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Decoding Design Thinking: Deepening the Lens on Values and Capabilities

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Abstract

Design thinking is widely recognised as a fundamental aspect of technology education, yet its meaning remains inconsistently applied across research, policy, and classroom practice. The term has been used to describe a broad spectrum of activities, dispositions, and cognitive processes, and these interpretations often vary substantially between contexts. As a result, the field lacks a well-defined and commonly accepted framework that can support meaningful connections between design thinking and the broader aims of technology education. Previous research has attempted to address this issue by identifying common trends in the use of design thinking and by grouping its characteristics into a set of components. From this work, eleven components have been proposed, organised across two levels: technical components, which relate to processes and actions involved in designing, and value- and capability-focused components, which capture underlying attitudes, dispositions, and ways of engaging with complex design problems. Due to the nature of the previous study being a rapid review, only a surface level identification of components was developed. This paper extends the earlier research which only provided a broad overview by providing a deeper and more nuanced exploration of the value- and capability-focused components. Drawing on a review of the literature, this paper analyses these components and examines the ways in which they manifest within common practices in technology education. In doing so, the paper highlights how value- and capability-based aspects of design thinking support authentic engagement in technological problem-solving and strengthen alignment with curricular priorities. Ultimately, the paper seeks to clarify the nature and significance of the value- and capability-focused components of design thinking, providing insights that can inform future research, support pedagogical practice, and contribute to the development of a more coherent and commonly understood framework for design thinking in technology education.

Key Words: Design Thinking, Values, Literature Review

1 INTRODUCTION

Design has long been seen as a core part of technology education (Baynes, 2006; Stables, 2008), and the term design thinking has become a prominent feature of contemporary technology education discourse, which can be seen reflected in the title of the subject in certain countries (Design and Technology in the UK) as well as in the title of leading journals in the area (*International Journal of Technology and Design Education*, *Design and Technology Education: An International Journal*). This is especially true in the Irish secondary level educational system (NCCA, 2019a, 2019b). It is often argued as a core means through which learners engage with technological problem-solving, innovation, and creative practice. Across literature and curricula, design thinking is used to describe a wide range of activities, processes, and viewpoints, from structured and iterative cycles to broader ways of thinking about users, systems, and contexts. In practice, design processes generally focus on the development of technological systems or artefacts. While this wide array of uses reflects the perceived value of design thinking within technology education, it has also contributed to increasing uncertainty around what the term actually represents.

This lack of clarity poses challenges for both research and practice. When design thinking definitions vary, it can become difficult to develop commonalities of learning goals, to design appropriate pedagogical approaches, or to assess learning outcomes validly. In technology education in particular, design thinking is sometimes reduced to a sequence of steps, emphasising the completion of design tasks over a deeper engagement with the values and capabilities that underpin authentic design. Such a procedural viewpoint risks hindering the educational purpose of design thinking and limiting its potential to support complex, real-world problem-solving.

Previous research has aimed to address this issue by analysing how design thinking is described and applied across the literature, resulting in the identification of eleven commonly occurring components (Maquet et al., 2025). These components were organised into two categories: technical components, which relate to the procedural actions involved in designing, and value- and capability components, which capture underlying values, attitudes, and ways of dealing with complexity. While this initial identification of components provided a useful starting point, the rapid review methodology employed limited the depth of analysis that could be conducted. Building on this earlier work, this paper seeks to expand the understanding of design thinking by exploring selected value- and capability-focused components in greater detail. By conducting a review of the earlier-identified literature, the paper examines how these components are currently framed and how they may manifest within technology education. In doing so, it argues that the value- and capability-based aspects of design thinking play a critical role in supporting authentic technological problem-solving and in aligning design learning with broader curricular priorities. This paper seeks to strengthen the understanding of design thinking components and their potential utility at secondary level, such that future research regarding its implementation may have a clearer methodological starting point. In practice, it is vital that educators are provided with clear frameworks to guide teaching and learning, such that implementation and assessment of these methods may be clear to both learners and teachers, this paper offers an initial step in this important clarification.

2 METHODS

This paper presents a narrative literature review based on the analysis of a dataset previously compiled through a rapid review of design thinking models. The original rapid review (Grant & Booth, 2009), conducted by Maquet et al. (2025), initially retrieved 1929 records, which through screening then reduced to 124, using the following search strings:

SCOPUS: TITLE (("design*" OR "creativ*") AND ("Think*" OR "capabil*" OR " competenc*" OR "abil*" OR "liter*") AND ("framework" OR "model*" OR "tool" OR "structure" OR "paradigm*" OR "method*" OR "process*" OR "component*" OR "element*" OR "dimension*" OR "stage*" OR "phase*" OR “review”)) AND PUBYEAR > 2020 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))).

Web of Science, with the same limitations as above included: TI=("design*" OR "creativ*") AND TI=("Think*" OR "capabil*" OR " competenc*" OR "abil*" OR "liter*") AND TI=("framework" OR "model*" OR "tool" OR "structure" OR "paradigm*" OR "method*" OR "process*" OR "component*" OR "element*" OR "dimension*" OR "stage*" OR "phase*" OR "review").

The PRISMA guidelines were adhered to for the literature search (Moher et al., 2009), which was conducted on 28/5/2025. Full information on the literature search can be found in the original paper.

These 124 articles described design thinking models either conceptually or in use.

The included articles were analysed through a narrative thematic analysis using an inductive approach. Full texts were read to identify the models used, and each term used in these models was extracted. After all terms were extracted, these were examined and grouped into emerging interpretive themes. During this, attention was given to similarities, differences, and contradictions. These patterns informed the development of the overarching themes. From the eleven design thinking components identified in the rapid review, this paper focuses on the subset of five value- and capability-focused components. These components were selected due to their relevance to educational aims in technology education and due to their lack of exploration in the previous paper. Descriptions were developed to explain how value- and capability-focused components were framed, named, and enacted within the various models. Attention was given to the terminology used to describe these components, the purposes they served in the model, and the ways in which designers (learners) engaged with them. As a narrative review, this analysis does not seek to provide an exhaustive account of all design thinking literature. Rather, it aims to generate a deeper insight into selected components by examining patterns across studies. GenAI was used only for the purpose of copyediting the paper before submission.

3 VALUE AND CAPABILITY COMPONENTS

3.1 Understanding Users and Perspectives

During the initial rapid review process, a range of terms were collated into the component of 'understanding users and perspectives', including *empathise* and *empathy (both of which were quite prominently observed), create alter egos, perspective discovering, point of view,* and *user-centredness.* A clear and recurring theme emerged around understanding users within design thinking, which was a prominent feature across most examples reviewed. The human-centred nature of design thinking places empathising with users as a component of central importance (He et al., 2023) The dominant terms of *empathise* and *empathy* were consistently associated with developing "a deep understanding of the needs of the users involved in the solution that has been developed, as well as of their environment" (Yedra & Aguilar, 2022, p. 6), with researchers emphasising that "being able to understand how people feel is critically important" (Montero, 2023, p. 157). Core processes of developing empathy include interviews, questioning, conversations, and observations in order to understand the users' experiences and needs (Castiblanco Jimenez et al., 2021; Moffett & Cassidy, 2023; Pondelíková, 2023). While the lesser-used terms varied in wording, they remained conceptually consistent. For example, *create alter egos* referred to the generation of personas and scenarios in order to guide the design activity by providing a concrete user focus (Arvanitakis et al., 2025). *Perspective discovering* was quite unique in its application to teachers, offering opportunities to tailor the design thinking process to learners' needs, while still emphasising user understanding (Elwood & Jordan, 2022). The term *point of view* described the synthesis of gathered information to form an understanding of user needs (Orliv et al., 2021; Yang & Man, 2021). Finally, *user-centredness* was framed not as a discrete stage, but as an overarching practice and underpinning principle of design thinking (Cai et al., 2023). Although at times structured tasks were utilised, it is important to note that the purpose of these tasks was to develop empathy as a capability within the learners, rather than to complete a task on empathy.

3.2 Collaborative Engagement

While reviewing the literature another clear component began to develop, that of collaborative engagement. Collaboration and engagement, with others, were seen to be core elements of design thinking, from the perspective of epistemic development. Worapun and Nuangchalerm (2024), while using the term *explanation*, discuss the importance of collaboration for the sharing of knowledge, and promotion of critical thinking. Similarly, Van Uffelen et al. (2024) discuss the importance of gaining a wide range of perspectives under the terms *interdisciplinary teams and knowledge*, and *active participation of multiple stakeholders*. Gaining differing viewpoints from a wide range of stakeholders is important not only for representation purposes, but to "capture and integrate divergent perspectives and inspirations into a holistic viewpoint to generate creative ideas and solutions" (Cai et al., 2023, p. 4). This is captured by Cai et al. under the term *embracing diversity* (Cai et al., 2023). Collaborative engagement is seen to be an important element at all stages of a design process from the initial steps of *collective problem solving* (Ozsoy & Mengüç, 2024) and *brainstorm and share ideas* (Xi et al., 2024), to the later step of *co-creation* (Jarrett et al., 2022). The use of collaborative approaches within design is fundamental to developing ideas

as it provides an opportunity to develop one's ability to engage in design decision-making and design judgement, supporting both collective design outcomes and individual design judgement.

3.3 Reflecting and Reframing

Reflection as a part of iteration can also be seen in existing design thinking models. Aris et al. (2025, p. 5) discuss the use of reflection to allow the designers (learners) opportunities to examine "the entire design process, including challenges, successes, and areas for improvement". The term *reflective reframing* has also been used to describe this process, with the importance being highlighted for both teachers and learners. This entails a designer "thoughtfully drawing from previous stages" (Elwood & Jordan, 2022, p. 1801). Reflecting and reframing is an integral part of design thinking, as it provides opportunities for the designer to critically examine what it is they have done, and how well it achieves the goal of the design. This in turn facilitates redefinition of design problems and supports authentic engagement in an iterative process characteristic of technological practice.

3.4 Developing Social Consciousness and Ethical Awareness

Another core component of design thinking is 'developing social consciousness and ethical awareness' (formerly referred to as 'cultivating design values and awareness'), so that designers (learners) are developing their own values rather than just skills while engaging with design. Worapun and Nuangchalerm (2024) use the term *engagement* to describe how learners engage with real world, local, problems to encourage curiosity and creative thinking. In their model of design thinking, Högsdal & Grundmeier (2021) incorporate the *notice* phase, where learners were asked about their motivation for getting involved. This was done to acknowledge any beliefs that may have an impact on the process. The term *inspire* is used by Sedini et al. (2024), where they discuss the importance of inspiration on the design process so that designers can understand why they are engaging with the process. Arvanitakis et al. (2025, p. 470) use the term *sustainability* to explain the importance of developing learners' awareness of global issues so that they can "understand and respond to complex challenges, such as climate change and responsible citizenship". Together, these terms frame design thinking as a value-laden practice rather than a neutral problem-solving tool.

3.5 Communicating and Sharing Design Work

Many design thinking models incorporate an element of communication somewhere, as it provides a key opportunity for learners to receive critical feedback which may drive their designs forward. Fotaris and Mastoras (2022) use the term *brief* to discuss the need for communication at the beginning of a process, as a way to set goals and expectations. Blundell (2024) simply uses the term *communication* to describe the communication of findings or results at the end of a design thinking process. Park et al. (2022) similarly discusses the sharing of final ideas at the end of a process, by using the term *discourse* to describe this phase added on to the end of a traditional double-diamond model. Thammaariyasakun et al. (2025, p. 139) call this step *presentation* but echo the need for the communication of ideas, arguing that these "offer learners the opportunity to receive expert feedback for future improvements and developments". Under the phrase *communicate and share the results* Xi et al. (2024, p. 2273) explain that "effective communication

of the final results is about telling the story of the project, including the challenges faced, the solutions developed, and the knowledge gained". The terms *document* (Fotaris & Mastoras, 2022), *share* (Högsdal & Grundmeier, 2021), and *design discussion* (Fu et al., 2024) are also used to highlight the need to share an explanation of final designs to others. Fotaris and Mastoras discuss the importance for this discussion, using the term *debrief*, to promote metacognition. It is vital that this communication is not a tick box exercise, but an authentic discussion of design progress so that meaningful learning can occur.

4 DISCUSSION

This paper set out to broaden the understanding of design thinking in technology education by looking at the components that extend beyond procedural aspects of design. The literature review highlights that although many different models of design thinking exist, there is a consistent thread within them that focusses on developing learners' capacities to understand users, collaborate, reflect, develop values, and communicate their work meaningfully. Together, these components place design thinking within technology education as a practice concerned not only with producing solutions, but with developing learners' capabilities, values, and capacity to engage with complex problems.

Within the literature, these components collectively move design thinking away from only being understood as a linear sequence of steps and towards a more interpretive practice impacted by many factors. Understanding users and perspectives emphasises empathy as a capability to develop rather than a task to complete, requiring learners to understand needs, contexts, and experiences in ways that will inform design decision-making. Collaborative engagement further supports this by placing knowledge development as a social act, where ideas are shaped through interaction and exposure to multiple viewpoints. Reflection and reframing extend this by providing learners an opportunity to critically evaluate their design actions, redefine problems, and respond to emerging insights. Together, these components reflect core characteristics of authentic technological practice, where uncertainty is central and adaptation of ideas is key.

The findings of this paper also highlight the value-laden nature of design thinking. Components linked with cultivating design values and awareness demonstrate that designing is not only procedural, but it is shaped by beliefs, values, knowledge of user needs, and broader concerns such as sustainability. When these aspects are actively employed, design thinking can support learners in developing awareness of why they design and what consequences these designs may have. This aligns strongly with curricular goals in technology education that emphasise ethical awareness, informed decision-making, and ability to engage in social and environmental contexts, rather than purely technical efficiency.

Communication and sharing of design work further reinforces the role of design thinking as a learning-centred practice. Within the literature, communication is discussed not only as the presentation of final outcomes, but as an opportunity for feedback, reflection, and metacognitive development. Authentic discussion of design progress, challenges encountered, and decisions made can support learners in articulating their reasoning and in shaping their ideas in response to

feedback. Communication, when engaged with correctly, becomes central to learning through design, rather than something that happens at the end of it.

This review suggests that uncertainty in design thinking terminology isn't problematic in itself, but challenges may arise when design thinking is understood as only procedural steps and disregards underlying values and capabilities. By clarifying how value- and capability-focused components are framed and enacted within the literature, this paper contributes to a more coherent understanding of design thinking that still allows for contextual nuance.

5 CONCLUSION

This paper aimed to expand on existing research on design thinking in technology education by moving beyond surface-level descriptions and providing a deeper examination of selected components. In response to uncertainty around the definition and enactment of design thinking, this paper highlights the importance of focusing not only on the procedural, but also on the values and ways of thinking about designing. These findings suggest that these components play an important role in enabling learners to navigate uncertainty, respond to real world information, and demonstrate autonomy within technological problem-solving tasks. By clarifying how these components are framed in the literature, this paper contributes to the development of a more coherent and commonly understood framework for design thinking. This clarity has implications for future research, particularly in relation to the implementation and assessment of design thinking, and likewise for pedagogical practice and teacher education. However, as this study is limited to a literature-based analysis, further empirical research is needed to explore how these components are enacted in diverse classroom contexts. Another limitation of this study is the short-term, yet broad, view as with the nature of the rapid review. Future work would benefit from being more comprehensive in nature (more than 5 years) and focused solely on technology education for greater clarity. Ultimately, strengthening the conceptual foundations of design thinking in technology education requires consistent attention to what both learners and educators do when engaging with design problems. By deepening the lens on values and capabilities, this paper offers a step towards more meaningful applications of design thinking within the field.

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