry Packer Civic Gallery in Adelaide, South Australia

Authentic forms of assessment

Another complex problem faced by educators with the rise of AI is the need to rethink the way we assess students. If essays can be produced with just a single click, how can we ensure the authenticity of what we are evaluating? Design Thinking facilitates the shift from summative to formative assessment methods. In other words, finding ways to assess students throughout their learning process may be a solution to address integrity issues posed by generative AI.

As Design Thinking comprises several phases – empathy, definition, ideation, prototyping, and testing (detailed in Figure 1) – each step provides a specific outcome to be achieved. This structure allows educators to monitor students' progress and make necessary interventions, assessing them through several touchpoints across the process, which can easily span periods ranging from a single class to an entire term or year. It is important to remember, though, that while the outcomes are indicators of how students are progressing, Design Thinking should be interpreted as a non-linear process. That is, students should have the autonomy to revisit or advance through these steps as they deem necessary.

Because Design Thinking projects lead to a multitude of different outputs, progressing through the phases facilitates formative assessment at both individual and group levels. Individual evaluation can occur through research or self-reflection pieces, fostering motivation and a sense of ownership over the learning process. Teachers can also assess collaborative work through prototypes, mind maps, or presentations. Furthermore, observations become feasible as teachers can shift their focus from delivering content to observing students in the classroom, thereby being more attentive to their development and integrating these observations into the assessment process.

Embracing formative assessment also facilitates prompt feedback, which aids students in recognising their strengths and weaknesses, allowing them to make improvements and adapt their learning strategies. Feedback can be provided not only by teachers but also by peers. Encouraging students to view and reflect on other projects also helps them develop their critical thinking and collaboration skills. Teaching them how to provide feedback is vital and should be presented in a positive manner to promote collaboration and achievement. A simple method used in Design Thinking practice is the "I like... I wish" format, where areas for development are seen as opportunities for student reflection and growth (Kelley & Kelley, 2013). A practical activity to implement a feedback loop in the classroom involves prompting students to offer feedback on their peers' prototypes. For each prototype presented, students should write two notes: one highlighting a positive aspect ("I like") and another suggesting an area for improvement ("I wish"). This method transforms feedback into a form of formative assessment, fostering critical thinking. Students are not only encouraged to construct meaningful feedback but also to evaluate whether the feedback received should be integrated into their solutions, thereby enhancing the learning experience.

Design Thinking also offers a straightforward method for assessing interdisciplinary projects, enabling students to engage with authentic contexts and problems. Complex problems are rarely confined to just one discipline; thus, an interdisciplinary approach often leads to a more profound understanding of the world. This approach is particularly critical in the fields of STEM, as it provides cohesive and applicable learning experiences (Lee, 2018). In this context, teachers can collaborate on project implementation while assessing outcomes specific to each discipline. However, this integration does not necessarily need to be limited to STEM disciplines only, as Design Thinking allows for flexibility to include a wide range of other subjects. For instance, pitch presentations might be evaluated in Language or Arts subjects, and cost estimation could be a topic in Mathematics. Finally, interdisciplinary projects help not only to alleviate teachers' workload but also set visible examples for students, highlighting the benefits of fostering collaboration.

Figure 3 Students working at Match Studio: A multitude of outputs is generated once students advance in the Design Thinking phases, which facilitates the easy implementation of formative assessment.

The project developed by Match Studio, which resulted in the exhibition, serves as a great example of how Design Thinking can enrich formative assessment. The exhibition showcases the work of multidisciplinary groups, including both undergraduate and postgraduate students – illustrated in Figure 3. Assessments were conducted on both an individual and a group basis, tailored to the expected competencies at their respective academic levels. The formative assessments comprised individual research on the problem related to their field of study, group presentations, and active participation in class. Lecturers, peers, and industry professionals were encouraged to provide timely feedback in each session. More importantly, the outputs of the project—the inherently human-centric solutions the students produced—are impossible to achieve with AI. This method ensured a thorough and developmental assessment of every student participating in the project, ensuring the authenticity of the produced outputs, and minimising the risk of integrity concerns.

In conclusion, the education sector must prepare for a world that is continuously changing due to digitalisation. While Design Thinking may not be the only solution for the future of education, it is undoubtedly a successful strategy that can be readily adopted across K-12 education systems to address some of the most pressing challenges associated with AI and global digitalisation. The 'Co-Creating Community Connections' exhibition exemplifies the profound and multifaceted transformative potential of Design Thinking within a tertiary education context, serving as a prime example of how these concepts can be effectively transferred to K-12 education. Despite the rapid evolution of AI and its ongoing impact on education, this methodology currently provides educators at all levels with a flexible and pragmatic approach to be implemented in the classroom. Practically, it aids in the crucial shift from summative to formative assessments. Conceptually, it plays a critical role in nurturing human-centric competencies that AI cannot emulate. This approach not only ensures that STEM education stays relevant and adapts in line with AI's continuous advancements but also highlights the fundamental role of this methodology in preparing students for a world increasingly shaped by AI's complexities. The wider adoption of Design Thinking in classrooms across all grades offers a strong argument for making education more engaging and pertinent to real-world scenarios.

Learn more about the "Co-Creating Community Connections" exhibition https://www.unisa.edu.au/connect/hawke-centre/events-and-exhibitions/exhibitions/2023/exhibition-match-tournament/

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