JOTE Journal of Occupational Therapy Education

Volume 9 | Issue 1 Article 11

2025

# Design Thinking as a Theoretical Framework to Spark Innovation in Post-Professional Occupational Therapy Doctoral Projects

Jessica D. Asiello
*MGH Institute of Health Professions*

Sunny R. Winstead
*MGH Institute of Health Professions*

# Design Thinking as a Theoretical Framework to Spark Innovation in Post-Professional Occupational Therapy Doctoral Projects


## Abstract

Contemporary occupational therapy (OT) practice is situated within healthcare, education, and community-based systems faced with increasingly complex problems. There is therefore a need to develop OT practitioners' capacity for innovation to influence change. Post-professional Doctor of Occupational Therapy (PPOTD) students are seasoned clinicians with an understanding of the challenges of everyday practice, combined with an intrinsic motivation for professional growth that led to their return to higher education. Thus, PPOTD students are a sub-population of OT practitioners who are uniquely primed for development as innovators. Despite the prevalence of PPOTD programs in the United States, there is limited literature on this area of OT education. We propose that "design thinking," a human-centered approach to creative problem-solving, can provide PPOTD students with a structure and process to facilitate innovation in their doctoral capstone projects. The purpose of this paper is to describe how design thinking is applied as a signature pedagogy in an online PPOTD curriculum. This paper will provide OT educators with 1) knowledge of the historical context and supporting evidence for design thinking in health professions education, 2) an overview of the design thinking process for innovation development, 3) a description of how design thinking was applied as a complementary theoretical framework within an online PPOTD curriculum, 4) implications for future research and educational practice, and 5) specific teaching and learning resources.



## Keywords

Design thinking, innovation, occupational therapy, post-professional, capstone





## Acknowledgements

We thank Sarah McKinnon OT, OTD, OTR, BCPR, MPA, FAOTA, FNAP, Associate Professor, Interim Chair, Department of Occupational Therapy, and Program Director, Post-Professional OTD Program at the MGH Institute of Health Professions for contributions to curriculum development and for manuscript feedback. We thank Amanda Centi, PhD, Senior Manager, Mass General Brigham Emerging Technology and Solutions (MGBETS) for expert consultation on design thinking.

JOTE
Journal of Occupational Therapy Education

Volume 9, Issue 1

# Design Thinking as a Theoretical Framework to Spark Innovation in Post-Professional Occupational Therapy Doctoral Projects

Jessica D. Asiello, OT, OTD, OTR

Sunny R. Winstead, EdD, OTR/L

MGH Institute of Health Professions

United States

## ABSTRACT

Contemporary occupational therapy (OT) practice is situated within healthcare, education, and community-based systems faced with increasingly complex problems. There is therefore a need to develop OT practitioners' capacity for innovation to influence change. Post-professional Doctor of Occupational Therapy (PPOTD) students are seasoned clinicians with an understanding of the challenges of everyday practice, combined with an intrinsic motivation for professional growth that led to their return to higher education. Thus, PPOTD students are a sub-population of OT practitioners who are uniquely primed for development as innovators. Despite the prevalence of PPOTD programs in the United States, there is limited literature on this area of OT education. We propose that "design thinking," a human-centered approach to creative problem-solving, can provide PPOTD students with a structure and process to facilitate innovation in their doctoral capstone projects. The purpose of this paper is to describe how design thinking is applied as a signature pedagogy in an online PPOTD curriculum. This paper will provide OT educators with 1) knowledge of the historical context and supporting evidence for design thinking in health professions education, 2) an overview of the design thinking process for innovation development, 3) a description of how design thinking was applied as a complementary theoretical framework within an online PPOTD curriculum, 4) implications for future research and educational practice, and 5) specific teaching and learning resources.

## Introduction

Occupational therapy practitioners need innovative approaches to tackle the increasingly complex challenges faced daily within our healthcare, education, and community-based systems. Societal issues such as racial and economic disparities, healthcare access, climate change, school violence, food insecurity, and mental health and substance abuse challenges can all affect occupational performance for our clients. Occupational therapy practitioners across practice settings strive to provide high quality evidence-based care while meeting productivity expectations, navigating staffing and reimbursement challenges, and learning new technologies. Creativity, open-mindedness, and critical thinking are necessary attributes to address these and other problems.

Post-professional occupational therapy doctorate (PPOTD) programs offer an advanced degree option for people who have previously earned a bachelor's or master's degree in occupational therapy. There are currently nearly 80 PPOTD programs in the United States (American Occupational Therapy Association [AOTA], 2024). These programs offer experienced OTPs the opportunity to learn advanced skills in leadership, scholarship, and evidence-based practice (Morrow et al., 2020). While there is variability in curricula across PPOTD programs, draft guidelines recommend that all students engage in a culminating doctoral project experience (AOTA, n.d.; AOTA, 2017). The post-professional doctoral project experience offers students opportunities to address problems in professional practice. A survey of 49 PPOTD students at a midwestern university revealed that students often elect to align their doctoral projects with their long-term career goals, most commonly academic roles, advanced clinical skills, scholarship, and program development (Lampe et al., 2020). Despite the prevalence of PPOTD programs, there is limited literature focused on this area of occupational therapy education (Espiritu et al., 2024; Jacobs et al., 2015; Lampe et al., 2020; Morrow et al., 2020). There is a need to explore conceptual models to guide teaching and learning for this unique student population.

Design thinking (DT) is a human-centered approach to creative problem-solving. We propose that DT, in combination with other theoretical approaches, can provide PPOTD students with a structure and process to facilitate innovation in their doctoral project experiences. The purpose of this paper is to provide an overview of DT and current evidence in health professions education and to describe how this theory is applied as a signature pedagogy in an online PPOTD curriculum. Strengths and limitations of DT and its implications for future PPOTD education and research will be discussed.

## Theoretical Concepts

Design thinking is a human-centered approach to creative problem-solving. It was pioneered in the fields of engineering and product design and popularized by Silicon Valley influencers such as the design firm IDEO and Stanford University's Hasso Plattner Institute for Design (known as the d.school; Brown, 2008; Cahn et al., 2016; Luka, 2019; Mollo & Avery, 2017). Several models of DT have emerged over time across academic disciplines and industries (Luka, 2019). One key principle across models is that DT is an iterative process. Brown conceptualized the DT process as a

"system" with three "spaces" – inspiration, ideation, and implementation – that form "the continuum of innovation…rather than a predefined series of orderly steps" (Brown, 2008, p. 4). The Stanford d.school model proposes five "modes" of "empathize, define, ideate, prototype, and test" (Doorley et al., 2018, p. 2).

While the Brown and Stanford models are both used in health professions education (Luka, 2019; McLaughlin et al., 2019), our program made an intentional choice to include implementation as a sixth component in our DT approach (see Figure 1). We feel this additional element promotes actionable outcomes for graduates and increases the likelihood that our students' work will lead to improvements in occupational therapy practice and/or contributions to the occupational therapy scholarly literature.

Empathy for the end user is always at the heart of DT. We find this congruent with occupational therapy's person-centered approach to care. With its emphases on open-mindedness and rapid prototyping and testing of new ideas, DT also has a "bias towards action" (McLaughlin et al., 2019, p. 2), another characteristic that we find fitting for occupational therapy practitioners, who value learning by doing (Krishnagiri et al., 2019; Schaber, 2014).

## Design Thinking in Health Professions Education

Design thinking has expanded its influence in health professions education and is an emerging area of scholarship. A qualitative scoping review of 15 articles from 2009-2019 summarized diverse applications of DT in medicine, nursing, and allied health professions (McLaughlin et al., 2019). Seven of the 15 articles were peer-reviewed research or theoretical positions; the remainder were conference proceedings or commentary. Two of the studies reviewed examined the use of DT to facilitate problem-solving, although specific outcomes were not identified or discussed. Other DT applications included program or course development and learning activities like lectures and small group discussions. Despite the small body of literature and its heterogeneous methodologies and contexts, the authors concluded that DT has potential benefits for health professions education, specifically for promoting student self-efficacy, positive learning experiences, and the ability to generate solutions to specific problems (McLaughlin et al., 2019).

Recent publications on DT in the health professions have focused on medical and pharmacy schools, including conceptual and practical recommendations for the development of new products, curricula development, and promotion of critical thinking skills in students (Hutchinson, 2021; Sandars & Goh, 2020; Wolcott & McLaughlin, 2020; Wolcott et al., 2021). There are also studies describing and/or evaluating the use of DT for specific curricular projects in medical education. For example, Fish and colleagues (2022) described the re-design of a social determinants of health screening using DT to engage students and faculty stakeholders. Guo and colleagues (2024) described the use of DT principles to update teaching modules and instructional practices at a medical school in China. In both cases, the authors reported positive outcomes, including increased student satisfaction with the curriculum (Fish et al., 2022) and improved student learning outcomes (Guo et al., 2024).

There is limited literature on the application of DT within occupational therapy. One entry-level occupational therapy program described an interprofessional design-thinking-based "hackathon" to address toy, game, and playground design problems, as well as hospital-based design problems (Mollo & Avery, 2017). Another entry-level occupational therapy program applied DT in a lesson on adaptive driving (Schultz-Krohn et al., 2019). An anecdotal report from an occupational therapy faculty member described using DT in master's and doctoral-level assistive technology coursework (D. Jackson, personal communication, October 25, 2021), and an unpublished PPOTD dissertation proposed an entrepreneurship continuing education course guided by DT processes (Jordan, 2020).

Notably, across all health professions literature, there is a paucity of evidence on the application of DT to doctoral or capstone project experiences. An entry-level OTD textbook cites IDEO's *Field Guide to Human-Centered Design* (2015) as a guiding organizational framework for capstone projects but does not provide specific DT-oriented learning activities and does not discuss capstone projects specifically for PPOTD learners (DeLuliis & Bednarski, 2020). This paper will describe the application of a DT framework in a PPOTD program to cultivate creative problem-solving skills in clinician-scholars and thereby facilitate innovative solutions for change in professional practice settings.

## Design Thinking as a Signature Pedagogy for a PPOTD Doctoral Project

Our online PPOTD program is based in a northeastern United States graduate institute for health professions. Students engage in five seminar courses to develop their doctoral project (called "The Innovation Project" within our program), while concurrently taking core coursework. Doctoral project mentorship is individualized and includes an interprofessional team of faculty and expert scholars. All learning activities and resources are available asynchronously through the course management platform. In addition, synchronous virtual classes and mentorship are an integral part of the program.

Design thinking principles and activities—along with elements of other theoretical frameworks--were intentionally built into each of the five seminar courses that support students' doctoral project development. Figure 1 illustrates the DT process as applied in our PPOTD curriculum, merging the Stanford d.school model's five modes of empathize, define, ideate, prototype, and test, with the Brown model's space of implementation (Brown, 2008; Doorley et al., 2018). Figure 2 illustrates how our PPOTD program aligns the iterative, non-sequential stages of the DT process with the linear structure of the academic semester calendar.

Shulman (2005) introduced the concept of "signature pedagogies" in higher education to describe teaching processes that are unique to professional disciplines (p. 52). Signature pedagogies involve concrete knowledge as well as "how things become known" (p. 54). Schaber (2014) proposed that signature pedagogies for the OT profession include (1) relational learning, or learning through human connection, (2)

affective learning, which transforms personal identity, values, attitudes, and beliefs, and (3) highly contextualized active engagement, or learning by doing. Both Shulman (2005) and Schaber (2014) proposed signature pedagogies in the context of educating novice practitioners, whereas PPOTD learners are experienced OT practitioners.

For this paper, we are applying the term “signature pedagogy” at the level of our PPOTD program. We propose that DT is a signature pedagogy in our PPOTD doctoral project experience since it provides a distinct approach to teaching innovation, as well as “a process, way[s] of thinking, [and] creative problem-solving” (Schaber, 2014, S43). The remainder of this section describes the relationships between the DT theoretical framework, didactic content, instructional techniques, and application activities in our doctoral project sequence.

**Figure 1**

*Illustration of the Design Thinking Process as Applied in Our PPOTD Curriculum*

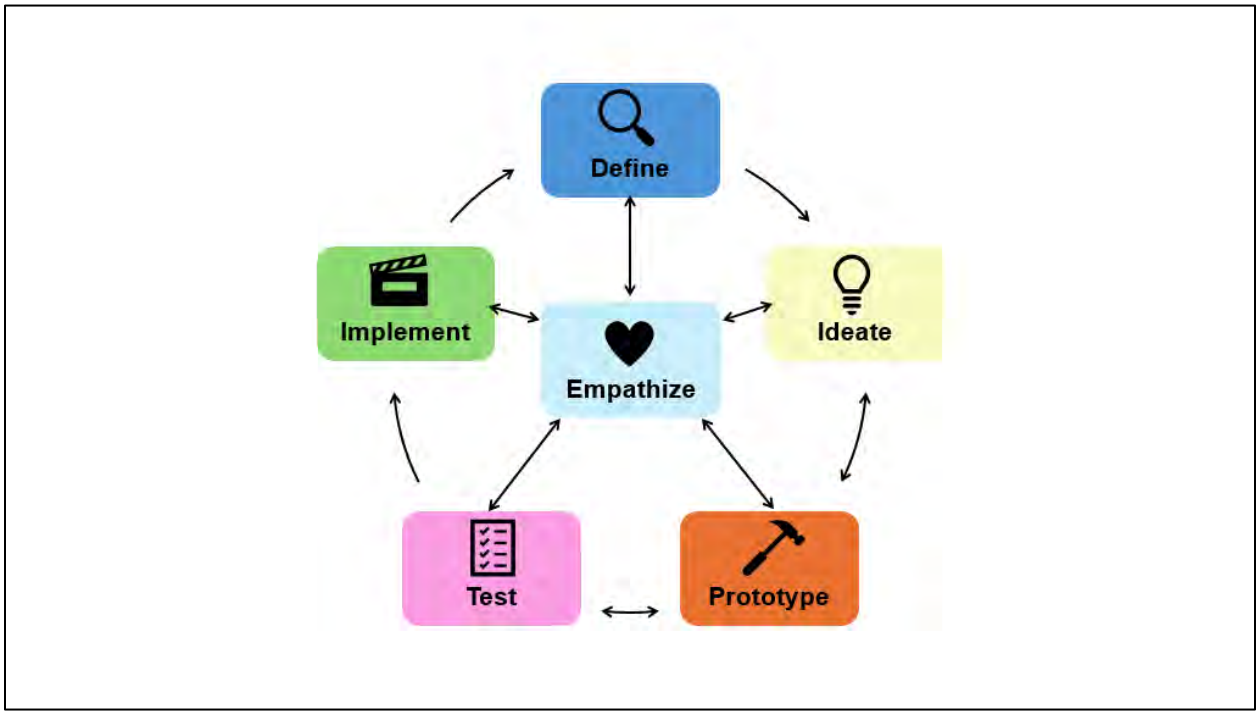


**Figure 2**

*Seminar Sequence with Connections to Design Thinking Processes*

| | PPOTD DOCTORAL PROJECT SEQUENCE | | | | |
|---|---|---|---|---|---|
| | **Seminar 1: Discover** | **Seminar 2: Design** | **Seminar 3: Build** | **Seminar 4: Improve** | **Seminar 5: Inform** |
| **Primary course objective** | Define a professional practice problem and population | Design an innovative solution to an identified practice problem | Develop the key ingredients needed to implement the proposed solution | Create a program evaluation and implementation plan | Implement project and disseminate findings |
| **Design thinking processes** | Empathize<br>Define | Empathize<br>Ideate<br>Prototype | Empathize<br>Prototype<br>Test | Empathize<br>Prototype<br>Test<br>Implement | Empathize<br>Implement |

**Empathize**

Empathy for the end user is "the first and most critical design thinking method," (Roberts et al., 2016, p. 12) and this concept is threaded throughout all five seminars.

***Relationship Between DT Theory and Pedagogy***

Through recorded and live lecture, class discussion, readings, and project mentorship, our faculty introduce the importance of empathy as the first stage in the DT process. For example, after reading several foundational articles and exploring websites including www.dschool.stanford.edu and www.designkit.org, students engage in class discussion that includes questions such as: 1) what is empathy and why does it matter to your project? 2) what tools will you use to gain a better understanding of your end user(s)? 3) what biases or assumptions do you have that could affect the design of this project? 4) how will you challenge these biases or assumptions (Hasso Plattner Institute of Design at Stanford University, 2024; IDEO, n.d.-c)? As students explore options for empathizing with end users, they build on skills they have developed as practitioners. Students are reminded that DT is not a linear process (Wolcott et al., 2021); empathy is one of the stages that requires frequent re-visiting.

Early in the doctoral project process (Seminar 1), students engage in searching, appraising, and synthesizing the literature to support the development of problem statements. During this process, faculty encourage students to include qualitative studies, since these often contribute important insights into the perspectives and values of individuals and can be valuable in enhancing empathy. In the project ideation, prototyping and testing stages (Seminar 2 and Seminar 3), we again remind students to return to the literature for insights into the needs of individuals and populations, as well as to seek out representatives of their end user groups to collect first-hand feedback. When designing evaluation plans for their projects (Seminar 4), students select measures and methods that are meaningful to their end users' values and goals.

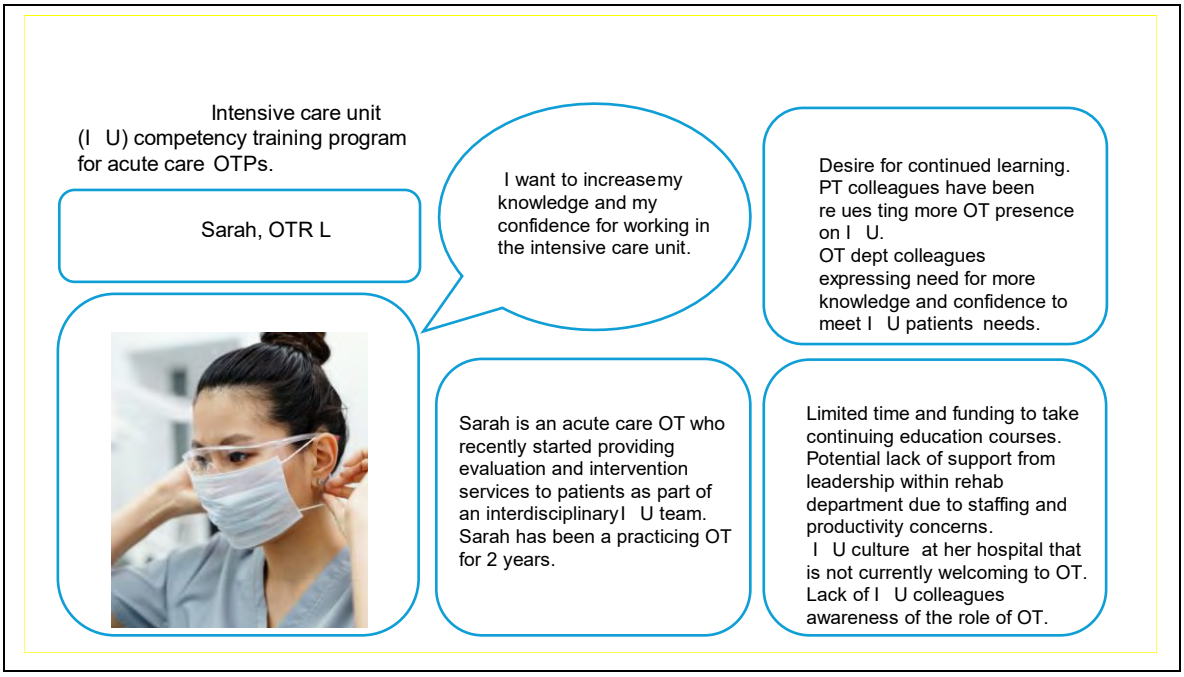
Similarly, consideration of their end users' needs is encouraged when selecting channels for disseminating their work (Seminar 5). This process dovetails with other courses in the curriculum that promote justice, equity, diversity, inclusion, and interprofessional collaboration.

Published strategies for developing empathy for the end user include contextual observation, interviews, simulated user experiences, and user documentation such as photos and videos (Elsbach & Stigliani, 2018; Roberts et al., 2016; Roddy & Polfuss, 2020; Wolcott et al., 2021). There are also descriptions in the non-scholarly literature of tools such as empathy maps, journey maps, and user persona profiles, although it is not clear which strategies and tools are most effective for developing empathy in healthcare education (McLaughlin et al., 2019).

Figure 3 is an example of a persona profile to support empathy for the proposed end user. This example is adapted from a PPOTD student who was developing an intensive care unit competency training program for acute care OTPs. One potential limitation of profiles and personas is that they may be vulnerable to students' biases and thus fail to generate representative examples (Emmanuel & Polito, 2022). Student designers should reflect on potential stereotypes reflected in their profiles or personas and strive to base them on engagement with real end users and subject matter experts to enhance accuracy.

**Figure 3**

*Sample Persona Profile for Empathetic Project Design*



**Define**

The second stage of the DT process is developing a problem statement to anchor future work (Roddy & Polfuss, 2020). Several authors have identified the risk of *group-think* at this stage, which can lead to over-simplification of the problem or choosing the wrong problem to investigate (Roberts et al., 2016). Those using a DT approach should therefore bring in dissenting voices and constantly question the problem to avoid reinforcing their own pre-existing ideas (Roberts et al., 2016; Wolcott et al., 2021). Wolcott and colleagues (2021) acknowledged that "when it comes to solving problems, we are biased toward what we know" (p. 504), so as educators we may need to help students move beyond biases and pre-conceived ideas to accurately define the problem in the early stages of DT-informed projects.

***Relationship Between DT Theory and Pedagogy***

Consistent with the literature, one of our challenges as instructors is to encourage students to go beyond their initial conceptualization of a problem. In Seminar 1, students draft a literature synthesis that eventually becomes part of a dissemination portfolio in Seminar 5. During this process, faculty facilitate critical thinking about the literature as students challenge their own assumptions about existing practice problems. We do this primarily through the seminar format, with guiding questions, open discussion, hands-on activities such as concept mapping, and instructor and peer feedback for forum posts and assignments.

We also introduce students early in the process to the role of a *community of practice (CoP),* since literature supports the value of bringing multiple and diverse voices into the design process (McLaughlin et al., 2019; Roberts et al., 2016; Rösch & Tiberius, 2023). Reaching out—not only to topic experts, but also to colleagues and potential end-users who have different perspectives—is one way to combat the tendency toward group-think that has been identified in the literature as a risk to authentic problem identification. We provide students with templates for contacting colleagues--both known and unknown, both inside and outside OT--who may provide guidance and expertise. This is an informal, student-driven process, and students share work at their discretion. Community of practice members receive files directly from students and do not have access to program documentation or collaborative online spaces.

Active engagement in the feedback process is a primary learning activity for students in this stage of the DT process. We use collaboration platforms such as Microsoft Teams© to allow our internal learning community (instructors, mentors, and peers) to view and comment on students' work as it develops. By both receiving and providing detailed, formative feedback, students develop the habits and structures that help them authentically define a practice problem.

**Ideate**

Ideation is the process of generating ideas to address the problem(s) identified in the Define stage. As with identifying the problem, there is a tendency for students to jump to a "top of mind" solution. Wolcott et al. (2021) and others suggest explicitly separating divergent thinking from convergent thinking during the Ideate stage. Divergent thinking

includes brainstorming (and its individual parallel, brain dumping) and creative idea generation. A facilitator or other structure can help a person or team brainstorm first--without judgment or boundaries--before moving onto the reductionist or convergent processes of evaluating and culling ideas to make a choice (Wolcott et al., 2021).

### *Relationship Between DT Theory and Pedagogy*

Some DT curricula discuss the use of storyboarding or mapping a theory of change at this stage to articulate how the ideated solution will lead to the desired outcome (IDEO, n.d.-e; Wolcott et al., 2021). In our program, parallel course content delves into the role of theory in guiding clinical interventions and/or program design. Students identify specific theories from occupational therapy or other disciplines to guide their project design. We introduce the Rehabilitation Treatment Specification System (RTSS) as an additional framework and students create visual concept maps to illustrate the theory-driven mechanisms of action by which their projects' key ingredients lead to a change in their targeted outcomes (van Stan et al., 2019).

After reviewing previous DT resources and introducing the role of theory in innovation, we invite in an outside expert at this stage in the process (Seminar 2). A guest speaker from a local hospital's innovation center co-facilitates an interactive hour-long online workshop with students. Activities include an improvisational brainstorming warm-up, ground rules for creating a safe, judgment-free zone to explore outside-the-box ideas, and didactic content on disruption versus innovation, the DT process, and change management. Students craft individual "how might we?" statements, which flip their previously generated problem statements into opportunistic inquiries (Doorley et al., 2018; Wolcott et al., 2021). Finally, students engage in rapid ideation of project ideas in small groups.

In addition to engaging in the facilitated workshop, students in Seminar 2 engage in course discussions and online forum discussions, receive instructor feedback, and take part in class activities designed to generate as many ideas as possible—from the traditional to the wacky. Many brainstorming strategies in the Ideate stage have a visual component, which allows ideas to be shared quickly, and are intentionally playful to promote optimism and creativity (Wolcott et al., 2021). In one warm-up exercise, for example, students hold up household objects to the camera and brainstorm alternative uses for the items to cultivate open-mindedness and creativity (Wolcott et al., 2021). After several rounds of divergent brainstorming, we guide students into convergent thinking using structured prompts and visual graphing techniques.

## Prototype

Prototyping means developing a tangible model that can be used or visualized by the end user(s) and/or other stakeholders (Roddy & Polfuss, 2020). It is noteworthy that prototypes must be tangible, but this does not necessarily require a physical product (Brown, 2008). Prototypes may include a simulation or a scaled-down mock-up of a solution and can range from low-fidelity approaches such as pen-and-paper or whiteboard sketches or outlines, comic strips, or videos, to models built with simple crafting supplies or LEGO® bricks, to high-fidelity approaches such as realistic 3D

models or written drafts of deliverables (Brown, 2008; Wolcott et al., 2021). In DT, "rapid prototyping" is often used to test multiple ideas quickly and in succession (Roberts et al., 2016, p. 13). Thus, prototypes do not need to be finished and polished (Brown, 2008). Their purpose is to "show not tell," to allow stakeholders to tangibly experience and interact with ideas (Doorley et al., 2018, p. 23). Through prototyping, designers can facilitate greater empathy for end users' experiences, obtain meaningful feedback on ideas' strengths and weaknesses to inform improvements, and trial ideas while the stakes are lower and minimal time and resources have been invested (Brown, 2008; Doorley et al., 2018; Wolcott et al., 2021).

### *Relationship Between DT Theory and Pedagogy*

Prototyping's inherent characteristics of user-centeredness, hands-on "making," and simulated practice and repetition have many parallels with occupational therapy processes, and therefore, in our experience, resonate with PPOTD students. A recent survey of faculty across four institutions found that prototyping is the least engaged-in DT practice in higher education settings, potentially due to the scope and time constraints of traditional semester-long courses (McLaughlin et al., 2022). In our PPOTD program, we ensure prototyping spans multiple semesters to allow adequate time for iteration and skill development (see Figure 2; McLaughlin et al., 2022).

In Seminar 2, early prototypes co-occur with the previously described ideation process. The brainstorming activities and the concept maps of students' theories that were described in the previous section both emphasize visualizations, thus manifesting their ideas into tangible early prototypes (Wolcott et al., 2021).

In Seminar 3, the instructor again focuses on the stages of DT through readings, mini lectures, class discussions, and online forums. The assigned outputs for this semester are completed, more refined prototypes of their projects, which in our program we call "key ingredient deliverables." Formal mentorship begins during this semester, and students are assigned a mentor with whom they meet bi-monthly for the remainder of the program. Mentors may be occupational therapy faculty members or adjunct instructors with content expertise. The mentor supports students' decisions on how to operationalize their key ingredient ideas into tangible deliverables, provides guidance on the development of these deliverables, makes networking suggestions, and helps link seminar content to the student's practice-based project. Examples of more refined prototypes that have been developed during Seminar 3 include 1) educational videos and written materials for new trainings; 2) syllabi, modules, and assignments for new courses; 3) early-stage websites; 3) draft manuals, protocols, or curricula for new programs; 4) outlines for new evaluation tools; and 5) draft social media campaigns.

Creativity and collaboration are critical aspects of DT, and co-designing with users during the Prototype stage may be one way to achieve this (Roddy & Polfuss, 2020; Wolcott et al., 2021). Looping back to the Empathize process, our students reach out to end users and their communities of practice to receive stakeholder feedback during the early stages of solution development.

**Test**

In some DT models, testing is the final stage (Doorley et al., 2018; Wolcott et al., 2021). During this stage, prototypes are tested, and because DT is an iterative process, designers may also return to previous stages to re-consider other problems and solutions.

***Relationship Between DT Theory and Pedagogy***

In their 2018 framework, Elsbach and Stigliani described DT as an experiential learning process. As faculty in a PPOTD program, we try to bring that spirit to our seminars by emphasizing the importance of active learning, reflection, and the connection between didactic content and the students' areas of practice. There are no bad ideas! Instructional approaches during this stage include 1) active mentorship; 2) guided peer feedback; 3) instructor feedback; and 4) learning activities such as online forums and class discussion that encourage students to obtain, describe, and use feedback from end users and members of their communities of practice.

The Empathy stage of the DT process is thus re-visited as students consider the perspectives of end users when testing project prototypes. Content in Seminar 4 and parallel coursework during that semester complement the Test stage of the DT process by encouraging students to apply specific frameworks and methodologies from the fields of culturally responsive program evaluation, quality improvement, and project management to guide a formal evaluation plan for their doctoral project. Iterative didactic content is provided across several courses in the curriculum on federal and institutional policies that guide ethical conduct of research and/or evaluation, including a guest lecture from the Institutional Review Board (IRB) in Seminar 4.

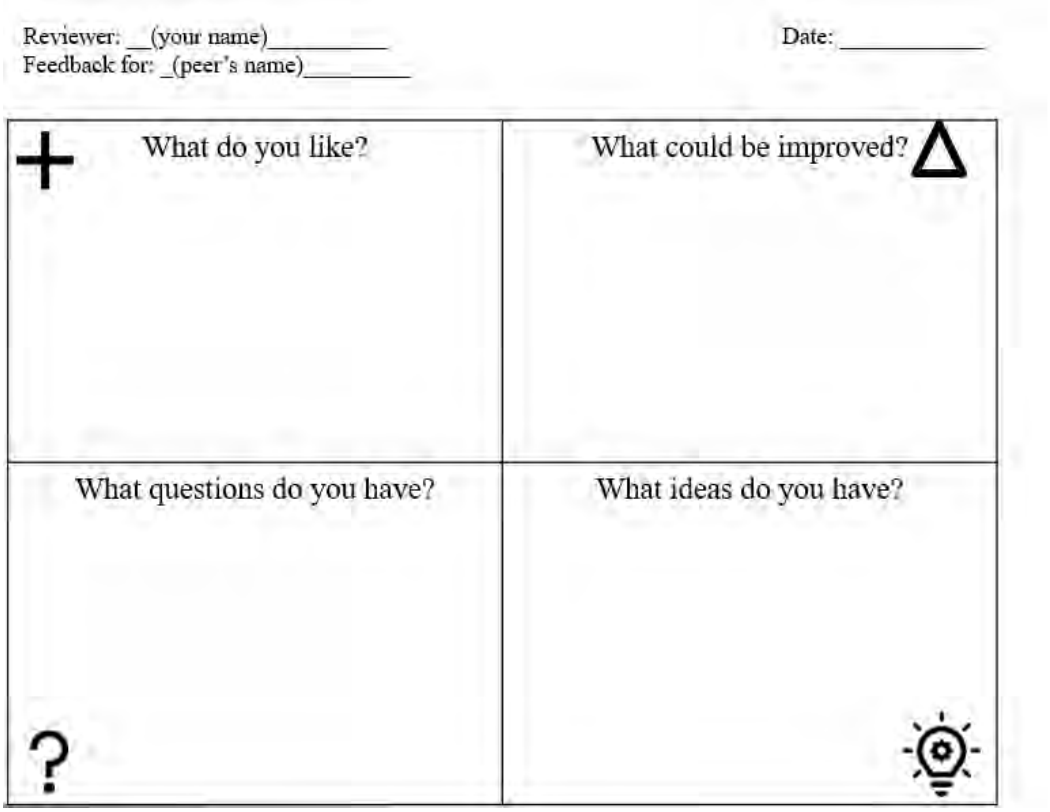
Students are given autonomy during this stage of the DT process. Because each project is unique, each student needs to identify her/his/their own best options for testing prototypes. In addition to instructor, mentor, peer, and community of practice feedback, students may choose to ask end users to try out the prototype and provide feedback. Alternatively, they might choose to actively develop and test a prototype in collaboration with end users (Wolcott et al., 2021) although this is more time-consuming than most students can accommodate. We employ a four-quadrant feedback matrix with specific prompts, commonly used in DT applications (Doorley et al., 2018), to capture feedback and facilitate integration of that feedback into action (see Figure 4). As applicable, students also collaborate with the IRB on their evaluation plans at this stage to ensure ethical conduct of prototype testing.

**Implement**

Some models of DT end at testing (Doorley et al., 2018), while others explicitly include a final process of implementation (Brown, 2008). Don Norman, director of the Design Lab at University of alifo rnia, San Diego, and a proponent of the latter model, argued, "we need more design *doing*" (Gibbons, 2016, para. 15). During the implementation process, refined solutions are executed, communicated, and disseminated (Brown, 2008).

**Figure 4**

*Feedback Grid for Testing Prototypes*






***Relationship Between DT Theory and Pedagogy***

Given the lack of accreditation standards for the PPOTD degree and the paucity of literature on PPOTD curricula, little is known about the PPOTD doctoral project experience across the nearly 80 active U.S. programs (Rains & Pfaff, 2024). An informal review of program websites suggests a range of credit loads and semesters dedicated to the doctoral project. The literature, in combination with the experience of our faculty and colleagues, suggests that PPOTD programs' capstone expectations range from hypothetical proposals to actualized projects to experiential components such as residencies (Lampe et al., 2020; Provident et al., 2015).

Our students are supported to implement aspects of their solutions during the program, although full-scale implementation is not required for graduation and the scope of implementation varies by student. Table 1 provides examples from three program alumnae, each of whom ideated an education-related innovation, but whose implementation timeframes varied based on learner audience, setting, timing, and duration of the projects. The examples in Table 1 are shared with the consent of the alumnae; names are fictitious.

**Table 1**

*Examples of Three Alumnae's Doctoral Projects to Illustrate Variations in Individual Doctoral Project Implementation*

| | x A "Lu " **No implementation during the program.** | x "K " **Partial implementation during the program.** | **Example C: " y" Full implementation during the program.** |
|---|---|---|---|
| **S u ' Defined Problem Statement** | Despite the birth of the disability rights movement 60 years ago, adults with disabilities are vastly underrepresented in work roles, contributing to financial, health, well-being, and social outcome disparities. | Delirium in the acute care setting is often under-diagnosed and under-treated, which leads to secondary complications for older adults, including prolonged hospitalizations, cognitive decline, and poor health outcomes. | Occupational therapy students may lack adequate preparation for Level II fieldwork (FW) in the acute care setting, resulting in unsuccessful completion of acute care FW, delays in graduation, and fewer entry-level therapists prepared to work in acute care settings. |
| **S u ' Actionable "S u "** | A critical disability theory-informed post-secondary course to improve business students' knowledge, skills, and attitudes regarding disability-inclusive work practices. | A quality improvement project including (1) educational mini-lessons, (2) monthly newsletters, and (3) a collaborative website to support better interprofessional delirium care in the acute care setting. | A 2-week module within a FW preparation seminar designed to support the development of entry-level occupational therapy clinical skills, professional behaviors, confidence, and resilience to foster success in Level II acute care FW. |
| **Pre-Graduation Implementation** | *Project Status:* The entire course was developed during the PPOTD program, including syllabus, course lecture materials, readings, assignments, | *Project Status:* All project content was created during the program, and Kate obtained buy-in from her acute care worksite to pilot the project. At the time | *Project Status:* All materials were developed during the program, including a syllabus, asynchronous didactic videos, asynchronous resilience-building |

| | | | |
|---|---|---|---|
| | discussion posts, and materials to pitch the course to post-secondary institutions. *Influencing Factors:* Due to the time required to get a new course approved at an educational institution, Lucia's communications to potential partners were still in progress at the time of graduation. | of graduation, 3 out of 6 planned months of the program had been implemented. *Influencing Factors*: Due to pre-existing relationships at Kate's hospital, she was able to get buy-in to pilot the program quickly. However, the start date was affected by hospital staffing and administrative factors. | activities, two synchronous lab sessions with experiential learning and simulation activities, and learning assessments. *Influencing Factors:* Given the timing of our institution's FW preparation course, Destiny was able to implement her project with a cohort of occupational therapy students and collect and analyze pre- and post-evaluation data prior to graduation. |
| **Post-Graduation Implementation** | *Project Status:* Within months of graduation, Lucia successfully partnered with an institution to teach her course and collect course evaluation data. *Career Impact:* Within a year of graduation, Lucia published one peer-reviewed article and one non-peer reviewed article related to her doctoral project, was hired as a contractor to consult with an employer on inclusivity and continues with advocacy activities related to inclusive employment. | *Project Status:* Kate continued to collect and analyze data on her full project after graduation. *Career Impact*: Within 6 months of graduation, Kate submitted a conference poster proposal and a manuscript to a peer-reviewed journal. She serves in a leadership role on her hospital's interprofessional delirium committee and is discussing potential expansions of the project to other hospital floors. | *Project Status:* Destiny presented her project design and findings at three conferences and has a manuscript currently under review by a peer-reviewed journal. *Career Impact:* Based on the successful implementation of her module, Destiny was hired for an adjunct faculty role to develop and co-teach a semester-long elective course on acute care practice for entry-level occupational therapy students. |

During the Implementation stage of the DT process, both successes and failures are framed as learning opportunities (Wolcott et al., 2021). In both the doctoral project and in professional practice, it is not uncommon to encounter implementation challenges that are beyond one's control. Surges in OV ID-19 cases, budget cuts, under-staffing, and unsupportive leadership at implementation sites are examples of external factors that can derail even the best laid project plans. While these setbacks are common, they can be disappointing to students. Content in Seminars 4 and 5 explicitly address these expectations to cultivate students' "growth mindsets." Parallel core coursework on leadership, quality improvement, and dissemination science instills specific skills in project management, organizational change, and sustainability of innovation. Within the doctoral project seminar sequence, specific learning activities and assignments that support implementation include the following below.

**Stakeholder Engagement**. Throughout the earlier stages of the DT process, students are prompted in discussion posts and/or assignments to reflect on the various stakeholders who are invested in their project and its outcomes, as well as potential implementation barriers and how to overcome them. These reflections culminate in Seminar 4 with the development of a formal stakeholder engagement plan to support buy-in and advocacy for the project. Creating a stakeholder map with a virtual or hands-on whiteboard and Post-it notes to visualize relationships between stakeholders, and then prioritizing them by plotting them on a matrix with key criteria on the axes, such as level of interest vs. level of influence or power, are popular classroom activities cited in both DT (Dam & Siang, 2022) and quality improvement (Silver et al., 2016) resources.

**Project Management Tools**. In Seminar 4, students create logic models to conceptualize and visually communicate their projects' inputs, activities, outputs, outcomes, and longer-term impact. Subsequently, they develop a detailed implementation plan using a Gantt chart, a classic project management tool (Robles, 2018) that has also been used within DT pedagogies in other disciplines (Androutsos & Brinia, 2019; Solodikhina & Solodikhina, 2022). In developing the implementation plan, students are encouraged to remain flexible to fit their individualized scopes and timelines. In keeping with AOTA's implementation science agenda (Juckett et al., 2019), students are prompted to anticipate implementation barriers and generate pre-emptive strategies and scenario plans.

**“ ” .** With the often-cited 17-year gap between new innovations and clinical practice (Morris et al., 2011), we also prioritize dissemination within the Implementation stage of DT. Unsurprisingly--given its provenance in Silicon Valley--a common DT activity is a "pitch" (IDEO, n.d.-b). At the culmination of each of the five semesters, our program hosts an online pitch event where students communicate their ideas to a virtual audience of peers, faculty, and interprofessional community of practice members. In doing so, the Prototype and Test stages of the DT process are re-visited, as students assemble a tangible example of their doctoral project to demonstrate during the pitch and systematically collect audience feedback via the feedback grid (see Figure 4).

**Dissemination Portfolio.** Finally, in Seminar 5, students develop a personalized dissemination portfolio. Depending on the student's project and professional development goals, the deliverables created for the portfolio assignment span traditional academic outputs such as manuscripts and conference abstract proposals, as well as contemporary channels such as social media, podcasts, and advocacy activities. At this point in their project development, re-iterating the Empathy stage of the DT process is critical to develop artifacts that are meaningful to the targeted end users' needs.

## Discussion

Design thinking is a theoretical framework that can guide creative problem solving. Design thinking--in combination with other theoretical approaches--has provided a useful scaffold for the PPOTD doctoral capstone project described in this article. While DT is not without limitations, our experience over three years suggests several benefits to using DT as a signature pedagogy.

### Benefits

Specific benefits of applying DT to the PPOTD doctoral project experience include (1) replicable structure, (2) student engagement, (3) client-centered outputs, and (4) alignment with PPOTD students' individualized learning goals. These themes align with Schaber's (2014) model of signature pedagogies in the occupational therapy profession.

#### *Replicable Structure*

Design thinking, with its cyclical format and freely available repositories of hands-on learning activities, facilitates innovation in a structured manner. While it is compatible with the traditional stages of doctoral capstone development (e.g. defining and understanding a problem, developing, implementing, evaluating, and disseminating the solution; Deluliis & Bednarski, 2020), it does so in a non-linear format that encourages students to overcome biases and to think beyond their original ideas. Rapid iterations of prototyping and testing lead to a final project that improves upon current practices to meaningfully address problems.

We posit that DT's structured cyclical framework, open-access resources including replicable exercises and templates (Wolcott et al., 2021), and the ability to complete a DT process via the mentored doctoral project experience, are factors that facilitate learners' future independent applications of the DT process to problems they encounter in their post-graduation careers as occupational therapy practitioner leaders. This proposition is consistent with Schell's (2018) discussion of the intentional incorporation of self-efficacy theory into DT pedagogy to facilitate learners' adoption, as well as Schaber's (2014) occupational therapy signature pedagogy of highly contextualized, active engagement, or "learning by doing."

#### *Student Engagement*

McLaughlin et al.'s (2019) qualitative review concludes that health professions students report positive experiences with DT learning activities. Indeed, in our online PPOTD program, we routinely observe behaviors suggesting attention and positive affect, including smiles and laughter, during our DT learning activities. Our impression is that

occupational therapy practitioners are particularly drawn to the action-oriented, hands-on approaches of DT exercises that are compatible with our profession's routines. We also appreciate visible changes in students' proposed project ideas in response to DT-derived feedback, suggesting learner engagement extends to internal cognitive processes like self-reflection, divergent and convergent reasoning, and problem-solving. The theme of student engagement aligns with Schaber's (2014) occupational therapy signature pedagogy of relational learning. Faculty mentorship, peer modeling during class activities, and community of practice interactions facilitate learning through human connection.

### *Client-Centered Outputs*

Design thinking's emphasis on empathy for the end user is congruent with occupational therapy's tenet of client-centered practice. Iteratively encouraging PPOTD students to reflect on the values, needs, and perspectives of their end users through DT exercises fosters doctoral project outputs that are client-centered (see Table 1). This theme is also congruent with the occupational therapy signature pedagogy of relational learning, which "exemplifies a human connection, empathy, and respect while seeing the patient [or, in this context, the doctoral projects' end users] as a whole person" (Schaber, 2014, S42).

### *Alignment with PPOTD Learning Goals*

PPOTD students are experienced clinicians with first-hand knowledge of the challenges of everyday practice, combined with an intrinsic motivation for professional growth that led to their return to school for a terminal degree. Thus, PPOTD students are a sub-population of occupational therapy practitioners who are uniquely primed for development as innovators. The DT structure and process can support these learners to achieve their individualized professional aspirations (Lampe et al., 2020). Schaber (2014) described the occupational therapy signature pedagogy of affective learning as a transformation of personal identity. We propose that engaging in the DT process during the doctoral project experience may prompt a change in students' self-concepts, developing their identities not only as occupational therapy practitioners, but also as designers, leaders, and change-makers capable of tackling complex problems.

## Limitations

The proliferation of DT across professions has not been without criticism (Cross, 2023), particularly in the field of higher education (Vinsel, 2018). Editorials have referred to DT as "floating balloons of jargon" (Vinsel, 2018, para. 2) and "little more than basic commonsense, repackaged" (Iskander, 2018, para. 2). Recent headlines pronounced "the end of the design thinking era" when IDEO, the Silicon Valley design firm long considered a thought leader for DT, laid off a third of its staff at the end of 2023 (Wilson, 2023, para. 1). Educators seeking to integrate DT into pedagogy should be mindful of this theory's potential shortcomings. We specifically recommend that PPOTD educators using DT should strive to (1) facilitate authentic, culturally responsive empathy; (2) synthesize DT with complementary theories and frameworks; and (3) contribute to the development of standardized assessments and future evidence.

### *Need for Authentic, Culturally Responsive Empathy*

One critique of DT is that its purported critical element of empathy for the end user is often superficial in practice. Design thinking critics present many historical examples of solutions that failed to sufficiently partner with end users in the design process, with disastrous results (Cross, 2023; Iskander, 2018; Vinsel, 2018; Wilson, 2023). Students must not assume the needs of their end users. Doing so "privileges the designer above the people she serves" (Iskander, 2018, para. 3) and could lead to biased and ineffective outputs.

Our PPOTD program attempts to mitigate this pitfall in several ways. Students participate in an interprofessional orientation program on antiracism in healthcare and a core first-year course on justice, equity, diversity, and inclusion (JEDI) in the health professions (Cahn et al., 2022). Subsequent doctoral project seminars apply themes from these foundational learning experiences. We also expect students to engage with a diverse community of practice that includes representatives from their end-user population throughout their doctoral project process.

When critically appraising background literature to define the problem in Seminars 1-2, students evaluate literature not only on traditional validity and reliability standards, but also on JEDI-related factors, such as authors' positionality, inclusion or exclusion of historically marginalized groups' perspectives in the author team and or in the study sample, and disaggregation of data to explore potential disparities (Frierson et al., 2010). When ideating solutions in Seminar 2, the persona profile activity encourages reflection on the values and needs of end users. When prototyping and testing their project deliverables in Seminar 3, the feedback grid (see Figure 4) is directly used with end-user representatives. When planning their doctoral project evaluation, implementation, and dissemination activities in Seminars 4-5, students are required to explicitly integrate principles of culturally responsive evaluation into their methodologies (Frierson et al., 2010). Thus, we believe the DT tenet of empathy is authentically practiced during the doctoral project experience, given the intentional complementary emphasis on JEDI throughout the curriculum.

### *Need for Synthesis with Complementary Guiding Theories and Frameworks*

Another DT critique is that some higher education institutions regard it as dogma (Vinsel, 2018). The universal application of DT methodologies across problem contexts risks inhibiting rather than fostering innovation, especially when the full process is not completed or when solutions are not sufficiently user-centered (Vinsel, 2018).

Occupational therapy has a long tradition of blending theories from multiple disciplines to holistically address multi-factorial occupational performance issues (Cohn & Coster, 2024). In this vein, our PPOTD program is careful to integrate DT as just one of several guiding frameworks in our doctoral project curriculum. Core coursework in parallel to the doctoral project emphasizes theories and frameworks related to evidence-based practice, outcomes measurement, quality improvement, program evaluation, implementation science, health promotion, leadership, teaching and learning, advocacy and policy, and JEDI. Students are encouraged to actively apply concepts from these

core courses into their doctoral project development. In addition, students are encouraged to identify discrete theories to guide their individualized projects' theories of change. Students then apply the Rehabilitation Treatment Specification System's (RTSS) language of ingredients, mechanisms of action, and targets to communicate how their projects effect change (van Stan et al., 2019).

### *Need for Standardized Assessments and Stronger Evidence*

Overall, there is a need for more standardized tools to measure DT teaching and learning processes and outcomes (Lake et al., 2021; McLaughlin et al., 2019; McLaughlin et al., 2022). In their 2019 review of DT in healthcare education, McLaughlin and colleagues reported that studies on DT have examined a wide range of outcomes, including student self-efficacy, positive perceptions of learning experiences, and ability to generate solutions to specific problems. Existing literature is primarily on the use of DT to generate and evaluate other outcomes. Few studies have measured the DT process itself, or its components (McLaughlin et al., 2019). Beyond the health professions, DT education outcomes from the literature include student creativity and problem-solving (Guaman-Quintanilla et al., 2023) and quality of solutions (Lake et al., 2021; McLaughlin et al., 2022), but the reliability and validity of these results are limited by inconsistent measures that are largely qualitative or non-standardized rubrics or surveys.

There is a need for future research on DT teaching and learning, including studies that link DT pedagogy to longer-term impacts on student outcomes. Additional areas for future DT implementation and research include healthcare curriculum development, the inclusion of DT in the education and training of healthcare providers, faculty development, addressing organizational problems, and problem-solving for healthcare practice (McLaughlin et al., 2019; Roddy & Polfuss, 2020; Sandars & Goh, 2020; Wolcott & McLaughlin, 2020).

## Implications for Occupational Therapy Education

The PPOTD doctoral capstone experience presents an opportunity to spark innovation in a population of learners who straddle the professional and academic realms. The leadership pillar of AOTA's *Vision 2025* envisages occupational therapy practitioners' ability to influence change within complex systems (AOTA, 2019), yet provides limited actionable guidance. This paper has presented DT as a framework to promote human-centered creative problem-solving and its application within an online PPOTD doctoral project curriculum.

Table 2 illustrates sample doctoral project outputs from our program over the first three student cohorts. Design thinking-based pedagogy resulted in PPOTD project outputs spanning several areas of innovation, including clinical program development, entry-level education, continuing education, interprofessional collaboration, clinical assessment, and advocacy and policy. While student learning outcomes have not yet been formally assessed within our curriculum, we hypothesize they may include improved creative problem-solving skills and improved abilities to execute a DT process, in turn leading to a longer-term impact on students' professional goal

attainment and systemic improvements. Future research could explore and test the hypothesized benefits of DT on graduates' proximal learning outcomes as well as longer-term professional outcomes. Multi-site research could compare learner outcomes across heterogenous PPOTD curricula to explore whether how programs' application of DT affects student outcomes, relative to more common curricular features such as mentorship and social learning.

**Table 2**

*Example Outputs of a Design Thinking PPOTD Doctoral Project Pedagogy*

| Output Categories | Selected PPOTD Project Examples |
|---|---|
| Clinical program innovations | Occupation-based support group to mitigate postpartum depression risk for mothers of neonates in the neonatal intensive care unit.<br>Virtual self-management program for return-to-work in people with long COVID.<br>Behavioral health occupational therapy consult service for acute care emergency department. |
| Occupational therapy entry-level education innovations | Peer mentorship program for BIPOC (Black, Indigenous, and People of Color) entry-level occupational therapy students.<br>Podcast to promote Level II fieldwork success.<br>Business plan for a faculty- and student-led pro bono hand therapy clinic. |
| Continuing education and professional development innovations | Social media campaign for intraprofessional collaboration between occupational therapists and occupational therapy assistants.<br>Online training program for occupational therapy practice in the intensive care unit.<br>Virtual newsletter and video repository on delirium assessments and interventions. |
| Interprofessional collaboration innovations | Quality improvement project to enhance evidence-based care for disorders of consciousness on an acute trauma unit.<br>Toolkit for team-based palliative care rehabilitation in the acute care setting.<br>Continuing medical education course for hospitalists on the role of occupational therapy on the medicine service. |
| Clinical assessment innovations | Mentorship program for school-based occupational therapists on data-driven progress assessment.<br>Vocational assessment tool for young adults with intellectual disabilities.<br>Framework for participation-based pediatric assessment in schools. |

| | |
|---|---|
| Advocacy and policy innovations | Legislative action to improve access to early intervention for homeless families.<br>Course for business leaders to improve inclusive employment of people with disabilities.<br>Occupational therapy virtual coalition with parents to advocate for access to Response to Intervention (RtI) services in schools. |

Table 3 summarizes specific DT resources that occupational therapy educators may explore for integration into their classrooms. We particularly recommend the first listed resource of networking with local innovation centers to identify experts who can facilitate DT exercises as a guest lecturer. PPOTD learners have diverse professional aspirations spanning higher education, administrative leadership, policymaking, and entrepreneurship (Lampe, 2020). A DT specialist with experience facilitating workshops across industries brings uni ue perspectives that can broaden students' conceptualizations of the potential impact of their doctoral projects, as well as expand their professional networks beyond the occupational therapy discipline.

**Table 3**

*Selected Design Thinking Resources for OT Educators*

| Resource | Comments |
|---|---|
| Local innovation centers | Many hospitals, universities, technology start-ups, and product design consulting agencies have innovation departments with personnel skilled in DT session facilitation.<br>Try a LinkedIN search for people with DT keywords in their profile, which is how we originally connected with a guest facilitator for our seminar. |
| Design Thinking certificate programs | Many business schools and private continuing education companies offer formal DT certification programs or bootcamps that range from free to several thousands of dollars.<br>A general Internet search will yield many options, with several blog posts comparing programs. |
| IDEO<br><br>Links:<br>https://www.ideou.com/pages/design- | Design firm widely recognized as original thought leaders in design thinking.<br>Many freely available activities and resources that can be used or adapted for |

| | |
|---|---|
| thinking-resources<br>https://www.ideou.com/pages/brainstorming-resources<br>https://www.ideou.com/pages/innovation-resources<br>https://www.designkit.org/<br><br>(IDEO, n.d.-a; IDEO, n.d.-c; IDEO, n.d.-d; IDEO, n.d.-f) | the classroom are available. |
| Hasso Plattner Institute of Design (d.school)<br><br>Link:<br>https://dschool.stanford.edu/resources<br><br>(Hasso Plattner Institute of Design at Stanford University, 2024) | Design thinking institute within Stanford University.<br>Many freely available activities and resources that can be used or adapted for the classroom are available. |
| IBM Enterprise Design Thinking<br><br>Link:<br>https://www.ibm.com/design/thinking/<br><br>(IBM, n.d.) | As of the timing of this publication, they are offering their toolkit and resources for free with account sign-up. |
| LUMA Institute<br><br>Link:<br>https://www.luma-institute.com/<br><br>(LUMA Institute, 2023). | Paid access to content and experts, but a 30-day free trial is available for some resources. |

## Conclusion

Occupational therapy practitioners encounter a wide range of issues that impact professional practice and the lives of the people we serve. As clinical leaders, scholars, and educators doctoral-trained occupational therapy practitioners must therefore be able to create actionable solutions to address complicated problems. Design thinking is a contemporary theoretical framework that can be used—in combination with other theoretical approaches—to enhance problem-solving skills in occupational therapy clinician-scholars. This article has described the role of DT in shaping innovative doctoral capstone projects for students in a PPOTD program. We believe that a grounding in the DT process can help PPOTD students contribute to meaningful improvement in the complex contexts of professional practice.

## References


American Occupational Therapy Association [AOTA]. (n.d.) *ACOTE post-professional doctoral guidelines [Draft I].* https://www.aota.org/-/media/Corporate/Files/EducationCareers/Post-Professional-Guidelines-Draft-I.pdf

American Occupational Therapy Association. (2017). *Draft ACOTE® post-professional guidelines and notice of open hearings*. https://www.aota.org/Publications-News/AOTANews/2017/Open-Hearing-ACOTE-Post-Professional-Guidelines.aspx

American Occupational Therapy Association. (2019). The Association—AOTA board expands Vision 2025. (2019). *American Journal of Occupational Therapy, 73*, 7303420010. https://doi.org/ 10.5014/ajot.2019.733002

American Occupational Therapy Association. (2024). *Post professional programs in OT –Doctoral level programs*. https://www.aota.org/education/find-a-school/postprofessional-programs-in-ot---doctorate-degree-level

Androutsos, A., & Brinia, V. (2019). Developing and piloting a pedagogy for teaching innovation, collaboration, and co-creation in secondary education based on design thinking, digital transformation, and entrepreneurship. *Education Sciences*, *9*(2), 113. https://doi.org/10.3390/educsci9020113

Brown, T. (2008). Design thinking. *Harvard Business Review*, *86*(6), 84-92. https://doi.org/10.3109/13561820.2015.1122582

Cahn, P. S., Makosky, A., Truong, K. A., Young, I., Boutin, E. R., Jr., Chan-Smutko, G., Murphy, P., & Milone-Nuzzo, P. (2022). Introducing the language of antiracism during graduate school orientation. *Journal of Diversity in Higher Education, 15*(1), 1–6. https://doi-org.treadwell.idm.oclc.org/10.1037/dhe0000377

Cahn, P. S., Bzowyckyj, A., Collins, L., Dow, A., Goodell, K., Johnson, A. F., Klocko, D., Knab, M., Parker, K., Reeves, S., & Zierler, B. K. (2016). A design thinking approach to evaluating interprofessional education. *Journal of Interprofessional Care*, *30*(3), 378–380. https://doi.org/10.3109/13561820.2015.1122582

Cohn, E. S. & Coster, W.J. (2024). Examining how theory guides practice: Theory and practice in occupational therapy. In G. Gillen & C. Brown (Eds.), *Willard & Spackman's occupational therapy* (14th ed., pp. 536-554). Wolters Kluwer.

Cross, N. (2023). Design thinking: What just happened? *Design Studies*, *86*. https://doi.org/10.1016/j.destud.2023.101187

Dam, R.F. & Siang, T.Y. (2022). *Stakeholder mapping: The complete guide to stakeholder maps.* Retrieved August 1, 2023 from https://www.interaction-design.org/literature/article/map-the-stakeholders.

Deluliis, E. D. & Bednarski, J. A. (2020). *The entry level occupational therapy doctorate capstone: A framework for the experience and project*. Slack Incorporated.

Doorley, S., Holcomb, S., Klebahn, P., Segovia, K. & Utley, J. (2018). *Design thinking bootleg*. Hasso Plattner Institute of Design at Stanford University. Retrieved August 1, 2023 from https://dschool.stanford.edu/resources/design-thinking bootleg

Elsbach, K. D., & Stigliani, I. (2018). Design thinking and organizational culture: A review and framework for future research. *Journal of Management*, *44*(6), 2274–2306. https://doi.org/10.1177/0149206317744252

Emmanuel, G.-S., & Polito, F. (2022). How related are designers to the personas they create? In M. M. Soares, E. Rosenzweig, & A. Marcus (Eds.), *Design, user experience, and usability: Design thinking and practice in contemporary and emerging technologies* (pp. 3–13). Springer International Publishing. https://doi.org/10.1007/978-3-031-05906-3_1

Espiritu, E. W., Yeatts, P. E., & Evetts, C. L. (2024). Predictors of general well-being in post professional students of occupational science and occupational therapy. *The Open Journal of Occupational Therapy, 12*(1), 1-11. https://doi.org/10.15453/2168-6408.2181

Fish, A. M., Fields, J. M., Ziring, D., McCoy, G., Ostroff, P., & Hayden, G. (2022). Curriculum development by design thinking: Analyzing a program for social determinants of health screening by pre-clerkship medical students. *Journal of Medical Education and Curricular Development, 9,* 1-9. https://doi. 10.1177/23821205221080701

Frierson, H. T., Hood, S., Hughes, G. B., & Thomas, V. G. (2010). A guide to conducting culturally-responsive evaluations. In J. Frechtling (Ed.), *The 2010 user-friendly handbook for project evaluation* (pp. 75–96). National Science Foundation.

Gibbons, S. (2016). *Design thinking 101*. Nielsen Norman Group. https://www.nngroup.com/articles/design-thinking/

Guaman-Quintanilla, S., Everaert, P., Chiluiza, K., & Valcke, M. (2023). Impact of design thinking in higher education: A multi-actor perspective on problem solving and creativity. *International Journal of Technology and Design Education*, *33*(1), 217-240. https://doi.org/10.1007/s10798-021-09724-z

Guo, Y., Wang, X., Gao, Y., Yin, H., Ma, Q., & Chen, T. (2024). Flipped online teaching of histology and embryology with design thinking: Design, practice and reflection. *BMC Medical Education, 24*(1), 1–11. https://doi-org.treadwell.idm.oclc.org/10.1186/s12909-024-05373-7

Hasso Plattner Institute of Design at Stanford University. (2024). https://dschool.stanford.edu/resources

Hutchinson, M. (2021, May 13). *Implementing design thinking in medical school to develop creative problem solvers* [Webinar]. Wolters Kluwer. https://info.lww.com/expert-insights-webinar-series.html

IBM. (n.d.) *Enterprise design thinking.* https://www.ibm.com/design/thinking/

IDEO. (2015). *The field guide to human-centered design*. San Francisco, CA: Ideo.org.

IDEO. (n.d.-a). *Brainstorming resources.* https://www.ideou.com/pages/brainstorming-resources

IDEO. (n.d.-b). *Create a pitch*. Design Kit. Retrieved August 1, 2023, from https://www.designkit.org/methods/create-a-pitch.html

IDEO. (n.d.-c). *Design kit.* https://www.designkit.org/

IDEO. (n.d.-d). *Design thinking resources*. https://www.ideou.com/pages/design-thinking-resources

IDEO. (n.d.-e). *Explore your theory of change*. Design Kit. https://www.designkit.org/methods/explore-your-theory-of-change.html

IDEO. (n.d.-f) *Innovation resources.* https://www.ideou.com/pages/innovation-resources

Iskander, N. (2018, September 5). Design thinking is fundamentally conservative and preserves the status quo. *Harvard Business Review*. https://hbr.org/2018/09/design -thinking-is-fundamentally-conservative-and-preserves the-status-quo

Jacobs, K., Doyle, N., & Ryan, C. (2015). The nature, perception, and impact of e-mentoring on post-professional occupational therapy doctoral students. *Occupational Therapy in Health Care, 29*(2), 201–213. https://doi-org.org/10.3109/07380577.2015.1006752

Jordan, G. (2020). *Embracing entrepreneurship: Occupational therapy's introduction to design-thinking for innovation* [Unpublished doctoral project]. Boston University. https://www.proquest.com/openview/24c59b787afad38f3e8252547ff569d3/

Juckett, L. A., Robinson, M. L., & Wengerd, L. R. (2019). Narrowing the gap: An implementation science research agenda for the occupational therapy profession. *American Journal of Occupational Therapy, 73*(5), 7305347010p1 7305347010p6. https://doi.org/10.5014/ajot.2019.033902

Krishnagiri, S., Hooper, B., Price, P., Taff, S. D., & Bilics, A. (2019). A national survey of learning activities and instructional strategies used to teach occupation: Implications for signature pedagogies. *American Journal of Occupational Therapy, 73*(5), 7305205080p1-7305205080p1. https://doi.org/10.5014/ajot.2019.032789

Lake, D., Flannery, K., & Kearns, M. (2021). A cross-disciplines and cross-sector mixed-methods examination of design thinking practices and outcome. *Innovative Higher Education*, *46*(3), 337–356. https://doi.org/10.1007/s10755-020-09539-1

Lampe, A., Jewell, V. D., Dunn, R., Lawson, T., Stewart, E., & Linhart, J. (2020). Career goals and student perceptions of a post-professional occupational therapy doctoral experiential component. *Journal of Occupational Therapy Education, 4*(2), 11. https://doi.org/10.26681/jote.2020.040211

LUMA Institute. (2023). *Luma Institute.* https://www.luma-institute.com/

Luka, I. (2019). Design thinking in pedagogy: Frameworks and uses. *European Journal of Education, 54*(4), 499-512. https://doi-org/10.1111/ejed.12367

McLaughlin, J. E., Chen, E., Lake, D., Guo, W., Skywark, E. R., Chernik, A., & Liu, T. (2022). Design thinking teaching and learning in higher education: Experiences across four universities. *PLOS ONE*, *17*(3), e0265902. https://doi.org/10.1371/journal.pone.0265902

McLaughlin, J. E., Wolcott, M. D., Hubbard, D., Umstead, K., & Rider, T. R. (2019). A qualitative review of the design thinking framework in health professions education. *BMC Medical Education*, *19*(1), 98. https://doi.org/10.1186/s12909-019-1528-8

Mollo, K. A. & Avery, M. (2017). The occupational designer: New frontiers in teaching and clinical practice [AOTA continuing education article]. *OT Practice, 22*(19), CE-1-CE-7.

Morris, Z. S., Wooding, S., & Grant, J. (2011). The answer is 17 years, what is the question: Understanding time lags in translational research. *Journal of the Royal Society of Medicine*, *104*(12), 510-520. https://doi-org/10.1258/jrsm.2011.110180

Morrow, N., Townsend, B., Jewell, V. D., Bahle-Lampe, A., & Qi, Y. (2020). Retrospective analysis of graduates' outcomes in a post-professional occupational therapy doctorate program. *Journal of Occupational Therapy Education, 4*(4). https://doi.org/10.26681/jote.2020.040412

Provident, I. M., Salla, J., Dolhi, C., Schreiber, J., Mattila, A., & Eckel, E. (2015). Design of an online curriculum promoting transformative learning in post professional doctoral students. *Online Learning*, *19*(3), 1-16. https://doi.org/10.24059/olj.v19i3.526

Rains, R. & Pfaff, M. (2024). *The post-professional OTD: Should I, or shouldn't I? OT Practice, 29*(4), 28-30. https://www.aota.org/publications/ot-practice/ot-practice-issues/2024/ot-in-higher-ed-the-post-professional-occupational-therapy-doctorate

Roberts, J., Fisher, T. R., Trowbridge, M. J., & Bent, C. (2016). A design thinking framework for healthcare management and innovation. *Healthcare*, *4*(1), 11–14. https://doi.org/10.1016/j.hjdsi.2015.12.002

Robles, V. D. (2018). Visualizing certainty: What the cultural history of the Gantt chart teaches technical and professional communicators about management. *Technical Communication Quarterly, 27*(4), 300–321. https://doi.org/10.1080/10572252.2018.1520025

Roddy, L. & Polfuss, M. (2020). Employing design thinking methods in nursing to improve patient outcomes. *Nursing Forum*, *55*(4), 553–558. https://doi.org/10.1111/nuf.12461

Rösch, N., Tiberius, V., & Kraus, S. (2023). Design thinking for innovation: Context factors, process, and outcomes. *European Journal of Innovation Management*, *26*(7), 160–176. https://doi.org/10.1108/ejim-03-2022-0164

Sandars, J., & Goh, P. S. (2020). Design thinking in medical education: The key features and practical application. *Journal of Medical Education and Curricular Development*, *7*, 2382120520926518. https://doi.org/10.1177/2382120520926518

Schell, J. (2018) Design thinking has a pedagogy problem…and a way forward. *Journal of Design and Creative Technologies*. https://designcreativetech.utexas.edu/design-thinking-has-pedagogy-problem-way-forward

Schaber, P. (2014). Keynote address: Searching for and identifying signature pedagogies in occupational therapy education. *American Journal of Occupational Therapy, 68*(Suppl. 2), S40–S44. https://doi-org/10.5014/ajot.2014.685S08

Shulman, L. S. (2005). Signature pedagogies in the professions. *Daedalus, 134*, 52–59. https://doi-org/10.1162/0011526054622015

Schultz-Krohn, W., Walter, S., Stroud, M., Marrah, S., Stonesifer, C. & Liao, Y. K. (2019). Autonomous vehicles, design thinking, and occupational therapy. *OT Practice, 24*(12), 20-23.

Silver, S. A., Harel, Z., McQuillan, R., Weizman, A. V., Thomas, A., Chertow, G. M., Nesrallah, G., Bell, C. M., & Chan, C. T. (2016). How to begin a quality improvement project. *Clinical Journal of the American Society of Nephrology*, *11*(5), 893–900. https://doi-org/10.2215/CJN.11491015

Solodikhina, A., & Solodikhina, M. (2022). Developing an innovator's thinking in engineering education. *Education & Information Technologies*, *27*(2), 2569–2584. https://doi-org/10.1007/s10639-021-10709-7

van Stan, J. H., Dijkers, M. P., Whyte, J., Hart, T., Turkstra, L. S., Zanca, J. M., & Chen, C. (2019). The Rehabilitation Treatment Specification System: Implications for improvements in research design, reporting, replication, and synthesis. *Archives of Physical Medicine and Rehabilitation*, *100*(1), 146-155. https://doi.org/10.1016/j.apmr.2018.09.112

Vinsel, L. (2018, May 25). Design thinking is a boondoggle: Its adherents think it will save higher ed. They're delusional. *Chronicle of Higher Education*, *64*(34), 1. https://www.chronicle.com/article/design-thinking-is-a-boondoggle/

Wilson, M. (2023, November 3). *Design giant Ideo cuts a third of its staff and closes offices as the era of design thinking ends.* Fast Company. https://www.fastcompany.com/90976682/design-giant-ideo-cuts-a-third-of-staff-and-closes-offices-as-the-era-of-design-thinking-ends

Wolcott, M. D., & McLaughlin, J. E. (2020). Promoting creative problem-solving in schools of pharmacy with the use of design thinking. *American Journal of Pharmaceutical Education*, *84*(10), 1271-1276. https://doi.org/10.5688/ajpe8065

Wolcott, M. D., McLaughlin, J. E., Hubbard, D. K., Rider, T. R., & Umstead, K. (2021). Twelve tips to stimulate creative problem-solving with design thinking. *Medical Teacher*, *43*(5), 501–508. https://doi.org/10.1080/0142159X.2020.1807483